

Association for Information Systems

AIS Electronic Library (AISeL)

MCIS 2024 Proceedings

Mediterranean Conference on Information
Systems (MCIS)

10-3-2024

Achieving Business Benefits Through Big Data Analytics: A Case Study in the Telecom Industry

Flávio Costa Romão

ISEG – Lisbon School of Economics & Management, flavio.romao@iseg.ulisboa.pt

Mário Caldeira

ISEG – Lisbon School of Economics & Management, caldeira@iseg.ulisboa.pt

Follow this and additional works at: <https://aisel.aisnet.org/mcis2024>

Recommended Citation

Romão, Flávio Costa and Caldeira, Mário, "Achieving Business Benefits Through Big Data Analytics: A Case Study in the Telecom Industry" (2024). *MCIS 2024 Proceedings*. 40.

<https://aisel.aisnet.org/mcis2024/40>

This material is brought to you by the Mediterranean Conference on Information Systems (MCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in MCIS 2024 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

ACHIEVING BUSINESS BENEFITS THROUGH BIG DATA ANALYTICS: A CASE STUDY IN THE TELECOM INDUSTRY

Research full-length paper

Romão, Flávio Costa, ISEG – Lisbon School of Economics & Management, Lisbon, Portugal,
flavio.romao@iseg.ulisboa.pt

Caldeira, Mário, ISEG – Lisbon School of Economics & Management, Lisbon, Portugal,
caldeira@iseg.ulisboa.pt

Abstract

This paper describes the realization of business benefits from Big Data Analytics Capabilities (BDAC) within a leading telecommunications operator in Portugal. It explains how BDAC enables strategic development and brings business benefits to commercial and operational activities. The case study method was used as a research strategy. Data was collected through semi-structured interviews with managers across different business units, focusing on the integration and utilization of BDAC. The findings reveal that BDAC significantly enhance operational efficiency and decision-making processes. Key benefits identified include increased sales efficiency, enhanced customer satisfaction and improved financial performance. The study also found that the firm employs a decentralized approach in organizing teams for BDAC, often due to lack of centralized services. The research provides original insights by employing a benefits management approach to explore BDAC's role in achieving strategic objectives. It emphasizes the importance of technical skills and business acumen in realizing the full potential of big data analytics.

Keywords: Big Data Analytics Capabilities; Benefits Management; Case Study Research; Data Democratization

1 Introduction

Big Data Analytics Capability is recognized in the academic literature as a transformative force across various business dimensions. It can revolutionize firms' operations (Barton and Court, 2012; Davenport, 2006), spurs innovation (Gobble, 2013), heralds a new science paradigm (Strawn, 2012), initiates a management revolution (McAfee et al., 2012), redefines knowledge assets (Hagstrom, 2012), and reshapes both theoretical and practical approaches (George, Haas and Pentland, 2014). Recognized by academics and practitioners alike, BDAC is crucial for securing sustainable competitive advantage (Akter et al., 2016).

The interest in BDAC spans both academic and practical realms (Ranjan and Foropon, 2021). Despite the focus on technical aspects (Chen, Chiang and Storey, 2012; Baesens et al., 2016; Lau et al., 2016; Günther et al., 2017), a comprehensive understanding of its business benefits and operational mechanisms remains limited. Although, business benefits such as enhanced supply chain efficiency (Wang and Alexander, 2015), advancements in R&D (Research & Development) and improvements in customer and risk management are recognized (Shahid and Sheikh, 2021; Elgendy and Elragal, 2014), they are often discussed superficially. Although benefits management is an important subject for organizations and research has been conducted to prove this issue (Caldeira et al., 2012), there still is limited application regarding the realization of business benefits.

The complexity of BDAC benefits – encompassing technological, procedural, and human factors – poses significant research challenges (Oesterreich et al., 2022). The predominance of confirmatory research limits new discoveries, underlining the need for further exploration into BDAC's business impacts (Trieu, 2017; Müller, Fay and Vom Brocke, 2018; Jensen, Persson and Nielsen, 2023). This study aims to bridge these gaps by using benefits management as an analytical framework. Grounded in theories previously used, such as the Resource-Based View (Günther et al., 2017), dynamic capabilities (Wamba et al., 2017) and sociomaterialism (Akter et al., 2016), this research seeks to deepen our understanding of BDAC. By adopting a benefits management perspective (Ward and Daniel, 2012), this study not only aims to extend current knowledge but also to uncover new insights that are relevant, for both academics and practitioners. By analyzing a case study in a telecom firm, the research explores how BDAC enables specific business benefits and strategic impacts. The main research question is:

RQ1: “How firms benefit from Big Data Analytics Capabilities?”.

Additionally, this study addresses two secondary research questions. The first concerns the processes and strategies essential for enabling BDAC, specifically aiming to clarify the organizational changes required to harness these capabilities effectively for realizing business benefits. The second question seeks to deepen the understanding of organizational design decisions crucial for optimizing BDAC exploitation, especially in the context of escalating investments in these capabilities. Therefore, the secondary research questions are articulated as follows:

RQ2: How can Big Data Analytics Capabilities enable the realization of business benefits?

RQ3: How can a firms organize its teams to deploy Big Data Analytics Capabilities?

Considering the research questions posed are 'how' questions, this study adopted a research strategy deemed appropriate for such inquiries (Yin, 2018). Specifically, a positivist case study strategy was used, involving an in-depth case study conducted in a large telecommunication company operating in Portugal.

1.1 From Big Data Analytics to Advanced Analytics

The concept of big data is comprehensively characterized by the 7Vs framework, which includes:

- Volume – represents the volume of data involved, with the aggregation of a vast number of variables and observations, highlighting the sheer scale of data (George et al., 2016);
- Velocity –represents the rapid rate at which data is collected and analyzed, incorporating real-time or near real-time processing (George et al., 2016);
- Variety - indicates the diverse range of both structured and unstructured data sources (George et al., 2016);
- Veracity – ensures the reliability, authenticity, and security of data (Demchenko et al., 2013);
- Value – reflects the potential economic benefits that can be derived from data insights (Wamba et al., 2017);
- Variability – relates to the adaptability in data interpretation, necessary due to changes in media or the emergence of new data sources (Seddon and Currie, 2017);
- Visualization – This involves the ability to discern patterns and trends within data, aiding in data interpretation (Seddon and Currie, 2017).

These dimensions underscore big data's role in enabling significant value creation (El-Kassar and Singh, 2019). The expansion of big data is driven by technological advancements, including social networks, internet growth, and mobile technologies, broadening the scope of data types from transactional and clickstream data to multimedia like video and audio (Kauffman, Srivastava and Vayghan, 2012).

Building on these foundations, big data analytics involves sophisticated tools and techniques for managing and analyzing vast datasets, evolving from traditional business intelligence towards a more integrated and data-centric approach (Chen et al., 2012; Chaudhuri, Dayal and Narasayya, 2011). This development has been further propelled by new data sources such as social media and mobile devices, expanding analytical objectives to include social and political dimensions (Troisi et al., 2020). The ongoing proliferation of data has spurred interest in advanced analytics, which extends beyond traditional methods by integrating more complex algorithms from fields like machine learning and artificial intelligence (Rose et al., 2017).

1.2 Benefits Management

Benefits Management is defined as “the process of organizing and managing such that the potential benefits arising from the use of IS/IT are actually realized” (Ward and Daniel, 2012, p. 8). In this context, a business benefit is defined as an advantage for any stakeholder. Peppard, Ward and Daniel (2007) also outline five principles for realizing business benefits, which are relevant and guide this research. These principles include:

- IS/IT Has No Inherent Value: The mere possession of technology does not confer benefits or create value. Unlike assets like real estate, the value of technology lies not in ownership but in its effective use.
- Benefits Arise When IT Enables People to Do Things Differently: Benefits materialize only when technology enables individuals or groups within the organization, or its customers or suppliers, to perform their roles more efficiently or effectively.
- Only Business Managers and Users Can Release Business Benefits: Benefits stem from changes and innovations in ways of working. Therefore, IT and project staff cannot be held accountable for realizing these benefits; this responsibility falls to business managers and users.

- All IT Projects Have Outcomes, But Not All Outcomes Are Benefits: It is crucial to distinguish between outcomes and benefits, as not all IT projects produce positive results; some may even jeopardize the organization's survival.
- Benefits Must be Actively Managed to be Obtained: Benefits do not automatically occur post-implementation. They must be actively managed until all expected benefits have been realized or deemed unattainable.

Furthermore, while the terms 'business benefit' and 'value' are often used interchangeably, they represent distinct concepts. For the purposes of this paper, 'business benefits' specifically refer to the gains or improvements achieved through organizational changes, whereas 'value' is calculated as the difference between benefits and the costs incurred to achieve them (Jensen, Persson and Nielsen, 2023).

The process model for benefits management is structured into five sequential steps:

- Identifying and Structuring Benefits: This initial step focuses on pinpointing potential benefits from IS/IT investments and organizing them to facilitate effective management and measurement.
- Planning Benefits Realization: At this stage, comprehensive plans are formulated to achieve the identified benefits, which include designating responsibilities and establishing timelines.
- Executing the Benefits Plan: This involves the practical implementation of the benefits realization plan, requiring changes to processes, systems, and organizational structures.
- Review and Evaluate Results: The realized benefits are assessed against the initial plans to evaluate the success of the benefits realization effort, potentially leading to replanning.
- Potential for Further Benefits: This final step concentrates on leveraging the achieved benefits optimally and exploring avenues for further enhancement.

Benefits management is a cyclical process that promotes continuous improvement and ensures that the benefits from IS/IT investments are maximized, aligning closely with the strategic objectives and goals of the organization.

A pivotal concept in the literature on benefits management is the Benefits Dependency Network. This framework employs a cause-and-effect approach to demonstrate how strategic benefits can be achieved through a synergistic combination of business changes and IS/IT capabilities (Peppard, Ward and Daniel, 2007). The BDN structures the pathway from specific IS/IT enablers to enabling changes, driving business changes that lead to desired business benefits, aligned with the business objectives of the organization.

Additionally, a Benefits Dependency Network elucidates the connection between business objectives and the benefits realized, offering a holistic view of how strategic goals are met through IS/IT interventions. This model is instrumental in understanding both the direct and indirect impacts of IS/IT investments on an organization's strategic outcomes, thereby facilitating the alignment of IS/IT strategies with overall business strategy.

BDAC profoundly influences business practices, recognized in literature for its strategic and operational benefits. Within the Benefits Dependency Network, Enabling Changes are prerequisites for implementing business process change. These business process changes, may introduce new operational methods and procedures. This relationship is further elucidated by Ward and Daniel (2012), emphasizing the importance of assigning owners to each benefit to ensure their realization. A relevant dimension, although not shown in the diagram of figure 2 are the business drivers, the reasons why the firm is investing in information technology projects.

While BDAC is instrumental in areas, such as supply chain management and customer relationship management, contributing to efficiencies and enhanced decision-making (Wang and Alexander, 2015; Shahid and Sheikh, 2021), research on the benefits management aspect of BDAC remains limited. Jensen, Persson and Nielsen (2023) focus on the benefits management process, identifying key busi-

ness advantages including scalability, automation, and improved economic outcomes. Furthermore, BDAC has facilitated advancements in various sectors, from manufacturing to banking, enhancing processes like predictive maintenance, fraud detection, and risk management (Shahid and Sheikh, 2021; Elgendy and Elragal, 2014). These capabilities not only support cost reduction and process automation but also foster innovation in products and services (Balachandran and Prasad, 2017).

Moreover, BDAC's role in sustainable performance highlights its impact on a firm's strategic agility and creativity, further enhancing its competitive advantage and ability to adapt to market changes (Al-yahya et al., 2023). Despite its widespread application and benefits, the current literature still lacks a detailed focus on how firms can effectively translate BDAC into tangible business outcomes, suggesting an opportunity for deeper research into the strategic implementation and value of these analytics capabilities.

1.3 Theoretical Approaches

Previous studies on BDAC frequently draw upon strategic management theories, particularly the Resource-Based View (RBV). RBV posits that firms possess unique, heterogeneous resources and a degree of resource immobility that, when synergistically utilized, yield sustained benefits (Peteraf and Barney, 2003; Barney and Hesterly, 2010). The VRIO framework within RBV identifies resources as valuable, rare, imperfectly imitable, and well-organized, contributing positively to firm performance (Amit and Schoemaker, 1993).

At the core of RBV is the interplay between resources – both tangible and intangible – and capabilities, which enhance resource productivity and can lead to sustainable competitive advantages (Makadok, 1999; Porter and Millar, 1985). Another pivotal theory is dynamic capabilities, introduced by Teece, Pisano and Shuen (1997), which describes a firm's ability to adapt and innovate in rapidly changing environments. This theory extends RBV by emphasizing strategic adaptiveness and innovation as means to gain competitive advantages (Eisenhardt and Martin, 2000; Contractor, Yang and Gaur, 2016).

Additionally, the concept of sociomaterialism explores the intricate interplay between social and material aspects of organizational life, positing that technology and social practices are co-constitutive (Orlikowski, 2007; Leonardi, 2011). This perspective is valuable for understanding how technological capabilities and human decision-making interact in the realm of BDAC.

Lastly, systems theory offers a holistic view of how BDAC operates within an organizational framework. It portrays organizations as open systems engaging dynamically with their environments (Bertalanffy, 1968), which is crucial for the effective integration and utilization of BDAC. This perspective highlights the interconnectedness of data with organizational processes, technology, and human resources, enhancing our understanding of BDAC's role within broader organizational contexts.

1.4 Data Democratization

Data Democratization, integral to BDAC, involves making data accessible to all employees, irrespective of their technical expertise, while adhering to legal confidentiality and security constraints (Awasthi and George, 2020). BDAC solutions may directly provide data or enhance systems used by employees. Lefebvre, Legner and Fadler (2021) highlight five key enablers of Data Democratization:

- Broader Data Access: Emphasizing data catalogues and internal, sometimes external, data sharing.
- Self-Service Analytics Tools: Including BI/reporting tools and expansive platforms.
- Development of Data and Analytics Skills: Focused on internal training to boost data literacy.
- Collaboration and Knowledge Sharing: Encouraging data communities and cross-functional collaboration.

- Promotion of Data Value: Integrating data's importance into company values and promoting its benefits.

Samarasinghe and Lokuge (2022) further identify critical success factors for Data Democratization, such as effective data management policies, a culture of data sharing, supportive management, and robust data security and privacy practices. These factors are vital for fostering an environment that supports data-driven decision-making and enhances the utility of BDAC in achieving business benefits. Thus, data democratization is a key concept under the context of this research acting as an enabler for leveraging BDAC to derive business benefits.

2 Research Approach

Yin (2018) describes a research design as a logical plan that navigates the transition from "here" (research questions) to "there" (research answers), encapsulating the essence of the research process. This study began with identifying a suitable research subject and was grounded in an extensive literature review and an examination of the business context of companies in the Portuguese market. The literature review informed the formulation of research questions and guided the selection of theoretical frameworks for adaptation.

Preliminary observations of these companies indicated investment patterns in BDAC, influencing the decision on which company to focus on to ensure effective collaboration. The choice of a company located in Portugal was also strategic to facilitate access.

The research design adopted includes critical components outlined by Yin (2018):

- Case Study Questions: Informed by the literature review, which clarified and made the research questions more relevant.
- Propositions: Derived from the literature, helping to articulate propositions that guided the case studies towards coherent and targeted information gathering.
- Case Definition: The focus of the case study was determined based on the formulated questions and propositions, ensuring a focused and effective investigation.

3 The Case Study

The case study method provides an empirical mean to conduct an in-depth investigation of contemporary phenomena within its real-life contexts. This approach is particularly valuable when the boundaries between the phenomenon and context are not clearly defined (Yin, 2018). Benbasat, Goldstein and Mead (1987) highlight three key advantages of using case studies in information systems research: (1) Natural Setting Exploration – It allows for the examination of information systems in their natural environments, enhancing understanding of current practices and facilitating theory generation; (2) Complex Questions – It is well-suited to address 'how' and 'why' questions, unraveling the complexities of underlying processes; and (3) Fields with Sparse Research – It is ideal in areas where there is little existing research, which matches the need to explore BDAC from a benefits management perspective as identified previously.

Yin (2018) emphasizes three factors to consider when choosing a research strategy: the type of research question, control over behavioral events, and the focus on contemporary phenomena. The case study method is apt for this research as it tackles 'how' questions within the context of current events without the need to control behavioral dynamics. Furthermore, this approach allows for a detailed exploration of BDAC within the operational contexts of the company. It aids in understanding complex social phenomena like Enabling Changes and Business Changes in the Benefits Dependency Network (Ward and Daniel, 2012), crucial for grasping organizational transformations. According to Yin, case

studies preserve the holistic and meaningful characteristics of real-life events, such as organizational processes, providing a rich, contextual analysis that aligns with the objectives of this research.

3.1 Data Collection

Data collection was conducted through interviews with individuals in management roles within commercial and operational activities impacted by or supporting BDAC, including a manager from IS/IT responsible for data activities. Following Saunders, Lewis and Thornhill (2019), the research utilized semi-structured interviews with questions based on the presented theoretical framing, which are suitable for exploratory studies as they allow researchers to infer causal relationships and delve deeper into participant responses based on theoretical guidance from the literature, adhering to an abductive approach.

Agreements with the company's top management facilitated the involvement of multiple organizational members, enabling data source triangulation to validate findings. Saunders, Lewis, and Thornhill (2019) and Patton (2015) describe triangulation as using multiple data sources and methods to ensure the validity of research findings. This study primarily focused on data source triangulation.

Interviews were limited to one hour each and conducted using a scripted approach to maintain focus and ensure all participants were aware of the interview's purpose, confidentiality measures, and consent for recording. These recordings were transcribed using technology to aid efficiency, although the accuracy of automated transcripts was carefully validated. Interviews conducted in Portuguese were translated into English using advanced language models to ensure precision in documentation.

The interview script incorporated themes from the literature review and Level 2 questions related to these themes, as outlined by Yin (2018). Given the varied profiles of participants, two distinct scripts were developed: one for individuals involved in primary activities like commercial and operations, and another for the interviewed manager from IS/IT. This research included data gathered from interviews to five members of the telco company:

- The Director of the Business to Consumer (B2C) segment, subsequently referred to as the B2C Director.
- The Analytics Manager of the Business to Business (B2B) segment, subsequently referred to as the B2B Manager, who leads the analytical team within B2B segment.
- The Field Force Analytics and Support Manager, subsequently referred to as the FF Manager, who leads both the segment internal analytics team, internal support and manages IS/IT development requests.
- The Support Office Manager within Customer Operations, subsequently referred to as the Support Manager, who leads internal support functions within the segment including an analytics team.
- The Business Intelligence (BI) Manager within IS/IT, subsequently referred to as the BI Manager.

3.2 Data Analysis

The interactive process of data collection, as noted by Saunders, Lewis, and Thornhill (2019), allows researchers to identify significant themes, patterns, and relationships. In this study, such themes and patterns were discerned during the data analysis phase, informed by insights from the literature review. Miles, Huberman and Saldaña (2014) emphasize the analytical challenge in developing coherent descriptions that account for gaps, inconsistencies, and contradictions inherent in personal and social life. Thematic analysis, a foundational method for qualitative analysis described by Braun and Clarke (2006), was employed in this study. Its primary objective is to identify themes within data, highlighting its utility in qualitative research. Thematic analysis enables researchers to understand and synthe-

size large and varied data sets, uncover and investigate key themes, generate thematic descriptions, develop and test theories, and formulate and validate conclusions (Saunders, Lewis, and Thornhill, 2019). In this study, thematic analysis was performed on interview transcripts coded with the support of MAXQDA using an abductive approach. This process began with a set of codes derived deductively from the literature review and was complemented by an inductive process as new codes emerged from the data analysis. The main themes identified were validated through data source triangulation, thus enhancing the reliability and depth of the findings.

3.3 Findings

This case study focuses on a telecommunications operator operating in Portugal, one of the top players in the industry. Providing both cabled and wireless telecommunications services, its coverage extends across most of the Portuguese territory. The telecommunications market in Portugal is highly competitive, with penetration rates of 100%. In this environment, operators strategically prioritize client retention and aim to maximize profitability within their existing customer base. Furthermore, these industry leaders are known for their efforts to diversify their service offerings beyond traditional telecommunications to meet broader market demand.

Satisfying the current client base and ensuring retention are also key business objectives for this firm, given the competitive market landscape. Financial performance is also a primary objective, particularly crucial due to intense competition. Additionally, regulatory compliance is a significant consideration, as the firm operates in a heavily regulated industry subject to frequent interventions by regulators. In the following sections, we will explore the establishment of BDAC in the company's primary activities, specifically in commercial segments and operations, and examine how the IS/IT function supports these efforts and enables associated benefits.

3.4 Big Data Analytics Capabilities

The firm leverages BDAC across various segments, integrating both internal and external data sources to enhance its analytical capabilities. Data from customer interactions, products and services, equipment, and operations form the core of this integration. The firm utilizes a mix of operational and analytical internal systems, such as a corporate data warehouse for fixed services and a data mart for mobile services, supplemented by a corporate data lake.

External data sources, such as meteorological information, play a crucial role in optimizing operational strategies like field force capacity planning. The FF (Field Force) Manager emphasized the value of external data: "The weather service is a very important component," highlighting the significance of integrating such data to enhance operational efficiency. In the B2B segment, external data sources are indispensable for enriching client databases, enabling a comprehensive view of sales channels. The B2B manager stated, "by bringing in information from outside, I can greatly enrich my database," underscoring the strategic use of external data for deeper business insights.

The firm's approach to data management shows a preference for agility, with decentralized data marts and warehouses developed atop existing structures. This method, though enhancing responsiveness, sometimes leads to architectural inconsistencies, posing threats to their long-term impact on data strategy.

Various tools are employed across the data lifecycle, influenced by historical mergers and the autonomy of different business units. The widespread use of tools like SAS across the firm supports data democratization and cross-functional data sharing. The B2C Director noted, "We have access via SAS, via SAS Guide, which is what's most democratized throughout the organization," highlighting the importance of tool familiarity, and how there is a trend to maintain past adoption decisions.

The firm recognizes the need to blend business knowledge with technological expertise to produce insightful analyses. This strategy varies between centralizing technical skills in specific teams or dis-

tributing them across business units. The Director of the B2C Segment remarked on the critical nature of this blend: "There has to be, because otherwise, someone will make correlations of things that are correlated but are neither cause nor consequence."

Collaboration is a recurring theme, essential for leveraging data that influences various sectors of the firm. This collaborative spirit is also evident in how BDAC insights are shared within the organization and with external partners, enhancing decision-making and operational strategies. The FF Manager confirmed the extent of sharing: "Primarily with partners, yes. They rely on that data," indicating the strategic importance of data sharing, specially to facilitate communication with business partners.

A data-driven culture is evident across the firm, with significant reliance on BDAC for daily operations and strategic decisions. Dashboards are frequently used to display analytical capabilities, reflecting the firm's evolving data-driven mindset. The emphasis on data is crucial, as stated by the Support Manager: "We are essentially engineers and managers, and it is crucial to present data for all our activities". Thus, it can be argued that the decentralized capabilities identified, throughout the activities included in this research, are a response to this mindset.

3.5 Business Benefits

The interviewees noted that BDAC significantly enhances the firm's efficiency and effectiveness, aligning with business objectives. This paper analyzes these benefits using the benefits management framework. Identified business objectives include increasing customer satisfaction and retention, improving financial performance, and ensuring regulatory compliance in a competitive market. The firm, a leader in its industry with high service penetration, focuses on maintaining client satisfaction, often monitored through the Net Promoter Score (NPS) to directly enhance customer satisfaction. Financial performance improvement is an underlying theme in objective discussions. Additionally, as the telecommunications industry faces strict regulations, achieving regulatory compliance is crucial, with BDAC playing a key role in this effort.

To understand how BDAC is integrated into the firm, we examine its application across various segments, adopting benefits management lens. In the B2B commercial segment, diverse data sources function as IS/IT enablers. Regarding external data sources the B2B Manager explained, "We cross-reference with external sources for customer characterization, including data like postal codes from CTT, among other specific information. Thus, our ecosystem is fed by numerous internal and external sources."

Data sources in the firm are derived from internal systems, split into Operations Support Systems (OSS) for operations and engineering, and Business Support Systems (BSS) supporting marketing, commercial, finance, and billing functions. External data sources, such as portal addresses and client categorization information, complement these. Despite lacking a centralized architecture, the firm utilizes various analytical platforms including an enterprise data warehouse, a mobile-specific data mart, and a partially completed data lake that still receives daily updates.

3.5.1 B2B Commercial Segment

In the B2B segment, a Gamification Platform integrates extensive data analytics, including a churn prediction model and specific dashboards maintained by the IT department's data analytics team, while other dashboards and advanced analytics solutions are developed by the B2B team itself.

These IS/IT enablers result from and facilitate multidisciplinary and interdepartmental collaboration, leading to significant business process changes. The B2B Manager highlighted transformations in product and sales strategies, now bolstered by comprehensive client data, predictive analytics, and a new incentives model via the gamification platform. A notable process change, as discussed by the B2B Manager, involves streamlining approval processes. Previously, competencies were escalated to higher levels, but it was determined this approach was inefficient. Now, a more decentralized declara-

tion and control process prevents abuse of delegated powers, focusing instead on monitoring activities, thus optimizing operational efficiency.

The business process improvements have delivered significant benefits. Enhanced P&S portfolio management, better aligned with market demands, has led to an increase in sales. The commercial team, informed by robust data and supported by a new incentives model through the gamification platform, has become more effective. Notably, a streamlined approval flow for commercial proposals has expedited processes and boosted sales volumes. Additionally, profitability has benefited from the incorporation of P&S rentability into data-driven decision-making. These changes have not only increased sales effectiveness but have also enhanced the NPS and client retention. Both data-informed churn management and the updated portfolio strategy have been pivotal, aligning with the core objectives of improving customer satisfaction and financial performance.

3.5.2 B2C Commercial Segment

In the B2C commercial segment, data sources largely overlap with those in other segments, including OSS, BSS, the data lake, and data warehouses managed by both the IS/IT function and the segment itself. The segment-specific Data Warehouse, vital for KPI generation, allows data visualization through dashboards. Additionally, leveraging SAS technology, the segment has developed a "Customer Data Platform" aiming for a comprehensive 360-degree customer view. Although not yet fully realized, this platform supports sophisticated models like the currently operational churn model and integrates external datasets for benchmarking.

The collaboration of multidisciplinary teams is identified as a crucial enabler, merging business knowledge with analytics to inform up-sell and cross-sell strategies, and customer relationship management. The B2C Director noted the platform's utility in visualizing critical customer information, crucial for managing business operations and enhancing customer engagement, as is clear in this citation: "If I didn't produce campaigns [with BDAC], if I didn't identify opportunities to enhance the value of each customer and ended up with customers at a higher risk of churn, in practice, I would be passive, and the customer would either leave or get what they asked for, and customers typically don't call us to request tariff increases".

Operational changes include data-driven campaigns and a refined churn management approach, underpinned by training on analytical tools and a focus on data quality. Humorously highlighting data inaccuracies, the B2C Director mentioned customers listed as over 110 years old, emphasizing the importance of data reliability. Further, a streamlined P&S portfolio aims for cost-effectiveness and alignment with customer needs.

Data-driven initiatives have led to increased sales, cost savings by phasing out obsolete services, and enhanced customer retention and NPS. These improvements directly support the business objectives of boosting financial performance and customer satisfaction.

3.5.3 Customer Support Operations

Customer support operations align with other firm segments in utilizing OSS and BSS systems, the corporate data warehouse, and data lake. Unique to this segment is a dedicated system for managing contact center operations, which is directly owned by the segment and serves as a significant data source. This bespoke approach may indicate either a shortfall in IT or the need for customized solutions due to the unique nature of operations. Analytics from these data sources are primarily delivered through dashboards, showcasing operational KPIs and complex analysis outcomes.

The Support Manager mentioned a gamification platform for call center operators, rooted in big data analytics, similar and inspired in the initiative in the B2B segment. This platform is being expanded across the organization, reflecting a firm-wide collaborative approach to adopting successful practices.

Customer support is divided into two primary groups: direct client support for core services and business process outsourcing. Both groups are supported by the same analytical team, which varies in business knowledge based on the operation. The use of BDAC-driven analytics enhances operations, particularly in operator allocation and capacity management, ensuring optimal match and staffing levels.

The gamification platform has been successful in improving operator performance and motivation by integrating incentive calculations. This success is supported by multidisciplinary collaboration and training on the platform's use and incentives.

The analytical solutions have led to significant benefits: cost reductions from continuous improvement efforts, optimized support agent allocation, BDAC-informed capacity planning, strategic feature additions in self-care channels to reduce contact center calls, and a revised incentives model based on the gamification platform. These improvements enhance efficiency and effectiveness across customer support operations. Well-illustrated by this input from the Support Office Manager: "It's through indicators that I can understand, which is then to see if I need to make any kind of adaptation to the outputs it has".

The enhancements in customer support operations have led to a notable increase in the NPS. Given that client support is central to this segment, it is expected that the changes identified positively affect the NPS. The Support Office Manager elaborated, "We analyze volumes and metrics to identify key factors influencing NPS or satisfaction, then model these factors to strategize impactful improvements."

Proactive maintenance through identifying faulty equipment batches and strategies focused on customer satisfaction also contribute to the rise in NPS. Moreover, these strategies not only enhance customer satisfaction but also bolster customer retention, which further benefits from NPS improvements.

Unexpectedly, the introduction of the BDAC-enabled gamification platform has also led to increased sales, despite this segment not traditionally focusing on sales activities. The Support Manager highlighted, "We have become one of the main telephone sales channels in the business sector," underscoring an unforeseen yet positive outcome.

In terms of business objectives, financial performance gains directly from cost reductions and increased sales. Meanwhile, customer satisfaction and retention are supported by the improved NPS and enhanced customer loyalty.

3.5.4 Field Force Operations

Field Force Operations utilize BDAC supported by common data sources such as OSS and BSS systems, alongside a corporate data lake and data warehouse. These resources enable the integration of operational and customer data, facilitating insights across both domains. The FF Manager highlighted, "We merge daily operational and work data with customer interactions, allowing us to link operational and customer areas effectively."

Like other segments, Field Force Operations maintain their own data warehouse, integrating both internal and external data to meet specific needs and maintain some independence from the IS/IT function. This setup supports tailored developments crucial for segment-specific requirements.

For data visualization, dashboards are extensively used, with some analytical data and insights being utilized both internally and by external suppliers. These are accessed directly from the data warehouse or through data export functionalities. Additionally, the corporate systems supporting these operations are equipped with significant big data analytics capabilities, fulfilling requests specific to the segment, a topic that will be explored further.

Field Force Operations, which manages the largest budget within the firm due to extensive national operations, has leveraged BDAC to enhance efficiency through multidisciplinary collaboration. Key process improvements include data-driven management of scheduling and capacity, as well as more

analytics-based communication with suppliers. The FF Manager emphasized that analytics are primarily shared with partners supplying field operation technicians, integrating both internal and external data sources, such as weather forecasts.

These enhancements have led to cost reductions, improved NPS, and better fulfillment of mandatory service reposition targets due to regulatory requirements. The FF Manager explained, "Current regulations require compensation for service unavailability after a certain period, so we proactively schedule repairs within this window to avoid penalties." Furthermore, the segment also employs a data-driven approach for continuous improvement, particularly in evaluating the effectiveness of IS/IT system updates. The FF Manager noted, "We use analytics to assess new features in operating systems and ensure they perform as expected, allowing for quicker adjustments than waiting for feedback or complaints."

Real-time data sharing with clients has also improved NPS and retention, attributed to more precise technician scheduling and increased likelihood of clients being available for appointments. These benefits support the firm's objectives of enhancing financial performance, ensuring regulatory compliance, and boosting customer satisfaction and retention.

4 Discussion

BDAC is increasingly recognized as a pivotal source of competitive advantage within the studied firm, fundamentally supporting the reshaping of strategic processes. Transformations facilitated by BDAC often surpass initial expectations, aligning with business objectives that emerge from newfound insights. The B2C Director emphasizes the critical role integration of technical skills and business acumen: "There has to be that combination of skills, because otherwise someone will make correlations between things that are correlated but are not cause and consequence...there has to be a buy-in from the owner of the process". This integration can be argued to align with sociomaterialism (Orlikowski, 2007), reinforcing this theory's value to study capabilities of this nature.

Data democratization was found to play a vital role, particularly in supporting platforms like B2B's gamification platform. The B2C Director highlights the existential importance of big data: "The use of big data, the advantage, is fundamental for the organization's survival...it allows us to gain competitive advantages; if I didn't have information about my customers, I would be blind and clearly at a disadvantage." This necessity underscores the critical role of BDAC in leveraging the firm's main assets—its customers and their data, only made possible by data democratization efforts.

From the perspective of the RBV (Peteraf and Barney, 2003), BDAC, facilitated by data democratization, contributes to sustainable competitive advantages. Evaluated through the VRIO framework (Amit and Schoemaker, 1993), the value of democratized data access, the rarity of bespoke data sources, and the unique blend of skills making BDAC challenging to imitate, collectively position the firm advantageously. Organizationally, while BDAC distribution appears unstructured, each segment effectively leverages these capabilities to secure competitive advantages, suggesting that an effective organization is achieved through a decentralized manner.

Innovations from BDAC range from simple process changes, such as B2B's churn model adjustments, to more significant shifts like new customer relationship models derived from operations data. The Support Manager illustrates this impact: "It was innovative in that it really revolutionized the way we interact with our customers...based on this, we were able to form a new model of customer relationship." These innovations not only enhance flexibility and responsiveness but also position BDAC as a critical communication channel with external suppliers and clients". Thus, BDAC can be argued to act as an innovation enabler with potential company-wide impact.

Despite these strengths, the firm faces challenges in coherent data strategy and governance. Individual segments have developed their own strategies, somewhat mitigating the broader strategic gaps. However, the recent introduction of a new customer support system without integrated analytics highlights

potential risks. The Support Manager shares concerns: “It hasn't started properly yet...we don't have associated country KPIs, we don't have anything, and we won't have it in that period.” This decentralized approach, while demonstrating adaptability, underscores the need for a more unified data strategy to fully exploit BDAC's potential and avoid negative impacts as the one reported linked with the introduction of a new system.

5 Conclusions

The primary research question of this study is: “How do firms benefit from Big Data Analytics Capabilities?”. Keeping this focus in mind, the case study provided a foundation for a comprehensive analysis. The main business benefits observed were instances of efficiency and effectiveness. Gains in sales, for example, could be attributed to the BDAC-powered capacity to better understand and approach clients with commercial offers. Additionally, offerings were managed based on their actual efficacy in business operations.

The discoveries extend beyond conventional realms of efficiency, effectiveness, and decision-making, which are well-documented benefits of BDAC. Client-focused benefits emerged as highly relevant in enhancing the NPS, particularly where BDAC enabled a novel client relationship model. The impact of such a model surpasses the benefit of improved client performance, especially when designed to cultivate an empathetic relationship. Thus, the data suggested BDAC can support cultural shifts, as seen in the new relationship model, although this assessment requires data beyond this research's scope. Nevertheless, there were recurrent mentions of significant impacts on decision-making processes, holding considerable relevance in how the firm makes decisions. BDAC's influence may extend further, reconfiguring how the firm interacts with the market.

The ramifications of democratized data access suggest potential for innovation from the interplay between BDAC and data democratization, leading to meaningful benefits. An example is the unexpected change in the proposal approval process stimulated by democratized data access. Therefore, this combination of BDAC and data democratization, and their effects on innovation, emerges as a pivotal discovery, directly answering the secondary research question: “How do firms enable Big Data Analytics Capabilities to realize business benefits?”. For this to happen, it was found to be crucial to combine technical and business skills, which are critical to ensuring the realization of business benefits.

In exploring “How do firms organize teams for Big Data Analytics Capabilities?”, the firm exhibits a decentralized approach, forming or expanding teams specifically to leverage BDAC and ensure benefits. This choice appears driven by the limitations of centrally provided IS/IT services, which are not equipped to address challenges in a timely manner, particularly in advanced analytics. This suggests a significant opportunity for the firm to develop these capabilities on a company-wide scale, enhancing cohesion and leveraging data insights more effectively to improve responsiveness and competitive advantage. Although, the decentralized approach can be argued to have been effective to address the challenges faced.

This study's findings are limited by its focus on a single telecommunications firm in Portugal, which may limit generalizability to other sectors or regions. Additionally, the study provides a snapshot in time, not accounting for the evolving nature of BDAC and its long-term impacts. Future research should include comparative studies across industries and regions to enhance generalizability. Longitudinal studies are needed to observe the long-term impacts of BDAC. Quantitative analyses should complement qualitative insights to measure BDAC's effect on performance metrics. Investigating integration challenges and cultural implications, along with evaluating decentralized versus centralized BDAC team structures, would provide deeper understanding and practical guidance.

References

- Alyahya, M., Aliedan, M., Agag, G., & Abdelmoety, Z. H. (2023) "Understanding the relationship between big data analytics capabilities and sustainable performance: The role of strategic agility and firm creativity", *Sustainability*, 15(9), p. 7623.
- Amit, R., & Schoemaker, P. (1993) "Strategic assets and organizational rent", *Strategic Management Journal*, 14(1), pp. 33-46.
- Awasthi, P., & George, J. J. (2020) "A case for data democratization", in *Proceedings of the 26th Americas Conference on Information Systems (AMCIS)*, Virtual conference, 23, August 10.
- Baesens, B., Bapna, R., Marsden, J. R., Vanthienen, J., & Zhao, J. L. (2016) "Transformational issues of big data and analytics in networked business", *MIS Quarterly*, 40(4), pp. 807-818.
- Barney, J. B., & Hesterly, W. S. (2010) *Strategic management and competitive advantage: Concepts*. Prentice Hall.
- Barton, D., & Court, D. (2012) "Making advanced analytics work for you", *Harvard Business Review*, 90(10), pp. 78-83.
- Benbasat, I., Goldstein, D. K., & Mead, M. (1987) "The case research strategy in studies of information systems", *MIS Quarterly*, 11(3), pp. 369-386.
- Bertalanffy, L. V. (1968) *General system theory: Foundations, development, applications*. G. Braziller.
- Braun, V., & Clarke, V. (2006) "Using thematic analysis in psychology", *Qualitative Research in Psychology*, 3(2), pp. 77-101.
- Caldeira, M., Serrano, A., Quaresma, R., Pedron, C., & Romão, M. (2012) "Information and communication technology adoption for business benefits: A case analysis of an integrated paperless system", *International Journal of Information Management*, 32, pp. 196-202.
- Chaudhuri, S., Dayal, U., & Narasayya, V. (2011) "An overview of business intelligence technology", *Communications of the ACM*, 54(8), pp. 88-98.
- Chen, H., Chiang, R. H., & Storey, V. C. (2012) "Business intelligence and analytics: From big data to big impact", *MIS Quarterly*, 36(4), pp. 1165-1188.
- Contractor, F., Yang, Y., & Gaur, A. S. (2016) "Firm-specific intangible assets and subsidiary profitability: The moderating role of distance, ownership strategy and subsidiary experience", *Journal of World Business*, 51(6), pp. 950-964.
- Davenport, T. H. (2006) "Competing on analytics", *Harvard Business Review*, 84(1), p. 98.
- Demchenko, Y., Grosso, P., De Laat, C., & Membrey, P. (2013) "Addressing big data issues in scientific data infrastructure", in *International conference on collaboration technologies and systems (CTS), 2013*, pp. 48-55. IEEE Publications.
- Eisenhardt, K. M., & Martin, J. A. (2000) "Dynamic capabilities: What are they?", *Strategic Management Journal*, 21(10-11), pp. 1105-1121.
- El-Kassar, A. N., & Singh, S. K. (2019) "Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices", *Technological Forecasting and Social Change*, 144, pp. 483-498.
- Elgendy, N., & Elragal, A. (2014) "Big data analytics: A literature review paper", in *Advances in data mining. Applications and theoretical aspects. Proceedings of the 14th Industrial Conference, ICDM 2014, St. Petersburg, July 16-20, 2014*, pp. 214-227. Springer.
- George, G., Haas, M. R., & Pentland, A. (2014) "Big data and management", *Academy of Management Journal*, 57(2), pp. 321-326.
- George, G., Osinga, E. C., Lavie, D., & Scott, B. A. (2016) "Big data and data science methods for management research", *Academy of Management Journal*, 59(5), pp. 1493-1507.
- Gobble, M. M. (2013) "Big data: The next big thing in innovation", *Research-Technology Management*, 56(1), pp. 64-67.

- Günther, W. A., Rezazade Mehrizi, M. H. R., Huysman, M., & Feldberg, F. (2017) “Debating big data: A literature review on realizing value from big data”, *The Journal of Strategic Information Systems*, 26(3), pp. 191-209.
- Hagstrom, M. (2012). “High-performance analytics fuels innovation and inclusive growth: Use big data, hyperconnectivity and speed to intelligence to get true value in the digital economy”. *Journal of Advanced Analytics*, 2, 3–4.
- Jensen, M. H., Persson, J. S., & Nielsen, P. A. (2023) “Measuring benefits from big data analytics projects: An action research study”, *Information Systems and e-Business Management*, 21(2), pp. 323-352.
- Kauffman, R. J., Srivastava, J., & Vayghan, J. (2012) “Business and data analytics: New innovations for the management of e-commerce”, *Electronic Commerce Research and Applications*, 11(2), pp. 85-88.
- Lau, R. Y. K., Zhao, J. L., Chen, G., & Guo, X. (2016) “Big data commerce”, *Information and Management*, 53(8), pp. 929-933.
- Lefebvre, H., Legner, C., & Fadler, M. (2021) “Data democratization: Toward a deeper understanding”, in *Proceedings of the International Conference on Information Systems (ICIS)*.
- Leonardi, P. M. (2011) “When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies”, *MIS Quarterly*, 35(1), pp. 147-167.
- Makadok, R. (1999) “Interfirm differences in scale economies and the evolution of market shares”, *Strategic Management Journal*, 20(10), pp. 935-952.
- McAfee, A., Brynjolfsson, E., Davenport, T. H., Patil, D. J., & Barton, D. (2012) “Big data: The management revolution”, *Harvard Business Review*, 90(10), pp. 60-68.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014) *Qualitative data analysis: A methods sourcebook* (3rd ed.). SAGE.
- Müller, O., Fay, M., & Vom Brocke, J. (2018) “The effect of big data and analytics on firm performance: An econometric analysis considering industry characteristics”, *Journal of Management Information Systems*, 35(2), pp. 488-509.
- Oesterreich, T. D., Anton, E., Teuteberg, F., & Dwivedi, Y. K. (2022) “The role of the social and technical factors in creating business value from big data analytics: A meta-analysis”, *Journal of Business Research*, 153, pp. 128-149.
- Orlikowski, W. J. (2007) “Sociomaterial practices: Exploring technology at work”, *Organization Studies*, 28(9), pp. 1435-1448.
- Patton, M. Q. (2015) *Qualitative research and evaluation methods* (4th ed.). SAGE.
- Peppard, J. & Ward, J. (2016) *The Strategic Management of Information Systems*. Wiley, Chichester.
- Peppard, J., Ward, J., & Daniel, E. (2007) “Managing the realization of business benefits from IT investments”, *MIS Quarterly Executive*, 6(1).
- Peteraf, M. A., & Barney, J. B. (2003) “Unraveling the resource-based tangle”, *Managerial and Decision Economics*, 24(4), pp. 309-323.
- Porter, M. E., & Millar, V. E. (1985). “How information gives you competitive advantage”. *Harvard Business Review*., 63(4), 149-160.
- Ranjan, J., & Foropon, C. (2021) “Big data analytics in building the competitive intelligence of organizations”, *International Journal of Information Management*, 56, p. 102231.
- Rose, J., Berndtsson, M., Mathiason, G., & Larsson, P. (2017) “The advanced analytics Jumpstart: definition, process model, best practices”, *JISTEM-Journal of Information Systems and Technology Management*, 14, pp. 339-360.
- Samarasinghe, S., & Lokuge, S. (2022) “Exploring the critical success factors for data democratization”, arXiv preprint arXiv:2212.03059.
- Saunders, M., Lewis, P., & Thornhill, A. (2019) *Research methods for business students* (8th ed.). Pearson.

- Shahid, N. U., & Sheikh, N. J. (2021) "Impact of big data on innovation, competitive advantage, productivity, and decision making: Literature review", *Open Journal of Business and Management*, 9(2), pp. 586-617.
- Strawn, G. O. (2012) "Scientific research: How many paradigms?", *Educause Review*, 47(3), p. 26.
- Teece, D. J., Pisano, G., & Shuen, A. (1997) "Dynamic capabilities and strategic management", *Strategic Management Journal*, 18(7), pp. 509-533.
- Trieu, V. H. (2017) "Getting value from Business Intelligence systems: A review and research agenda", *Decision Support Systems*, 93, pp. 111-124.
- Troisi, O., Maione, G., Grimaldi, M., & Loia, F. (2020) "Growth hacking: Insights on data-driven decision-making from three firms", *Industrial Marketing Management*, 90, pp. 538-557.
- Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J. F., Dubey, R., & Childe, S. J. (2017) "Big data analytics and firm performance: Effects of dynamic capabilities", *Journal of Business Research*, 70, pp. 356-365.
- Wang, L., & Alexander, C. A. (2015) "Big data driven supply chain management and business administration", *American Journal of Economics and Business Administration*, 7(2), pp. 60-67.
- Ward, J., & Daniel, E. (2012) *Benefits management: How to increase the business value of your IT projects*. John Wiley & Sons.
- Yin, R. (2018) *Case Study Research and Applications – Design & Methods* (6th ed.). SAGE.