



The Role of Big Data Analytics in Improving Customer Retention: An Empirical Study Using Structural Equation Modeling

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ABSTRACT

With the advent of digital technologies, organizations are significantly changing how they gather, analyze, interpret, and utilize customer information. Big data analytics (BDA) has become a key organizational ability that helps companies transform their customer data into valuable information that can be used to enhance customer experiences and build lasting relationships. With increased competition to acquire customers, customer retention has become an important strategic outcome for the analytics-driven marketing and has become a priority for organizations that strive to retain customers by personalizing, responding fast, improving service and fostering relationships. The purpose of this study is to investigate the impact of these key elements of big data analytics on customer retention, namely analytical capability, customer insight generation, personalisation and customer relationship management capability. The study is based mainly on the resource-based view and the dynamic capability theory. Quantitative research design was employed and structured questionnaires were used for the collection of responses on the utilization of customer-related big data analytics in organizations and customers' perception of the quality of the relationships and retention. Structural equation modeling were used to test the measurement and structural models. Reliability, convergent validity, discriminant validity, coefficient of determination, effect size, predictive relevance, direct effects and mediation analysis were used in the analysis. Based on the empirical model, it can be concluded that there is a positive effect of big data analytics on customer retention, which is quite significant. The results also highlight that generation of customer insight, personalization capability and customer relationship management capability have significant positive impact on retention. The pathway from big data analytics to customer retention is partially mediated by customer satisfaction, indicating that the value of big data analytics for customer retention is realized when big data provides insights that are leveraged to enhance customer experiences. The results add to the growing body of research that tie big data analytics capability not only to firm performance or measures of sales outcome, but also to measures of customer retention. The study also offers implications from the managerial perspective on how managers can build analytics-based customer retention.

Keywords: Big data analytics, customer retention, customer relationship management, personalization, customer satisfaction, customer insights, structural equation modeling, PLS-SEM

INTRODUCTION

Background of Study

As business activities are gradually becoming digital, the amount of customer information has hit a new high. Customers have access to the organizations via the website, mobile app, social media, electronic payment methods, customer relationship management, loyalty programs, word-of-mouth reviews, call centers, and other digital platforms. These interactions create structured, semi-structured and unstructured information that offers organizations with wide-ranging opportunities to understand



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customers' needs and behavior. But the data isn't just meant to be valuable to the business. Organizations need analytical skills to discover trends, forecast customer actions, break the markets into segments, tailor products based on that segmentation and adjust to customer needs. The use of big data analytics (BDA) is therefore not only a technological investment but a capacity of an organization that connects information resources with processes focused on customers and managerial decision making (Wamba et al., 2017). (Mikalef et al., 2018; Mikalef et al., 2020).

Gaining a loyal customer base is more crucial than ever since keeping existing customers is more likely to ensure sustained organizational results through repeat purchases, building relationships, word-of-mouth referrals, and reduced need to constantly pursue new customers. Competitive markets allow customers to have a number of options and easily compare prices, service, features, and experiences. Therefore, it is important for organizations to have a better understanding of what their customers want and care about to figure out when they are unhappy and when they need something different in order to offer a timely intervention. Big data analytics offers tools that can enable organizations to convert past and current customer data into meaningful insights that can aid in these activities. (Lemon & Verhoef, 2016; Hennig-Thurau & Klee, 1997).

There have been many studies on the subject of analytics and customer outcomes. Previous studies have proven that big data analytics competence can help in improving organizational performance and business processes using two means, namely, dynamic capability and business processes (Wamba et al. 2017). It has also been found that BDA has the potential to enhance the capacity of Customer Relationship Management (CRM) that can ultimately affect the Sales and Relationship performance (Shahbaz et al., 2020). Likewise, research that investigates the use of big data analytical intelligence has shown that analytics can advance the performance of CRM by providing features like mass customization and data-driven decision making (Nam et al., 2019). These results show that value added by analytics is partly related to the capabilities of the organization in respect to customers. (Holmlund et al., 2020; Shahbaz et al., 2020; Nam et al., 2019).

In spite of all this research, there is still a key research gap. Previous studies have tended to focus on the effects of BDA on a number of firm outcomes, such as sales performance, firm performance, innovation and operational efficiency. Customer retention is less a behavioural and relational outcome of comparison. This is crucial as customer retention is not just about a transaction but about building a relationship with a customer over time. (Mikalef et al., 2020; Holmlund et al., 2020).

The ability to understand and respond to individual customer preferences is especially vital to customer retention. Analytics can detect customer buying trends, growing disengagement, customer service issues, attrition signals, and customer preference shifts. With these insights, organizations can customize communication, tailor promotions, anticipate service recovery efforts, and make product suggestions. These practices help to reinforce customer satisfaction and perceived value of the relationship, which contributes to a higher probability of customer retention. (Lemon & Verhoef, 2016; Holmlund et al., 2020; Verhoef, 2003).

In the present study, the author focuses on how big data analytics can help customer retention. The study views BDA as a strategic organizational capability and explores how analytics impacts retention. Specifically, this research examines the relationships between BDA capability, customer insight generation, personalization capability, customer satisfaction, CRM capability and customer retention.



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The central questions of the study concern itself with four: So does big data analytics really help to retain customers? Secondly, does BDA improve the generation of customer insights and personalisation? Third, does a CRM capability help with customer retention? Finally, is customer satisfaction an intervening variable between BDA & customer retention?

The study makes a number of contributions to the literature. First, it takes BDA action research from an organization-wide performance measure to a specific customer-focused measure. Second, it brings together the technological capability and relationship-management aspects in one empirical model. Third, it uses the structural equation modeling technique to analyse direct and indirect relationships between analytics capability, customer experience, relationship management and retention. Fourth, it offers management implications that are not confined to the role of an information technology function.

LITERATURE REVIEW

Big Data Analytics

The Big Data is defined as a collection of the data that is high volume, high velocity, high variety, high veracity and high value. The strategic value of big data isn't just about the volume of data, however. The value of big data for an organisation is dependent on the skills required to gather relevant data, to combine various data sources, detect patterns, understand the results and incorporate these findings into decision making. (Mikalef et al., 2018; Mikalef et al., 2020).

Big data analytics is the processes and technologies used to analyze large sets of data to discover patterns, relationships, trends, and predictions. For customers, BDA involves the likes of customer segmentations, predictive modelling, recommendation systems, sentiment analysis, churn prediction, behavioural analysis, as well as real-time personalisation. (Mikalef et al., 2018; Holmlund et al., 2020).

Wamba et al. (2017) defined big data analytics capability as a capability which integrates technological and organizational resources. They found that BDA capability has a direct and indirect impact on the performance of the firm via process oriented dynamic capabilities. It's significant that this point is not a point of technology; it's a point of value. Instead, organizations need to cultivate additional capabilities that will enable analytical insights to impact business processes. (Mikalef et al., 2020; Wamba et al., 2017).

Moreover, Shahbaz et al. [2020] has also shown that BDA and CRM capabilities have positive effect on sales performance and CRM capability is the intervening variable between BDA and sales performance. This result will lay the groundwork for further analysis of customer retention as CRM is considered to be a tool for translating customer data into customer relationship. (Shahbaz et al., 2020; Nam et al., 2019).

Similarly, recent findings in Pakistan show how customer big data analytics are becoming more and more relevant in emerging-market organizations. Soomro and Baeshen (2026) revealed that, in Pakistani B2B firms, customer big data analytics had a positive impact on customer satisfaction and the firm performance and customer satisfaction was an important mechanism linking big data analytics to the firms' performance. (Soomro & Baeshen, 2026; Holmlund et al., 2020).

Resource-Based View



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The resource based view (RBV) suggests that firms gain a sustainable competitive advantage when they have resources they can value, be rare, hard to imitate and hard to substitute (Barney, 1991). An RBV approach would suggest that data about the customers is not always a competitive advantage as other competitors can acquire such data as well. The key to the betterment is the organization's capacity to meld data, analysis tools, business acumen, processes, and customer insight. (Barney, 1991; Akter et al., 2016; Mikalef et al., 2020).

When BDA capability is integrated into organizational processes it becomes a strategic organizational resource. An organization that has good analytical technology and poor managerial skills can miss the opportunity to translate results of analytics to customer value. The organization that can marry data with CRM, marketing, service and decision-making processes can turn data into a helpful tool for customers. (Mikalef et al., 2020; Akter et al., 2016).

The RBV then offers a theoretical foundation for the hypothesized positive correlation between BDA and customer retention. In the event that analytics is totally used into business processes, companies improve their customers' understanding and are better positioned to provide relevant and timely experiences. (Akter et al., 2016; Holmlund et al., 2020).

Dynamic Capability Theory

Dynamic capability theory is an extension of RBV as it addresses how organizations leverage resources to adapt to the changing environment (Teece et al., 1997). Dynamic Capabilities: Sense of opportunity and threat, seize opportunities, and transform/reconfigure resources. (Teece et al., 1997; Mikalef et al., 2019).

BDA fits well with dynamic capability theory because analytics will allow organizations to continuously sense the changes in customer behavior. Customer preferences are not static. There are several reasons customers switch brands, including price, service problems, convenience, competition, technological advances, and evolving expectations. With analytics, companies can identify these shifts sooner. (Lemon & Verhoef, 2016; Holmlund et al., 2020).

As per Wamba et al. (2017), the ability of BDA affects the organizational performance through the process capabilities. Research in the area of BDA-enabled dynamic capabilities also shows that analytics can play a role in the organization's performance in improving marketing ambidexterity and other adaptive capabilities (Business Process Management Journal, 2023). (Mikalef et al., 2019; Wamba et al., 2017).

When it comes to customer retention, the sensing is provided by analytics, the seizing is done through CRM and personalization, while the reconfiguration is achieved by continuous improvement of the customer experience. The relationships are presented in a theoretical logic. (Teece et al., 1997; Holmlund et al., 2020).

Customer Retention

Customer retention is the capacity to retain customers and keep them loyal to a company over time. Retention includes repeat purchases, relationship continuity, resistance to competitors, willingness to continue the relationship and behavioral intentions to stay with the organization.



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Retention differs from customer acquisition in that it's all about keeping your customer base intact, while acquisition is all about bringing in new customers. Customer retention is a key priority in competitive markets as it can foster repeat sales and lead to beneficial word-of-mouth.

There are several factors that affect customer retention: Customer satisfaction, trust, perceived value, service quality, switching cost, relationship quality, personalization, and organizational responsiveness. BDA has an impact on multiple of these determinants.

Predictive analytics, for instance, can help determine which customers' engagement is dropping. Reviews and social media comments can be used to identify negative sentiment. Recommendation systems can enhance product relevance. Customer Segmentation can help businesses deliver personalised offers. Churn prediction can forecast the risk of churning. These applications provide examples of how analytics can help you make decisions for retention.

Thematic 4: Big Data Analytics and Customer Retention

There are three main ways that BDA relates to customer retention.

The first benefit of BDA is that it provides a better understanding of customers. By analyzing customer data such as past transactions, browsing history, complaints, demographics, communication patterns, and more, organizations can create more detailed customer profiles.

Second, BDA enhances the response of the organization. Organizations can detect customer issues and behaviors more quickly with analytical systems. The sooner they respond the less chance that their dissatisfaction will lead to customer attrition.

Thirdly, BDA is personalization friendly. Consumers are becoming more demanding, expecting that the company will know how to meet their needs. With analytics, companies can personalize recommendations, communication, pricing offers, loyalty rewards and service interventions.

Therefore:

H1: Businesses that apply big data analytics to their customer interactions are likely to see higher retention rates.

Customer Insight Generation

Customer insight generation is the process by which the organization is able to convert customer data into valuable knowledge about customer needs, preferences, behavior and future actions.

It is crucial to recognise data from insight. Data is observation, insight is knowledge that is interpreted and used for making decisions. For instance, a record of the customer transaction is data. When the company gets the idea that a specific customer has begun to buy less and is turning to other brands, that's an insight.

BDA enhances customer insight generation as analytical tools enable patterns to be identified which would be hard to do manually. Predictive models can be used to predict customer behaviour and clustering techniques can be used to identify customer segments.



Therefore:

H2: Big data analytics has a positive impact on customer insight generation.

Personalization Capability

Personalization is modifying products, services, communications, recommendations and interactions based on the attributes of the individual customer.

As more and more data becomes available about customers, so have the opportunities for personalization. Analytical information can be used by firms to make product recommendations, create promotional messaging tailored to the customer, find the best communication pathways and make the right service interventions.

According to the study on big data analytical intelligence, big data analytics can help to achieve the mass customization capability and enhance the performance of CRM (Nam et al., 2019).

Personalization can also impact customer satisfaction as customers are given more relevant information. Relevance helps to cut through information overload and make organizational interactions seem more valuable.

Therefore:

H3: Generating customer insight is a significant positive influence on their capability of personalization.

H4: The degree of personalisation is a positive and significant influence on customer satisfaction.

Customer Information and Knowledge Management Capability

CRM capability is the organization's ability to effectively manage customer relationships through the integration of customer information, customer communication, customer services processes and relationship-oriented activities.

BDA adds to the strength of CRM as CRM systems need accurate and timely information about their customers. Analytics converts raw CRM data into valuable customer information.

The results of this study conducted by Shahbaz et al. (2020) revealed that the use of CRM capabilities plays a significant mediating role in relation to BDA and sales performance. This discovery indicates that analytics can be a value when it is part of relationship-management activities.

Therefore:

H5: Big data analytics has a positive meaningful impact on CRM capability.

H6: CRM capability provides a strong positive influence on customer retention.

The 8th key element to evaluate is when customers are satisfied with the service provided and when they continue to use the service.



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Customer satisfaction is the customer's assessment of whether the products, services and interactions of the organization are satisfactory to or exceed the expectations of the customer. Customers who are satisfied tend to be more likely to continue the relationship, buy from the organization, refer it to others, and not accept competitive offers.

The connection between satisfaction and retention is particularly important in an analytics-driven environment. It is analytics that doesn't keep customers! Instead, analytics produces information which organisations use to enhance customer experiences. When those experiences are positive, customers are more likely to stick around.

Empirical studies in Pakistan also confirm that in the context of Pakistan, customer satisfaction is also an important mechanism by which customer big data analytics affects organizational outcomes in recent times.

Therefore:

H7: There is a strong positive relationship between customer satisfaction and satisfaction with the service.

Moderating effect of Customer Satisfaction.

There might not be a direct correlation between BDA and customer retention. Analytics helps to retain customers when they feel the impact of data-driven decisions.

For instance, analytics can be used to determine what products a customer likes, when they like them best, and when they don't like them. The organization then makes suitable recommendations, thus enhancing the satisfaction of the customers. The organization will have a greater chance of having the satisfied customer shop again.

As a result, customer satisfaction is a process by which analytics can be applied for retention.

Therefore:

The customer satisfaction significantly mediates the relationship between big data analytics and customer retention.

Conceptual Framework

Conceptual framework uses BDA as the independent variable and customer retention as the dependent variable. The intermediate mechanisms are: customer insight generation, personalisation capability, CRM capability, and customer satisfaction.

A proposed model is:

The journey of Big Data Analytics continues to Customer Insight Generation → Personalization Capability → Customer Satisfaction → Customer Retention.

It is also suggested that a parallel relationship exists between two series:



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The Big Data Analytics will lead to a CRM Capability that will result in Customer Retention.

A direct pathway is held onto between BDA and customer retention to check if the overall relationship is still significant when the mediation mechanisms are included.

RESEARCH METHODOLOGY

Research Design

The study was of a quantitative cross sectional research design. The constructs from the BDA, CRM, customer satisfaction and personalisation literature were used to develop a structured questionnaire. Items were rated on a 5-point Likert scale from 1 = strongly disagree to 5 = strongly agree.

A set of observables was constructed and a sample of 420 was used for this worked empirical manuscript in order to illustrate the full SEM procedure and reporting format. These numerical results and findings are not given as the direct observations in the field, and must be replaced by the data collected in the field and presented as the academic publication.

Population and Sampling

The target population was users who had a relationship with service-oriented organizations and used digital channels with service organizations. The sample design included only respondents who had a high level of experience with digital customer interactions to assess personalization, data-driven services, satisfaction and relationship continuity.

A total of 450 questionnaires were included in the created analysis and 420 questionnaires were screened and usable. The response rate was 93.33%.

Measurement Instrument

Items reflecting the organization's capacity to (1) gather customer information, (2) combine data from other sources, (3) analyze customer data, (4) recognize patterns of customer behaviour, and (5) apply data analysis for decisions were chosen for assessing the BDA construct.

The customer insight generation was assessed via questions related to the organization's capacity to gain insight into customer preference, predict customer needs, define behavioural shifts and convert customer data into useful knowledge.

The attitude towards personalization capability was quantified by questions relating to customised recommendations, individual communication, relevant offers and adaptation of services to customer preferences.

The customer information integration, customer relationship monitoring, coordinated customer service and responsiveness were the factors used to determine the CRM capability.

The overall satisfaction, fulfillment of expectations, positive evaluation of service experience, and satisfaction with organizational interactions were used as indicators of customer satisfaction.



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The intention to continue the relationship, repeat purchase, resistance to competitor offers, willingness to remain a customer, and recommendation intention were used to measure customer retention.

Data Analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyze the model. The research dealt with the prediction and explanation of customer retention, involving multiple latent variables; thus, PLS-SEM was chosen. PLS-SEM is also suitable to be used in models with many constructs and mediation relationships (Hair et al., 2022). In the methodological literature the focus is on the evaluation of the measurement model and the structural model when using PLS-SEM.

This analysis was carried out in two steps.

The measurement model was assessed first by indicator reliability, Cronbach's alpha, composite reliability, average variance extracted (AVE) and discriminant validity.

Second, the structural model was tested by computing path coefficients, bootstrapping, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2) and indirect effects.

MEASUREMENT MODEL RESULTS

Reliability

The reliability analysis demonstrated satisfactory internal consistency for all constructs.

Construct	Cronbach's Alpha	Composite Reliability	AVE
Big Data Analytics	0.914	0.936	0.746
Customer Insight Generation	0.887	0.921	0.701
Personalization Capability	0.901	0.930	0.728
CRM Capability	0.908	0.931	0.730
Customer Satisfaction	0.895	0.927	0.761
Customer Retention	0.916	0.937	0.748



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The Cronbach alpha values for all the instruments were found to be higher than the standard of 0.70. Items' internal consistency was also high with composite reliability values above 0.70. All AVE values were above 0.50, suggesting good convergent validity.

These results indicate that the items used to measure these latent constructs were suitable.

Convergent Validity

Outer loadings and AVE were used to evaluate the convergent validity. The standardized loadings were greater than the acceptable levels and the retained items showed acceptable relationship with their constructs.

The AVE values ranged from 0.701 to 0.761. Convergent validity was found since each construct accounted for over 50% of the variance in its indicators.

Discriminant Validity

Discriminant validity was assessed using the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT).

Construct	BDA	CIG	PC	CRM	CS	CR
BDA	0.864					
CIG	0.701	0.837				
PC	0.654	0.731	0.853			
CRM	0.682	0.690	0.704	0.854		
CS	0.617	0.649	0.722	0.711	0.872	
CR	0.628	0.603	0.676	0.731	0.759	0.865

The square root of AVE for each construct exceeded its correlations with other constructs. This indicates adequate discriminant validity.

The HTMT values were also below the conservative threshold of 0.90, confirming that the constructs were empirically distinguishable.



Structural Model Results

After establishing measurement-model reliability and validity, the structural model was evaluated.

Coefficient of Determination

The R^2 values demonstrated substantial explanatory power.

Endogenous Construct	R^2	Interpretation
Customer Insight Generation	0.491	Moderate
Personalization Capability	0.534	Moderate
CRM Capability	0.465	Moderate
Customer Satisfaction	0.612	Substantial
Customer Retention	0.681	Substantial

The model explained 68.1% of the variance in customer retention. This indicates that BDA and the associated relationship mechanisms provided strong explanatory power for retention.

The model also explained 61.2% of the variance in customer satisfaction, suggesting that personalization and analytics-related capabilities were important determinants of customers' evaluations of their experiences.

Hypothesis Testing

Bootstrapping with 5,000 resamples was used to evaluate the significance of structural relationships.

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	BDA $\rightarrow$ Customer Retention	0.214	4.318	<0.001	Supported
H2	BDA $\rightarrow$ Customer Insight Generation	0.701	18.742	<0.001	Supported

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H3	Customer Insight → Personalization	0.731	20.185	<0.001	Supported
H4	Personalization → Satisfaction	0.722	17.936	<0.001	Supported
H5	BDA → CRM Capability	0.682	16.327	<0.001	Supported
H6	CRM Capability → Retention	0.291	5.742	<0.001	Supported
H7	Satisfaction → Retention	0.486	9.623	<0.001	Supported
H8	BDA → Satisfaction → Retention	0.341	7.462	<0.001	Supported

All eight hypotheses were supported.

The direct effect of BDA on customer retention was positive and significant ($\beta = 0.214$, $p < .001$) which supported H1. This finding shows that those with better analytics skills had better customer-retention results.

The greatest relationship in the model was between BDA and customer insight generation ($\beta = 0.701$, $p < .001$). The discovery supports the notion that analytics capability has a significant impact on the capacity of an organization to turn customer data into information that can be used for action.

Customer insight generation had a significant impact on personalization capability ($\beta = 0.731$, $p < .001$). This illustrates the need for the organization to understand and adapt to customer behaviour and preferences in effective personalisation.

Personalization was one of the variables that had a significant positive impact on customer satisfaction ($\beta = 0.722$, $p < .001$). The findings show that customer satisfaction is very dependent on relevant and personalized customer experiences.

BDA was also positively related to the capability with CRM ($\beta = 0.682$, $p < .001$). This validates analytics as a component to the relationship-management processes.

H6 was supported by the impact of CRM capability on customer retention with a β value of 0.291 and p value of <0.001.

The direct effect of customer satisfaction on customer retention was the highest ($\beta = 0.486$, $p < .001$). The discovery highlights the part analytics plays in retention, through the enhancement of the customer experience.

Mediation Analysis

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The indirect effect of BDA on customer retention through customer satisfaction was significant ($\beta = 0.341$, $t = 7.462$, $p < .001$). This confidence interval excluded zero, indicating that the mediation effect is significant.

Customer satisfaction partially explains the relationship between BDA and retention, as the direct effect of BDA on retention still existed after the mediator was entered in the model.

This discovery offers a significant insight into how analytics plays a part in retention. BDA is not just a technological device. It becomes useful when analytical data is converted into actionable changes that impact customers.

The mediation pathway can thus be represented as:

The use of Big Data Analytics can lead to a better customer experience, which can translate into customer satisfaction and finally customer retention.

This finding is in line with the results of the previous research, which identified the customer-oriented analytics capabilities as a pathway that affects organizational outcomes via customer relationship and satisfaction.

Effect Size Analysis

Effect sizes were examined through f^2 .

Relationship	f^2	Effect
BDA → Customer Insight	0.968	Large
Customer Insight → Personalization	1.145	Large
Personalization → Satisfaction	0.876	Large
BDA → CRM	0.872	Large
CRM → Retention	0.148	Small–moderate
Satisfaction → Retention	0.391	Moderate–large
BDA → Retention	0.092	Small



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The findings show that BDA has a strong impact especially regarding customer insight generation. The relative increase in the direct impact of BDA on retention compared with the impact on intermediate capabilities supports the belief that analytics creates customer-retention value through organizational and customer-experience effects.

Predictive Relevance

Predictive relevance was assessed using the Stone-Geisser Q^2 measure. The Q^2 values for the endogenous constructs were positive, indicating predictive relevance of the structural model.

Endogenous Variable	Q^2
Customer Insight Generation	0.337
Personalization Capability	0.371
CRM Capability	0.314
Customer Satisfaction	0.448
Customer Retention	0.496

The Q^2 value for customer retention was 0.496, indicating strong predictive relevance.

DISCUSSION

The results are clear and compelling evidence that big data analytics will offer an important ability in the customer retention space. The direct results of BDA on retention is noteworthy, which is where the analytics can help to help organizations understand their customers and react to their behavior changes.

This is in line with the resource-based viewpoint since BDA is valuable organizational capability if the resource and routines exist to convert the data into strategic value. The findings are also consistent with the dynamic capability theory: In this theory, the ability of an organization to adapt its relationship management activities depends on the capacity to sense the changes in customer preferences.

This is especially significant when looking at the strong correlation between BDA and generation of customer insight. Increasingly, organisations are gathering a lot of customer data, but the benefit of this is not simply the quantity of data. The critical capability is the ability to interpret data and create actionable knowledge.



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This discovery aligns with that of Wamba et al. (2017) who suggested that BDA capability brings organizational value by way of dynamic capabilities and process enhancements. In their empirical study of Chinese organizations, they found that performance can be affected by the analytics capability via a process-based lens, namely dynamic capabilities.

Customer insights have a significant influence on personalization to show that before the personalization can be effective, the organization must have accurate customer knowledge. When personalization is derived from incomplete or substandard data, it can turn into an invasion of privacy or irrelevant. Good analytics, then, is the informational basis upon which/or for which meaningful personalization can take place.

This is because personalisation has had a major impact on customer satisfaction, showing that customers are receptive when organizations offer tailored experiences. Customer effort reduction and perceived value increase will be achieved through personalized recommendations, targeted offers, timely communication and individualized service.

The important correlation found between BDA and CRM capability also validates the previous studies. Shahbaz et al., (2020) identified the relationship between BDA and sales performance is mediated by CRM capability. In the present study, we put this logic into practice by showing that a pathway from analytics to relationship continuity is also significant: CRM capability.

The strongest direct determinant of retention was customer satisfaction. Theoretically, this is a worthwhile outcome as it shows that technology is not a guarantee for customer loyalty. Customers stay with organisations when they have felt value, satisfaction, convenience, relevance and responsive service.

The findings of the mediation lend support to this interpretation. Partially mediated relationship between BDA and retention was observed. As a result, companies that put money into analytics but don't translate the analytical insights into customer value might not be getting the maximum value from their data capabilities for retaining customers.

THEORETICAL IMPLICATIONS

The study provides several theoretical contributions.

First, it extends BDA literature by emphasizing customer retention as an important outcome. Much previous BDA research has focused on firm performance, sales, innovation, and operational efficiency. The present model positions retention as a strategically important customer-level outcome.

Second, the study integrates RBV and dynamic capability theory. RBV explains why analytics represents a valuable organizational resource, while dynamic capability theory explains how organizations convert analytics into adaptive customer-management activities.

Third, the study identifies customer satisfaction as a key mechanism connecting analytics and retention. This contributes to understanding the customer-facing consequences of analytics.

Fourth, the study demonstrates that analytics capability creates value through complementary capabilities. BDA influences customer insights and CRM, which then affect personalization and satisfaction. This indicates that BDA should not be treated as an isolated technological variable.



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Fifth, the SEM findings provide evidence that the relationship between BDA and retention is both direct and indirect. The partial mediation indicates that analytics affects retention through multiple pathways.

Managerial Implications

The findings provide several implications for managers.

Create an Integrated Customer Data Infrastructure (ICDI).

Organizations must connect the dots between digital and physical customer data to ensure seamless integration. Whereas, interactions with the website, purchase history, complaints, social media data, loyalty-program data, and data relating to customers' interactions with customer service should be linked where it is appropriate and lawful.

An integrated customer profile allows managers to obtain a more comprehensive understanding of customer behavior.

Spend money on analytical skills instead of technology only.

Buying analytical software doesn't give you a competitive edge. Managers need to invest in the data scientist, analytical skills, managerial training, data governance, and cross functional work.

The relationship to the customer is strong, as is the relationship between BDA and customer insight – which takes data and turns it into knowledge.

Predictive Analytics for Retention: Use predictive analytics to forecast the likelihood of student retention.

Predictive models can be created to help organizations recognize customers early on, who are likely to be disengaged. Low purchase rates, fewer digital interactions, more complaints, less engagement and negative sentiment are potential measures of churn risk.

Retention interventions can then be targeted to customers who need attention.

Strengthen Personalization

Personalisation should be personalised and based on meaningful customer data, rather than indiscriminately using data. Organizations need to offer suggestions and communication that is appropriate to the customer's needs.

The findings highlighted the importance of the personalisation approach through the significant relationships that have been found with satisfaction.

Include Analytics in CRM

Analytics departments can't stand alone from the marketing and customer-service departments. The results of analyses should be incorporated into the CRM processes in order for employees to take action based on customer information.



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The strong BDA–CRM relationship is significant, indicating that this integration is of strategic relevance.

Monitor Customer Satisfaction

Customer satisfaction is an important pathway toward retention and managers should continually measure customer satisfaction.

Information from customer feedback, service complaints, online reviews, surveys, and behavior can be used combined to determine what needs to be improved.

As you can see, every aspect of your business relies on data. As you can imagine, all of your business depends on data.

As the use of customer analytics, however, continues to grow, there are also privacy and ethical obligations. Organizations gather a wealth of information about people, and that can tarnish trust when it's improperly used.

Customer data should thus be gathered and made use of in compliance with current privacy regulations, organizational guidelines, informed consent demands, and ethical standards. Organizations need to minimise unnecessary data collection and setting up appropriate access controls.

The use of algorithmic decision-making systems also means that monitoring must be carried out as predictive systems can generate biased decisions if the inputs to the predictive models have systematic bias. Analytical models should be continually assessed, and decisions based on automation should be managed accordingly.

One of the key implications of privacy in customer retention is if it is seen as surveillance, an organization can lose some of its customers. The goal of analytics is thus to provide customer value in a transparent, secure, fair and trustful way.

Limitations

There are several limitations of the study.

There are two points to be made in relation to the research model. First, the research model is based on cross-sectional data. Cross-sectional designs offer evidence of statistical relationships but are not as definitive as longitudinal designs in establishing temporally causal relationships.

Second, the model is based on selected mechanisms. Some other factors, like customer trust, switching costs, perceived value, service quality, brand attachment, and customer engagement, can also influence retention.

Thirdly, the empirical model uses self-reported measures. Future empirical research based on real behaviour records on retention rates can complement survey measures.

Fourth, the numerical dataset constructed for this manuscript is an empirical dataset with worked examples only and not field data. Therefore the results of the numbers should not be presented as observation from a real sample in a journal article. Data from the actual questionnaire should be



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analyzed with the same measurement and structural-model methods prior to submission of the manuscript.

Fifthly, cultural and industry differences can impact the link between analytics and customer retention. The strength of personalization, privacy concerns, customer expectations, and CRM maturity can vary substantially across industries and countries.

CONCLUSION

The role of big data in customer retention in this study was investigated using a structural equation model that includes customer insight generation, personalization capability, CRM capability and customer satisfaction.

The results show that BDA positively impacts the retention of customers. More significantly the findings indicate that there is not only a technological or a one to one relationship. Customer insights enhance personalization capability, and BDA enhances customer insight generation and CRM capability. Customer satisfaction has a direct impact on personalization, which, in turn, has a direct impact on customer satisfaction. Personalization definitely has an impact on customer satisfaction, and customer satisfaction definitely has an impact on personalization.

The mediation analysis indicates that customer satisfaction is a partial mediator of the relationship between BDA and customer retention. The result gives a crucial strategic takeaway: Companies can't simply accumulate a ton of data or sophisticated data analytics tools and expect to command loyalty. When analytical capabilities are translated into customer value, they keep customers.

The findings then confirmed the customer oriented approach towards big data analytics. Rather than storing vast amounts of customer data, organisations need to make data more useful and turn it into knowledge. Analytics should be embedded in the marketing, CRM, customer service, personalization and customer experience management.

The theoretical contribution of the study to the literature supports the relevance of RBV and dynamic capability theory to the understanding of the strategic importance of BDA. From a managerial viewpoint, the results suggest that the best value for investment in analytics is one that is complemented by organizational capabilities that enable the use of analytical insights in customer interactions.

In today's competitive business environment, retaining customers is a key business goal. With increased information and ease of switching between competing providers, it is imperative that organisations have better ways of knowing and responding to customer needs. It is this capability system that is embedded in big data analytics and that offers such a mechanism.

The real strategic benefit of BDA isn't in collecting all the data, it's in developing insights, insights into personalised experiences and personalised experiences into long-term customer relationships.

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