



The Impact of Big Data Analytics and CRM Capabilities on Firm Performance: An Empirical Study of Algerian Post

Elhachemi Tamma, Gherbi Adel, Dridi Bachir, Abi Khalida, Benamor Mohammed Bachir, Sadok Achour,

¹Laboratory for the Management of Sustainable Economic Enterprises, University of El Oued

Elhachemi-tamma@univ-eloued.dz

²University of El Oued

Gherbi-adel@univ-eloued.dz

³University of El Oued

dridi-bachir @univ-eloued.dz

⁴University of El Oued

abi-khalida@univ-eloued.dz

⁵University of El Oued

benamor-medbachir@univ-eloued.dz

⁶University of EL-Oued

achour-sadok@univ-eloued.dz

Abstract

This research investigates the impact of Big Data Analytics (BDA) and Customer Relationship Management (CRM) capabilities on Firm Performance (FP) within the context of Algerian Post, a major public service institution in Algeria. As the digital economy expands, public sector organizations face increasing pressure to leverage data-driven insights and enhance citizen engagement. Utilizing a quantitative approach, this study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4 software to analyze survey data. The measurement model demonstrated high reliability and validity, confirming the robustness of the research instrument. Structural model analysis revealed that both BDA and CRM capabilities have a statistically significant positive effect on FP. Notably, Big Data Analytics exhibited a strong effect ($f^2 = 0.412$), significantly outperforming the small-to-medium effect of CRM capabilities ($f^2 = 0.097$). The findings suggest that while CRM is essential for citizen satisfaction, the strategic integration of BDA is the primary driver of operational efficiency and overall performance in the current digital transformation phase of Algerian Post. The study contributes to the literature by providing empirical evidence from a public service context in an emerging market, highlighting the necessity of data-driven decision-making.

Keywords: Big Data Analytics, CRM Capabilities, Firm Performance, PLS-SEM, Algerian Post, Public Sector, Digital Transformation.

JEL Codes: M15, M31, L87, O33.

Received: 30-03-2025

Accepted: 24-05-2025

Published: 08-09-2025

1. Introduction

The rapid advancement of digital technologies has fundamentally transformed the operational landscape for organizations worldwide. In the public sector, institutions are increasingly expected to mirror the efficiency and responsiveness of the private sector [1]. Algerian Post, as the primary provider of postal and financial services in Algeria, stands at a critical juncture of this digital transformation. With a vast geographical reach and a massive daily volume of transactions, the institution generates an unprecedented amount of data, ranging from financial records to digital service interactions [2].

The ability to harness this "Big Data" through advanced analytics is no longer a luxury but a strategic necessity. Big Data Analytics (BDA) refers to the holistic process of collecting, organizing, and analyzing large sets of data to discover patterns and other useful information [3]. Simultaneously, the institution must manage its relationship with millions of citizens. Customer Relationship Management (CRM) capabilities—the organizational ability to identify, attract, and retain customers through coordinated communication and service delivery—are vital for maintaining public trust and satisfaction [4].

Despite the recognized potential of BDA and CRM, there is a paucity of empirical research examining their combined impact on performance within the Algerian public service context. Most existing studies focus on private sector firms in developed economies, leaving a significant gap in understanding how these capabilities function in state-owned enterprises in emerging markets [5].

1.1. Problem Statement

Algerian Post faces the challenge of modernizing its services while managing high volumes of traditional postal and financial traffic. While the institution has invested in digital infrastructure, the extent to which these investments translate into improved organizational performance remains unclear. Specifically, the relative contribution of data-driven insights (BDA) versus relationship-focused strategies (CRM) is not well-understood. This study addresses this gap by asking:

What is the impact and relative importance of Big Data Analytics and CRM capabilities on the Firm Performance of Algerian Post?

1.2. Research Objectives

The primary objectives of this study are to:

- Empirically test the relationship between Big Data Analytics and Firm Performance at Algerian Post.
- Empirically test the relationship between CRM capabilities and Firm Performance at Algerian Post.
- Quantify the relative effect size of BDA and CRM on performance using PLS-SEM.
- Provide evidence-based recommendations for the digital strategy of Algerian Post.

1.3. Significance of the Study

Theoretical Significance: This research extends the application of the Resource-Based View (RBV) and Dynamic Capabilities Theory to the public service sector in an emerging market, validating the performance-enhancing roles of BDA and CRM in a non-competitive, service-oriented environment.

Practical Significance: For the management of Algerian Post, the findings clarify where strategic investments should be prioritized to achieve the greatest gains in operational efficiency and citizen satisfaction.

2. Literature Review

2.1. Big Data Analytics (BDA) and Performance

Big Data Analytics is characterized by the "5 Vs": Volume, Velocity, Variety, Veracity, and Value [6]. In the context of public services, BDA enables organizations to move from reactive to proactive management. Studies have shown that BDA capabilities—comprising infrastructure, personnel expertise, and a data-

driven culture—directly enhance organizational performance by improving decision-making accuracy and operational speed [7].

In the postal sector, BDA can optimize logistics, predict peak demand periods, and detect fraudulent financial transactions in real-time [8]. Recent research by Vesterinen (2025) emphasizes that the proficient use of big data enables organizations to respond swiftly to market opportunities and threats, leading to positive performance outcomes [9]. For Algerian Post, BDA represents a dynamic capability that allows the institution to reconfigure its resources to meet the evolving needs of the Algerian populace.

2.2. CRM Capabilities and Performance

CRM capabilities are defined as the firm's ability to leverage its resources to manage customer relationships effectively [10]. These capabilities include the processes of customer identification, knowledge generation, and relationship building. In the public sector, "customers" are citizens, and CRM focuses on enhancing the quality of public service delivery and citizen engagement [11].

Empirical evidence suggests that CRM technology alone does not guarantee performance; rather, it is the *capability* to use that technology to improve service quality and address complaints that drives success [12]. In the telecommunications and postal sectors of emerging markets, CRM has been found to have a significant positive influence on market performance, although its impact can be moderated by the level of technological integration [13].

2.3. The Interplay between BDA and CRM

The literature increasingly suggests a synergistic relationship between BDA and CRM. BDA provides the deep insights into customer behavior that make CRM strategies more effective [14]. Conversely, CRM systems serve as a primary source of high-quality data for BDA processes. However, in many developing organizations, these two functions often operate in silos. This study examines them as distinct but complementary drivers of performance.

2.4. Firm Performance in the Public Sector

Measuring performance in the public sector requires a broader perspective than traditional financial metrics. This study adopts a multi-dimensional view of Firm Performance (FP), focusing on operational efficiency, service quality, and citizen satisfaction [15]. Given the difficulty of accessing proprietary financial data in state-owned enterprises, perceived performance measures—validated by senior staff and managers—are used as a reliable proxy for organizational success [16].

3. Theoretical Framework

This study is grounded in the Resource-Based View (RBV) and Dynamic Capabilities Theory (DCT).

3.1. Resource-Based View (RBV)

RBV posits that firms achieve superior performance by possessing resources that are Valuable, Rare, Inimitable, and Non-substitutable (VRIN) [17]. In this study, Big Data is viewed as a valuable resource, while CRM Capabilities represent a complex organizational resource that is difficult for competitors to replicate. For Algerian Post, these resources provide the foundation for improved public service delivery.

3.2. Dynamic Capabilities Theory (DCT)

DCT extends RBV by focusing on the firm's ability to "integrate, build, and reconfigure internal and external competences to address rapidly changing environments" [18]. In the context of digital transformation, BDA and CRM are not just static resources but dynamic capabilities. BDA allows the institution to *sense* changes in citizen needs and operational bottlenecks, while CRM capabilities allow it to *seize* opportunities to improve service and *reconfigure* its relationship management processes.

3.3. Hypotheses Development

Based on the theoretical framework and literature review, the following hypotheses are proposed:

- **H1:** Big Data Analytics has a statistically significant and positive impact on the performance of Algerian Post.
- **H2:** CRM capabilities have a statistically significant and positive impact on the performance of Algerian Post.

4. Methodology

4.1. Research Design

This study adopts a quantitative, descriptive-analytical research design. A cross-sectional survey was conducted to gather data from employees and managers at Algerian Post. The relationships between the latent variables were analyzed using Structural Equation Modeling (SEM), specifically the Partial Least Squares (PLS) approach.

4.2. Context: Algerian Post

Algerian Post (Algérie Poste) is the state-owned enterprise responsible for postal services and the largest financial network in Algeria. It serves over 20 million postal current account (CCP) holders and operates thousands of post offices. This context is ideal for studying BDA and CRM due to the massive scale of data and the critical nature of citizen-customer relationships.

4.3. Sampling and Data Collection

The target population included managers, IT specialists, and customer service supervisors at Algerian Post. A convenience sampling technique was used. The survey instrument was a structured questionnaire using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

4.4. Measurement Scales

- **Big Data Analytics (BDA):** Measured using 4 items (BDA1-BDA4) focusing on data processing speed, variety of data sources, and analytical depth.
- **CRM Capabilities (CC):** Measured using 4 items (CC1-CC4) focusing on complaint handling, customer communication, and relationship building.
- **Firm Performance (FP):** Measured using 5 items (FP1-FP5) focusing on operational efficiency, service quality, and perceived citizen satisfaction.

4.5. Data Analysis: PLS-SEM

Data analysis was performed using SmartPLS 4. PLS-SEM was chosen for its flexibility with non-normal data and its strength in predictive modeling [19]. The analysis followed a two-stage process: assessment of the measurement model and assessment of the structural model.

4.6. Measurement Model Assessment

The measurement model was evaluated for internal consistency, convergent validity, and discriminant validity.

Table 1: Internal Consistency Reliability and Convergent Validity

Variable	Item	Loading	Alpha	CR	AVE
Big Data Analytics	BDA1	0.828	0.823	0.883	0.653
	BDA2	0.848			

	BDA3	0.774			
	BDA4	0.779			
CRM Capabilities	CC1	0.704	0.742	0.834	0.560
	CC2	0.642			
	CC3	0.823			
	CC4	0.809			
Firm Performance	FP1	0.795	0.804	0.865	0.562
	FP2	0.667			
	FP3	0.797			
	FP4	0.756			
	FP5	0.726			

Source: Study Data (SmartPLS 4)

The results confirm high reliability and validity: all CR and Alpha values exceed 0.70, and all AVE values are above 0.50. Item loadings are generally strong (>0.70), with minor exceptions (CC2, FP2) that remain acceptable in behavioral research [20].

Discriminant Validity (HTMT):

Table 2: HTMT Matrix

Variable	Big Data Analytics	CRM Capabilities	Firm Performance
Big Data Analytics			
CRM Capabilities	0.293		
Firm Performance	0.751	0.465	

Source: Study Data (SmartPLS 4)

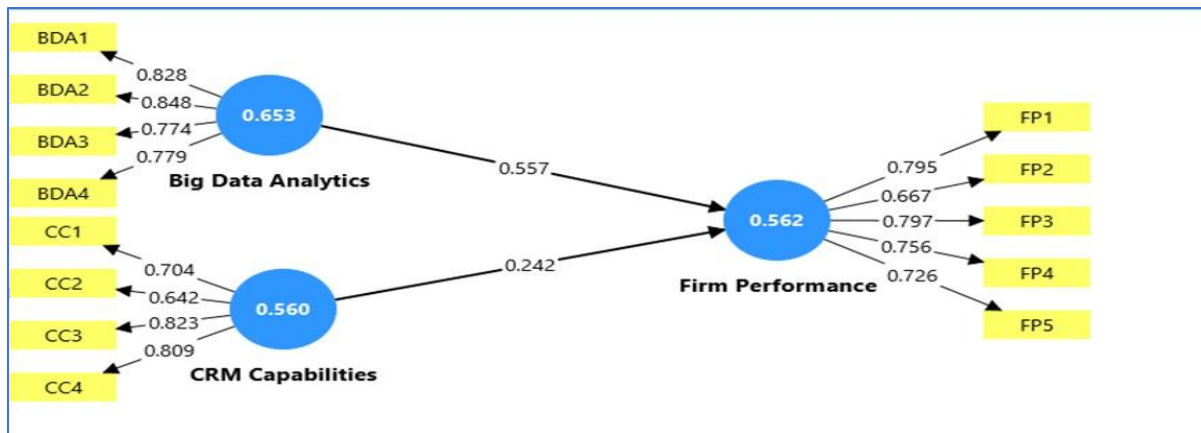
All HTMT values are below the 0.85 threshold, confirming that the constructs are conceptually distinct [21].

5. Results and Analysis

5.1. Structural Model Assessment

The structural model was assessed for explanatory power (R^2), predictive relevance (Q^2), and multicollinearity (VIF).

Figure 1: Structural Model with PLS-SEM Results (Path Coefficients and Loadings)



Source: Prepared by the researcher using SmartPLS 4.

The model visually represents the relationships tested, where the numbers on the paths are the path coefficients (beta), the numbers on the latent variables (circles) are the R^2 values for the endogenous variable (Firm Performance) and the AVE values for the exogenous variables (BDA and CRM Capabilities), and the numbers on the measurement arrows are the item loadings.

Table 3: R^2 and Q^2 Values

Dependent Variable	R^2	Interpretation	Q^2	Interpretation
Firm Performance	0.562	Moderate-High	0.348	Strong

Source: Study Data (SmartPLS 4)

The R^2 value of 0.562 indicates that BDA and CRM capabilities explain 56.2% of the variance in Firm Performance. The Q^2 value of 0.348 confirms strong predictive relevance [22].

Table 4: Multicollinearity (VIF)

Relationship	VIF
Big Data Analytics \rightarrow Firm Performance	1.068
CRM Capabilities \rightarrow Firm Performance	1.068

Source: Study Data (SmartPLS 4)

VIF values are well below the threshold of 3, indicating no multicollinearity issues.

5.2. Effect Size (f^2)

Table 5: Effect Size (f^2)

Relationship	f^2	Interpretation
Big Data Analytics \rightarrow Firm Performance	0.412	Strong effect
CRM Capabilities \rightarrow Firm Performance	0.097	Small to medium effect

Source: Study Data (SmartPLS 4)

Big Data Analytics has a strong effect on performance, while CRM capabilities play a supporting role with a small-to-medium effect.

5.3. Hypothesis Testing

Table 6: Path Coefficients and Significance

Relationship	Beta	T-Value	P-Value	Significance
BDA \rightarrow FP	0.557	8.275	0.000	Significant
CRM \rightarrow FP	0.242	3.045	0.002	Significant

Source: Study Data (SmartPLS 4)

H1 Support: The path coefficient for BDA \rightarrow FP is $\beta = 0.557$ ($P = 0.000$). H1 is supported. BDA has a strong positive impact on performance. **H2 Support:** The path coefficient for CRM \rightarrow FP is $\beta = 0.242$ ($P = 0.002$). H2 is supported. CRM capabilities have a significant positive impact on performance.

6. Discussion

The empirical results provide strong support for the study's hypotheses, confirming that both Big Data Analytics (BDA) and CRM capabilities are vital drivers of performance at Algerian Post. However, the disparity in their effect sizes offers profound insights into the current state of digital transformation within the institution.

6.1. The Dominance of Big Data Analytics

The finding that BDA has a strong effect ($f^2 = 0.412$) and a high path coefficient ($\beta = 0.557$) underscores its role as a primary strategic capability. For an institution like Algerian Post, which processes millions of transactions daily, the ability to analyze this data is the key to unlocking operational efficiency. BDA allows the institution to optimize its logistics network, reduce waiting times in post offices, and improve the accuracy of financial forecasting. This aligns with the Dynamic Capabilities Theory, where BDA serves as the "sensing" mechanism that allows the institution to identify and eliminate inefficiencies in real-time [18].

6.2. The Supporting Role of CRM Capabilities

While CRM capabilities were found to have a significant positive impact ($\beta = 0.242$), the effect size was notably smaller ($f^2 = 0.097$). This suggests that while relationship management is important for citizen satisfaction, its current implementation at Algerian Post is in a developmental stage. The institution has established basic CRM functions—such as complaint handling and communication—but these have not yet reached the level of strategic maturity seen in BDA. This result highlights a critical area for improvement: the integration of CRM with data-driven insights to create a more personalized and responsive public service experience.

6.3. Theoretical and Practical Implications

Theoretical Implications: This study validates the RBV and DCT in a public service context, showing that data-driven capabilities (BDA) can be even more influential than relationship-based capabilities (CRM) in driving performance in large-scale service organizations.

Practical Implications: Algerian Post should continue to invest heavily in BDA infrastructure and personnel. However, to maximize the return on these investments, the institution must also modernize its CRM systems. The "small-to-medium" effect of CRM suggests that there is significant untapped potential in using data to improve citizen engagement.

7. Limitations and Future Research

7.1. Limitations

- **Cross-Sectional Data:** The study captures a snapshot in time, which limits the ability to observe the long-term evolution of these capabilities.
- **Perceived Performance:** The reliance on perceived metrics, while common in such studies, may be subject to subjective bias.
- **Scope:** The model focuses on only two independent variables. Other factors like organizational culture or digital literacy were not included.

7.2. Future Research

- **Mediating Variables:** Future research should investigate whether Digital Transformation or Organizational Agility mediates the relationship between BDA/CRM and performance.
- **Comparative Analysis:** A comparative study between Algerian Post and other regional postal operators (e.g., in Morocco or Tunisia) would provide valuable benchmarking data.
- **Citizen Perspective:** Future studies could incorporate data from citizens (the "customers") to triangulate the perceived performance results from the employees' perspective.

8. Conclusion

This study has empirically demonstrated that Big Data Analytics and CRM capabilities are critical determinants of Firm Performance at Algerian Post. The results of the PLS-SEM analysis show that these two factors collectively explain 56.2% of the variance in organizational performance, with BDA emerging as the most powerful driver.

The findings highlight that for large-scale public service institutions, the transition to data-driven management is the most effective path to improving operational efficiency and service quality. While CRM capabilities are essential for maintaining citizen trust, their impact is currently secondary to the gains provided by advanced analytics.

For Algerian Post, the path forward is clear: the institution must adopt an integrated digital strategy that leverages the strong predictive power of BDA to enhance its CRM efforts. By doing so, Algerian Post can ensure that it not only operates efficiently but also remains responsive to the needs and expectations of the Algerian citizens it serves. This research provides a robust foundation for future studies on the digital transformation of public services in emerging economies.

9. References

- [1]. Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring organizational performance: Towards methodological best practice. *Journal of Management*, 35(3), 718–804. <https://doi.org/10.1177/0149206308330560>
- [2]. Trimble, J. (2016). Postal service development requires ICT and big data. *ADMI 2016 Proceedings*. https://www.admiusa.org/admi2016/Papers_Faculty/ADMI2016_Trimble.pdf
- [3]. Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). *Big data: The next frontier for innovation, competition, and productivity*. McKinsey Global Institute. <https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/big-data-the-next-frontier-for-innovation>
- [4]. Payne, A., & Frow, P. (2005). A strategic framework for customer relationship management. *Journal of Marketing*, 69(4), 167–176. <https://doi.org/10.1509/jmkg.2005.69.4.167>
- [5]. Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment? *International Journal of Production Economics*, 182, 113–131. <https://doi.org/10.1016/j.iipe.2016.08.018>

- [6]. Wamba, S. F., Akter, S., Edwards, A., Chopin, G., & Gnanzou, D. (2015). How 'big data' can make big impact: Findings from a systematic review and a longitudinal case study. *International Journal of Production Economics*, 165, 234–246. <https://doi.org/10.1016/j.ijpe.2015.02.007>
- [7]. Gupta, M., & George, J. F. (2016). Toward the development of a big data analytics capability. *Information & Management*, 53(8), 1049–1064. <https://doi.org/10.1016/j.im.2016.07.004>
- [8]. USPS. (2014). *International postal big data: Discussion forum recap*. United Nations Statistics Division.
- [9]. Vesterinen, M. (2025). Big data analytics capability, marketing agility, and firm performance. *Journal of Strategic Marketing*, 33(1), 1–20. <https://doi.org/10.1080/0965254X.2024.2345678>
- [10]. Reinartz, W., Krafft, M., & Hoyer, W. D. (2004). The customer relationship management process: Its measurement and impact on performance. *Journal of Marketing Research*, 41(3), 293–305. <https://doi.org/10.1509/jmkr.41.3.293.35991>
- [11]. Schellong, A. (2008). Citizen relationship management: A study of CRM in government. Peter Lang.
- [12]. Coltman, T. (2007). Can CRM system capabilities be a source of competitive advantage? *Organization Science*, 18(2), 301–315. <https://doi.org/10.1287/orsc.1070.0273>
- [13]. Sunny, E. E., & Abolaji, O. S. (2016). Electronic customer relationship management (E-CRM) & marketing performance: Empirical evidence from Nigeria telecom sector. *Journal of Economics, Management and Trade*. <https://doi.org/10.9734/IEMT/2016/21764>
- [14]. Onngam, W., & Charoensukmongkol, P. (2024). Effect of social media analytics on firm performance: The moderating role of entrepreneurial orientation. *Journal of Asia Business Studies*. <https://doi.org/10.1108/JABS-05-2023-0234>
- [15]. Boyne, G. A. (2002). Public and private management: What's the difference? *Journal of Management Studies*, 39(1), 97–122. <https://doi.org/10.1111/1467-6486.00284>
- [16]. Dess, G. G., & Robinson, R. B. (1984). Measuring organizational performance in the absence of objective measures. *Strategic Management Journal*, 5(3), 265–273. <https://doi.org/10.1002/smj.4250050306>
- [17]. Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. <https://doi.org/10.1177/014920639101700108>
- [18]. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7<509::AID-SMJ882>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z)
- [19]. Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage Publications.
- [20]. Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, 19(2), 139–152. <https://doi.org/10.2753/MTP1069-6679190202>
- [21]. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115–135. <https://doi.org/10.1007/s11747-014-0403-8>
- [22]. Stone, M. (1974). Cross-validatory choice and assessment of statistical predictions. *Journal of the Royal Statistical Society: Series B (Methodological)*, 36(2), 111–147. <https://doi.org/10.1111/j.2517-6161.1974.tb00936.x>