IMPACT OF RELATIONSHIP BETWEEN THE USE OF BIG DATA TECHNOLOGIES AND STRATEGIC COST MANAGEMENT ON THE COMPETITIVE ADVANTAGE: IRAQI EVIDENCE

Saud Saad Jasim

Thi Qar Directorate of Education, Nasiriyah, Iraq
*Corresponding author, email: saudsaad164@utq.edu.iq

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Abstract
The current research is an attempt to analyze the relationship between the use of big data technologies and strategic cost management and their impact on the competitive advantage of a sample of private banks listed on the Iraq Stock Exchange. Due to rising competition in the banking sector and the growing pace of change in the economic and technological environment, big data represents an important strategic asset for improving the performance of banks that are seeking to increase their competitive power and overall efficiency. Thus be able to take advantage of big data technologies and strategic cost management in an appropriate way, which is really appropriate for the dominance of banks over the market, is a must. The study is grounded on a principal hypothesis: The influence of the association of big data technologies and strategic cost management on competitive advantage The data collecting instrument was a questionnaire. The number of questionnaires is 173 distributed over a sample of accountants, auditors, financial analysts, and financial managers in most private banks listed on the Iraq Stock Exchange. Out of the distributed questionnaires, a total of 158 valid responses were returned (91%). The author administered the questionnaires and tested the hypotheses using the advanced statistical program Smart-PLS and Excel, applying Partial Least Squares Structural Equation Modeling (PLS-SEM). The results showed a significant effect of the relationship of both the use of big data technologies and strategic cost management on the competitive advantage of all the dimensions (determinants of the competitive advantage), cost and service quality, flexibility and flexibility to changes in the market, and creativity, innovation and time. The researcher further suggests that there is a need to develop the skills of bank employees in big data techniques, exploit big data as a strategic weapon to both enhance efficiency of the operational function and improve the strategic decision-making process, and to adopt sophisticated analytics to assess actual performance and facilitate risk management. In addition, the research highlights that big data technologies are aligned with strategic cost management, as a planning tool, and as a cost control tool used to achieve high service quality and operational efficiency, while also fostering a culture of innovation and continuous improvement. This capability will enable banks to transform their internal processes, create customer satisfaction with the immediate response to preferences, and therefore, gain their competitive advantage innovatively and efficiently.

1. Introduction

Amidst incessant technological advancements, big data is an enabler, and a strategic asset with game-changing potential, that can redesign private banks operations and objectives. As the private banks in Iraq seek to increase their competitive advantages in developing and dynamic markets, strategic cost management is one of the most contemporary techniques that provide the information that supports efficiency, effectiveness, adjustment and competitive advantage. In this competitive environment survival and continuity of the banks if there will be a necessity of adopting the strategic cost management approach. This focuses on creating long-term cost structure efficiencies that not only supports the banks' competitive position, but also provides new customer value that competitors are not providing. Therefore, there is a great potential to gain sustainable competitive advantage via the adoption of big data technology in a strategic cost management manner.

1.1. Research Problem

In terms of strategic cost just like the research problem that depicts the impact of the relationship between use of big data technologies and strategic cost management upon the competitive advantage of private banks in Iraq.

Private banks in Iraq are unaware of big data and how to use it to achieve better efficiency and cost in their operations. A lack of understanding prevents optimal use of this resource.

Most private banks at right now in time still do not have distinguished data strategies within the Banks corporation to help in how and primary objectives of integrating big data into their banking related operations poorly poor performing integrate data in strategic cost management and procurement in achieving right level of competitive advantage. Private banks work in a competitive environment where estate planning is the norm. Failure to use big-data could result in a loss of competitiveness.In light of the above, we derive the following principal research question:

Does the relationship between the use of big data technologies and strategic cost management affect the competitive advantage of private banks? From this main question, the following sub-questions emerge: 1) Does this relationship affect the cost of services provided? 2) Does it impact the quality of services offered? 3) Does it influence operational flexibility? 4) Does it affect innovation and creativity? 5) Does it influence service delivery timeliness and responsiveness to customer preferences?

1.2. Research Objectives

Analyze and explore the relationship between the use of big data technologies and strategic cost management in private banks.

Study the effect of the relationship between the use of big data technologies and strategic cost management on competitive advantage.

Contribute to academic literature and add value to research on the topic, particularly in the Iraqi banking context.

1.3. Research Significance

Develop effective strategies for improving strategic cost management and operational efficiency through big data.

Help private banks achieve competitive advantage through the integration of modern technologies.

Enrich academic knowledge on big data and strategic cost management, opening pathways for future research.

2. Research Hypotheses

Although some previous researches have provided useful insights into strategic cost management and big data analytics as well as the complementary roles that manifolds their relationship in one side and competitive advantage in the other, and although they had a precise contribution to the fields under consideration, none (to the best knowledge of the researcher) have linked the function exercised by the relationship between them and a competitive advantage emerged from such a relationship in a bank context and in specific the context of private banks in Iraq.

There is a significant impact of the relationship between the use of big data technologies and strategic cost management on competitive advantage.This leads to the following sub-hypotheses:

The relationship between the use of big data technologies and strategic cost management significantly affects the cost of services provided.

The relationship between the use of big data technologies and strategic cost management significantly affects service quality.

The relationship between the use of big data technologies and strategic cost management significantly influences creativity and innovation.

The relationship between the use of big data technologies and strategic cost management significantly affects service delivery Timeliness and responsiveness to customer preferences.

The relationship between the use of big data technologies and strategic cost management significantly influences flexibility in adapting to market changes.

2.1. Variables of Study

2.1.1. Independent Variable

Impact of big data technologies on strategic cost management with six dimensions: 1) Financial planning and forecasting. 2) Strategic decision-making. 3) Operational efficiency. 4) Added Value. 5) Sustainability and continuous improvement. 6) Risk management.

2.1.2. Dependent Variable

Competitive Advantage including five dimensions: 1) Cost of services. 2) Quality of services. 3) Being flexible and able to react to trends in the market: Innovation and creativity; timeliness and responsiveness.

2.2. Research Model

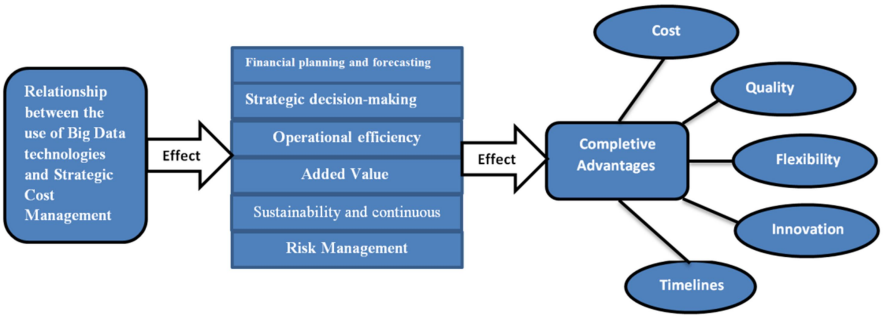


Figure 1. Research Model
Source: Prepared by the researcher

2.3. Literature Review

2.3.1. Researches Linking Big Data Technologies with Competitive Advantage

The objectives of this study were to initiate a discussion about the reasons why organizations may not be able to sustain competitive advantage through solely big data streams. One of the main conclusions was that big data by itself was not enough for competitive advantage, but rather the right strategies and integration in the organization (Lambrecht & Catherine, 2016).

This paper has investigated the literature on big data, examining its main ideas in order to gain insight into the issues of value extension and conduct, as well as the problems associated with the implementation of big data into business. The literature reviews also reveal that whether big data can provide an offence against competitors. Based on the resource-based view theory, the results highlighted the importance of big data as a unique source of competitive advantage (Husam, 2017).

That included the study that examined the relationship between big data applications and innovation and operational efficiency of firms. The result concluded that big data leads to an

increase in innovation and greater operational efficiency which helps in the competitive advantage. It stressed that in today's time it is necessary for companies to use big data to gain business insights and stay ahead of their competition (Nazmus, 2022).

Qualitative research methodology and a three-phase data analytical process (data reduction, data display and conclusion drawing) were deployed to examine how big data and analytics can enhance competitive advantage. You actually demonstrate, through your results, that big data and analytics are critical tools in the digital age that empower businesses to tailor customer experiences while optimizing operations and formulating business strategy. Companies sue big data to enable better decision-making, develop new products and services, drive efficiency and enhance customer relations (Playground & Ikhsan, 2024).

Abstract This study examined how innovation mediates the relationship between big data analytics and competitive performance. Using the dynamic capabilities lens, it assessed the interplay between big data analytics and business performance and found that big data analytics assist organizations in scanning the environment for opportunities and capitalizing on them through resource orchestration, resulting in BMI and ultimately competitive performance (Nandi et al., 2024)

2.3.2. Studies on the Relationship Between Strategic Cost Management and Competitive Advantage

The purpose of this research was to find out how tools of cost management assist in attaining strategic objectives in Kosovo enterprises. The paper therefore concluded that the strategic use of tools like value chain analysis and lifecycle costing improves financial performance and enables the firm to gain competitive advantage. In a complex, dynamic business environment, strategic cost management has become imperative for organizations of different types (Vlora, 2017).

The paper aimed to identify the role of strategic costs in activating competitive advantage in the paint industry in Khartoum as a field study. It discovered a relationship in which strategic cost management lowers costs in the product design stage and reinforces consciousness while analyzing competitor cost structures. The strategic cost methods should be applied in order to achieve sustainable competitive advantage and cost reduction according the this analysis study (Abubkr et al., 2017).

The objectives of this paper were to make a model approach for fulfilling the Sustainable Development Index and strategic cost management together. The study emphasized that strategic cost management provides reliable and relevant information on costs and caters strategic pricing decisions, leading to the improvement of profits and competitive advantages especially in the manufacturing sector. The study promoted the adoption of activity based costing, target costing, continuous improvement and lifecycle costing (Mohammad et al., 2021).

This study investigated the impact of strategic cost management on quality of decision making (QDM), competitive advantage, profitability and organisational sustainability. Strategic situation analysis and value chain analysis strongly influence decision quality, competitiveness, profitability, and sustainability. Cost-driver analysis in turn enhances competitive advantage and profitability (Anucha, 2021).

This research focused on using strategic cost tools as a choice to use for enhancing production processes one of the essential competitive pistons in the age of new dynamic economic surroundings of industrial companies. It said that value chain analysis and target costing cut costs and raise quality- albeit if backed by intensive staff training (Al-Salmawi, 2024).

2.3.3. Researches on Big Data Technologies, and Strategic Cost Management

This study aims to investigate the effect of big data analytics on facilitating the competitive advantage of Palestinian industrial companies. It found through descriptive-analytical research method that big data analytics has high effects on competitive position, low-cost leadership, differentiation and focus strategies as well (Abd El Rahman & Mohammed, 2021).

In this literature review, the impact of big data and analytics on cost control has been considered. The results confirmed that analytics have a strong impact on cost control decisions and that combining analytics with big data leads to increased market competitiveness (Titis, 2022).

The research examined the effect of big data analytics on managerial capabilities and firm performance. It facilitated the consensus that big data boost managerial capabilities, aids managing uncertainty and guarantees sustainability. The research showed that big data analytics are an important organizational asset enabling competitive proposition and organizational agility in volatile settings (Fillz, 2023).

Cost savings: Overview of some EC2 cost savings mechanisms used by Amazon itself: EC2 instance types Ecosystem spot instances Data lifecycle management (S3 lifecycle rules including cross-region transferring, etc.) Backups: The studied demonstrated on using spot instances as backup as well With great power comes great responsibility, and quantitative analysis from forumopsis offered 37% less operational costs for Amazon Web Services (AWS) infrastructure, data science that goes in the value you get out of the cloud (Vishnu & Chilukoori, 2024).

The present research illustrated the impact of blockchain and big data that changed the accounting and strategic cost management practices in Iraq. It highlighted better visibility and the ability to track costs in real time. Blockchain immutability is confirmed for reliable data integration that big data supported (Asaad & Yosra, 2025).

2.4. Theoretical Background of Big Data, Strategic Cost Management, and Competitive Advantage

Big Data is an essential strategic asset of any private bank in the today business world. Big data refers to huge collections of data gathered through different sources including business transactions, social platforms and sensors. Private banks now have the opportunity, supported by advanced analytics technologies, to generate accurate insights from this data to achieve higher operational efficiency by personalizing products and services to better meet customer requirements and facilitating innovation that will lead to enhanced competitiveness and sustainable growth in an increasingly demanding business environment. Similarly, strategic cost management in private banks is a method for planning and overseeing costs to fulfill defined objectives in an efficient manner. It helps to analyze costs associated with various operations, improve processes, streamline operations and cut costs where possible without affecting service quality—which ensures sustainability in business longevity and profitability over the long term and enhanced competitive capabilities.

2.4.1. Big Data

What is Big Data? Big Data — Definition

Big data is the large, heterogenous dataset which has a significant volume and a fast velocity of production, requiring for an advanced tools and techniques to be analysed and extracted values (Manyika et al.,2011). Data which volume, velocity, and variety, exceed the thresholds of traditional data tools capabilities to store, o process consumes, and assumes the horizontal need new technologies to process and analyze data (Laney, 2001).

Properties of Big Data

Volume

Relates to the large volumes of data being generated every day from varied sources such as social media, sensors and business transactions (Gandomi, 2015).

Velocity

Refers to the rate at which data is created and consumed; big data often needs instantaneous or close to instantaneous processing (Kitchin, 2014). It means how rapidly data is produced, transferred, and extracted to cater to an ever-growing appetite. Time between decision making and data arriving (Hajjaj, 2022). And time is pretty important when it comes to making decisions using these data.

Variety

This shows the various nature of data like structured and also unstructured data where unstructured data also include text, images and video (Chen, 2014). The reason for this diversity is that the data sources are multiple; social media, smart devices, sensors, web logs, and bez, The data formats on the other hand are different; text, video, images, audio, geographic and structured data, also noted by the data scheme, ratios between the data structures (well structured or unstructured), all of these requiring special technologies to store and process (Abawajy, 2015).

Veracity

Connected to data quality and correctness, since big data can sometimes consist of inaccurate or false data (Zikopoulos, 2012). It is about the reliability of the data source and the quality of the internal data, such as accuracy, integrity, and timeliness, and emphasizes the importance of reliability in using the data (Bahga & Madisetti, 2019).

Value

Critical to the ability to create value from big data via advanced analytics (Marr,2015) So it means expected utility from data, the better is the accuracy and the quality, the more you will gain. Duration for data processing is another consideration, because time for processing and time for actionable information are inversely proportional (Naeem et al., 2022).

The Significance of Big Data

Our experience with big data analytics opens up previously underutilized data sources to helpprovide entirely new and useful insights that enable companies to make faster, better decisions. The amount of digital data is growing—and growing faster than ever. In competitive business environments, the ability to successfully analyse big datasets will become, if it is not already, a matter of survival (Farid, 2021). So, big data is important because of the following:

Strategic Planning & Predictive Forecasting

Through machine-learning models and predictive analytics, big data enhances the quality of forecasting, allowing prediction of market trends, customer behavior, and economic shifts. Second is the support for strategic planning which means it helps in the analysis of all internal and external environments at a certain hour (Ghasemaghaei, 2020; Wamba et al, 2020).

Enhanced Decision-Making

Approach-based intensive and accurate insights which allows private banks to base their decisions on data rather than intuition (McAfee & Brynjolfsson, 2015).

Efficiency of Operations

Allows private banks to optimize their internal processes, cut costs, and boost productivity (Wamba, 2015)

Enhanced Customer Experience

Helps banks to analyze customer behavior and identifying the preference of customers, enhancing original product or service features (Chen, 2012).

Innovation & Value Addition

Provides an opportunity to see things that have not been seen which can lead to the development of new products and services suited to the changing market needs (George et al., 2014)

Risk Management

Assists in identifying and anticipating possible risks so that the banks can take proactive mitigation measures (Kwon et al., 2014).

2.1.4 Technologies for big data

Data Mining

Data mining is an analysis process used to extract actionable insights from huge data sets. It can discover patterns that remain hidden and constantly analyses data for making predictions

about the consumer trends with the outcome towards improved efficiency and the lowest overall cost (Dahiya et al., 2021; Witten et al., 2017; Ali, 2023).

Machine Learning

A facet of AI which revolves around algorithms and models that automatically improve through the experience of data. It can be used in consumer behavior analytics, supply chain optimisation, service automation, and competitive edge (Kühl et al., 2020; Janiesch et al., 2021; Harvard Business Review,2023; Iqbal, 2021), identifies patterns to make decisions or generate predictions with a high level of accuracy. The types of ML encompasses supervised, unsupervised and reinforcement learning (Syracuse iSchool, 2025).

Natural Language Processing (NLP)

A subset of AI which allows computers to understand human speech from diverse sources such as email, SMS, news, social media, audio, and video. It provides real-time functionality in analysing sentiment and meaning and is used in applications such as syntax, semantics, named entity recognition, machine translation (NMT), sentiment analysis, search engine, voice assistants, chatbots, and fraud detection (Wang et al.,2020; Young et al., 2018; Jurafsky & Martin, 2025; Hirschberg & Manning, 2015).

Neural Networks

Neuroscience: Computational models based on the brain, consisting of units called “neurons” connected to one another. They predominantly implement features of both pattern recognition and decisions based on data. They are the basis for deep learning, and are applied in computer vision, NLP, financial market prediction and analysis, and sentiment analysis (Schmidhuber, 2015; Abdul Malik, 2021; Goodfellow et al., 2016; Young et al., 2018).

2.4.2. Strategic Cost Management

What is Strategic Cost Management

Strategic cost management is a way of thinking targeted at cost and revenue optimization. It includes cost management and revenue management for increasing productive efficiency, profitability, and customer satisfaction for assisting the company in its decision to provide more customer value at less cost (ElKelety, 2006). It is a holistic initiative that is backed by standardized tools and techniques to maintain the competitive position by emphasizing strategy, cost drivers and the continual cost cutting (Mahidi, 2009). The proactivenature of it is due to the fact that managers influence product costs through the decisions they make, enabling the organization to sustaincompetitive advantage by providing product differentiation through higher value and lower cost (Khaled & Hamdan, 2016). Strategic cost management involves providing timely and accurate cost information that assists in the operating and decision-making processes, along with enforcing competitive strategy and performance control (Amin & Zghadar, 2014). It also provides a provision to evaluate investment decisions through the aid of IT systems (Za'rab, 2013). Its usage help determine strategic factors, environment analysis, provision of superior and cheaper products/services, efficient utilization of resources, identify continuous growth opportunities, and anticipate uncertainties (Al Dessouki, 2024).

It also incorporates risk management, solving cost uncertainty in advance (Mohamed et al., 2011). Benefits of resource costing are: it takes account of used resources, it helps to eliminate non value added activities, it helps to assess efficiency, helps to plan for the future and helps to maintain economic continuity in a very stiff competition (Al Khawaz & Yusuf, 2011).

Importance of Strategic Cost Management

The efficient allocation of resources and effective financial efficiency could be good sources of competitive advantage for private banks (Blocher et al., 2010), thus strategic cost management are essential in the industry. It backs both profitability goals and the performance of the entire organization. Key benefits include:

Planning & Forecasting

Improves the accuracy of cost forecasts used to support realistic budgeting and adjustment to changing economic conditions (Blocher et al., 2024).

Strategic Decisions

Availability of accurate cost structure information for strategic, profit oriented decisions (Shank & Govindarajan,1993; Johnson & Green,2020).

Operational Efficiency

Eliminates waste, maximizes efficiency, and cuts costs (without compromising quality) (Kumar, 2024).

Value Addition

Identify the value adding activities which increases customer loyalty and gives a better ROI (Bhargava et al., 2018).

Continuous Improvement & Sustainability

Cultivates a mentality of perpetual enhancement and business survival (Mansour & Abdelkarim, 2024).

Risk Management

Provides the opportunity to identify and assess financial risks in advance (Elsayed et al., 2011).

2.4.3. Competitive Advantage

Competitive Advantage Defined

Competitive advantage is the bedrock of strategic thinking—it is the collection of tangible and intangible resource capabilities that a firm possesses or discovers through its strategic focus. This will allow firms to attract and retain customers by providing more value (e.g., lower price or higher quality) compared to its competitors (Al-Bakrid, 2010; Teece, 2018). Including but not limited to superior technology, superior brand management, superior systems of productionistic – high performance in getting such desirable goods/service (Teece,2018; Pisano, 2015; Al Masoudi, 2010).

Basic elements of competitive advantage

All these competitive advantages are manifested through cost advantage, differentiation, or focuss. Writing a position – Private banks can choose appropriate strategies to reach for the competitive advantage (Cacciolatti & Lee, 2016). Core factors include (Al Masoudi, 2010): 1) Cost: Competing with lower prices than others to gain customers. 2) Quality: Better control over design + delivery processes. 3) Timeliness: This means responding to the requirements of customers quickly and delivering products/services within the committed time. 4) Flexibility: Making quick changes in operations according to the market. 5) Innovation: Making new products/services available to market sooner than competitors.

Competitive advantage characteristics

According to (Tahir & Idris, 2020) Features of sustainable competitive advantage: 1) Longevity and sustainability, not just short-term. 2) Relativity—measured against competitors or over time. 3) Continuously updated to match internal and external changes. 4) Flexible—able to shift with environment and resource evolution. 5) Aligned with the firm's short- and long-term goals.

Importance of competitive advantage

Access to competitive advantage is — or should be — of paramount importance to private banks as a means to mould strategy, identify new growth and innovation opportunities. Its significance includes: 1) Better Financial Performance: Achieving higher profits via value or cost advantage (Pisano, 2015). 2) Market Share: Increase of market presence through out-performing the competitors (Cacciolatti & Lee, 2016). 3) Improved customer relationship: value acts as increased loyalty and long-run tie with (Kumar, 2016). 4) Innovation Capability: They have higher

ability to invest in R&D (Crossan & Apaydin, 2010). 5) Sustainable Advantage: Sustainability of advantage guarantees success in dynamic environments (D'Aveni et al, 2010).

The empirical part of the research will follow and thus relationships among the study variables will be theoretically examined and dimensions defined to help construct the questionnaire to be statistically analysed.

2.5. The Relationship Between the Use of Big Data Technologies and Strategic Cost Management

We identified a number of dimensions for studying the connection of big data technology usage with analytical research which are based on the theoretical review of the research' variables. In the empirical part, these dimensions will be subjected to a statistical analysis:

2.5.1. Financial Planning & Forecasting

Strategic cost management resources such as financial planning, and budgeting, help corporations establish cost targets and assess their performance financially (Horngren et al., 2012). Since big data serves as a useful tool in policy and decision-making—by using the results of the analysis and processing of this data to develop plans, policies, and major decisions in a timely and accurate manner (Merendino et al., 2018). Additionally, the strategic cost management effectiveness of the IT is a function of timeliness of data, auxiliary firm performance and other decision-making systems also are supported by the IT (Kheneth & Jane, 2014).

2.5.2. Strategic decisions

The phases of investment decision assessment utilizing strategic cost management in IT systems (Za'rab, 2013) It is important to implement strategic cost management tools in a system of information under uncertainty since strategic cost management tools provide cost analysis through a precise measurement and efficiency. Consequently, they bolster strategic decision making. They allow the identification and analyses of the determinants of factors affecting cost internally and externally, facilitating accuracy reporting for decision-making at the strategy level for an improved adaptability and competitive edge (Al Dessouki, 2024). However in this context, big data helps do a outsmart customer service through accurate analysis of customer preferences and needs. Big data technology has become a vital element in competitive markets which ensures a clear advantage to corporations utilising big data technologies. By providing advanced models for understanding market behaviors and trends (enabling accurate market forecast-ing), deep data analytics and market metrics facilitate strategic decision making (Merendino et al., 2018) Thanks to big data, they can also collect and analyse performance related data, enabling managers to make evidence based decisions (Davenport, 2014).

2.5.3. Operational Efficiency

As stated by Drury (2018), strategic cost management is committed towards controlling costs, however, cost management is always forward looking and relates to cost reduction, continuous improvement, and how activities and operations are being carried out. Cost reducing strategies consist of improvements to processes, process redesign, and more efficient use of technology resulting in reduced operational and production costs (Kaplan & Cooper, 1998). The first stage is recognizing the core costs, which is a part of strategic cost management, and it involves analysis of the fundamentals as cost elements in operations to associate them with every product or service to increase the profitability (Drury, 2018). For example, big data improves production processes by analyzing productivity and cost-related data, and supports waste reduction and efficiency gains (Gang et al.,2019). The use of data-driven innovation to identify trends and enhance offerings also allows firms to compete better (Brynjolfsson, 2014).

2.5.4. Added Value

Strategic cost management, on the other hand, seeks both to minimize a companys costs and to use its cost position as a base for a competitive advantage, which involves providing customer satisfaction at a lower cost than competitors. One must also remember though that lowering cost comes detrimental to customer satisfaction (Drury, 2018). Porter (1985) describes this as Value analysis — it focuses on the assessment of all activities and components that contribute value to the

customer, with the aim of minimizing costs in activities that are not essential to apprehending the product value. Here, big data allows organizations to study and improve customer behavior and preferences which contribute to better services and higher satisfaction and retention (Kumar & Reinartz, 2016).

2.5.5. Continuous Improvements and Sustainability

Strategic cost management consists of managerial actions depending on cost reduction (some ideas of that intention could be managed by accounting information system). Such process improvements make the process flow more efficient and effective and can reduce expenses while helping to satisfy customers (Drury, 2018). The scope of continuous improvement is not limited to reducing costs but also includes those related to planning, control, and performance assessment processes (Al Masoudi, 2010) Apart from this, big data analytics provides decision makers with deep insights into a multitude of patternspatterns that impact their business environment, helping them not only anticipate changes but also identify opportunities that offer a greater advantage over competitors with better, repeatable decisions and less uncertainty. This data-driven technique exposes unseen traditions, providing executives with the ability to implement groundbreaking and evidence-based improvement (Ohaba, 2023).

2.5.6. Risk Management

Strategic cost management also strengthens price-related decision making as a rational choice that economizes on multiple strategic factors and integrates the influences of internal and external environments. It also facilitates the delivery of unique products (or services) through the persistent enhancement of quality or cost by utilizing the cost leadership strategy or through innovation via the R&D activities. In addition, it helps in allocating resources accurately between value adding activities external and internal to the organization and also helps in identifying potentials for sustenance and predicting threats (Al Dessouki, 2024). Maintaining a sound Strategic cost management but within a risk management perspective to be able to foresee and mitigate handling the future risks. Modern theory of financial risk focuses on mitigating uncertainty of costs in strategic cost management based on the concept of risk is defined as events or the process of causing external and/or internal occurrence that would not be desirable and may cause significant threat to adequacy of profit (Mohamed et al., 2011). Big data technologies help mitigate risks for companies by predicting future trends, as well as analyzing current and historical data trends that support strategy formulation for anticipated changes in the future (Waller & Fawcett, 2013).

Because of this theoretical examination of the relationship between strategic cost management and big data Technologies, the researcher felt to have an empirical setting to highlight the expected impact of this relationship on competitive advantage in the setting of Iraqi Private Banks. This will be done through qualitative data analysis based on prepairedquestionaire using statistical analysis software. Statistical Analysis of the Research Variables will be introduced in the next chapter.

3. Method

3.1. Research methodology

Big data is high-volume, high-velocity information that cannot be processed using traditional software solutions. It consists of structured and unstructured data and covers business transactions, customer behavior, social media, geography, health and many other aspects of data (Chen et al, 2014). With the onset of the digital age, big data has proven to be a crucial raw material for institutions to make decisions and gain competitive advantage (McKinsey Global Institute, 2011).

3.2. Design of Research

The researcher took a dual approach: deductive reasoning on the theoretical side (via literature review) and on the empirical side an inductive reasoning approach to measure the effects of big data and strategic cost management in their role as mediator variables on the competitive advantage of private banks in Iraq.

3.3. Research Population & Sample

The research population consists of Employees of Private Banks registered in the Iraq Stock Exchange, while the research sample was limited to employees of (accountants, auditors, financial analysts and financial managers) with a sample size of 158 respondents from various branches of private banks in the province of Thi Qar.

3.4. The limits of time and space

Spatial: Employees working in private banks listed in the Iraq Stock Exchange in Thi Qar Governorate. Temporal: 20 April 2025 to 20 May 2025 for questionnaires.

A descriptive-analytical methodology was employed, supported by a structured questionnaire as the primary data collection tool. Statistical techniques were used to analyze the relationships among the variables under study.

4. Results and Discussion

4.1. Hypotheses Testing and Interpretation of Results

Following the theoretical foundation explored in previous chapters, this section presents the empirical component of the study. The current chapter focuses on testing the proposed hypotheses and discussing the findings in detail.

4.1.1. Variables Items Coding

To complete the statistical analysis, the study variables and their dimensions were coded systematically. These codes served as references within the SmartPLS modeling environment.

Table 1. Coding scheme used for each variable and its sub-dimensions.

#	Variables	Dimensions	Codes			
1	Relationship between big data technologies and strategic cost management	Financial Planning and Forecasting	A1	A2	A3	A4
		Strategic Decision Making	B1	B2	B3	B4
		Operational Efficiency	C1	C2	C3	C4
		Value Added	D1	D2	D3	D4
		Sustainability and Continuous Improvement	E1	E2	E3	E4
		Risk Management	F1	F2	F3	F4
2	Competitive advantage	Cost of services provided	G1	G2	G3	G4
		Quality of services provided	H1	H2	H3	H4
		Flexibility and Market dynamics Response.	I1	I2	I3	I4
		Innovation & Creation	J1	J2	J3	J4
		Timeliness of service delivery & responsiveness to customer preferences	K1	K2	K3	K4

4.1.2. Measurement Model Evaluation Criteria

The measurement model was assessed based on the standards established for Partial Least Squares Structural Equation Modeling (PLS-SEM), as proposed by Hair et al. (2017). The model was evaluated using the following key criteria:

Table 2. Evaluation criteria for the measurement model

Standard	Evaluation Criteria
Internal Consistency Reliability	Composite reliability (CR) ≥ 0.60, Cronbach's Alpha ≥ 0.70
Indicator Reliability	Outer loading ≥ 0.70
Convergent Validity	Average Variance Extracted (AVE) ≥ 0.50
Discriminant Validity	The square root of AVE should be higher than inter-construct correlations (Fornell-Larcker criterion).

4.1.3. Measurement Model Evaluation

To assess the quality of the measurement model, SmartPLS software was employed. Figure 2 illustrates the measurement model and the path coefficients. Loadings on arrows indicate indicator reliability, while values within circles represent composite reliability.

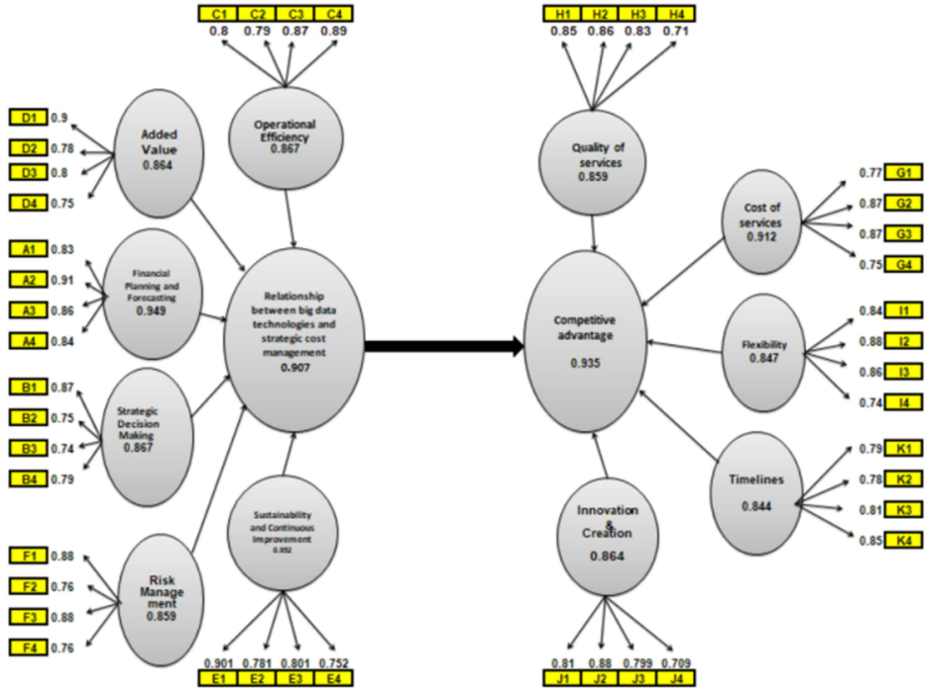


Figure 2. Measurement model and path coefficients
Source: Designed by the researcher using SmartPLS results.

According to Hair et al. (2017), indicators with loadings above 0.70 are retained. Items with loadings between 0.40 and 0.70 may be excluded if their removal enhances the model's quality. In this study, all indicators exceeded the threshold of 0.70 and were retained accordingly.

Table 3 presents the reliability and validity statistics for each construct, including indicator loadings, Cronbach's Alpha, composite reliability, and AVE values. All values indicate satisfactory internal consistency and convergent validity.

Table 3. Results of the Measurement Model Evaluation

No	Variables / Dimensions	Items	Standardized Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
1	Financial Planning and Future Forecasting	A1	0.834	0.854	0.949	0.622
		A2	0.913			
		A3	0.859			
		A4	0.839			
2	Strategic Decision-Making	B1	0.867	0.863	0.867	0.625
		B2	0.747			
		B3	0.735			
		B4	0.787			
3	Improving Operational Efficiency	C1	0.804	0.866	0.867	0.626
		C2	0.794			
		C3	0.874			
		C4	0.894			
4	Achieving Added Value	D1	0.789	0.864	0.864	0.626
		D2	0.779			
		D3	0.869			
		D4	0.929			
5	Sustainability and Continuous Improvement	E1	0.901	0.851	0.852	0.621
		E2	0.781			
		E3	0.801			
		E4	0.752			
6	Risk Management	F1	0.876	0.856	0.859	0.623
		F2	0.756			
		F3	0.884			
		F4	0.764			
7	Cost of Services Provided	G1	0.771	0.858	0.912	0.624
		G2	0.874			
		G3	0.867			

No	Variables / Dimensions	Items	Standardized Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
8	Quality of Services Provided	G4	0.747	0.859	0.859	0.624
		H1	0.847			
		H2	0.857			
		H3	0.834			
		H4	0.714			
9	Flexibility and Responsiveness to Market Changes	I1	0.844	0.844	0.847	0.616
		I2	0.884			
		I3	0.859			
		I4	0.739			
10	Creativity and Innovation	J1	0.809	0.861	0.864	0.625
		J2	0.879			
		J3	0.799			
		J4	0.709			
11	Timelines (Speed of Service Delivery and Responsiveness to Customer Needs and Preferences)	K1	0.785	0.841	0.844	0.613
		K2	0.783			
		K3	0.812			
		K4	0.853			

4.2. Hypothesis Testing

This section presents the statistical testing of the research hypotheses. Each hypothesis was evaluated using the SmartPLS software based on bootstrapping techniques. The significance of the relationships between the constructs was assessed using path coefficients (β), t-statistics, and p-values.

4.2.1. Main Hypothesis

There is a statistically significant impact of the relationship between big data technologies and strategic cost management on competitive advantage.

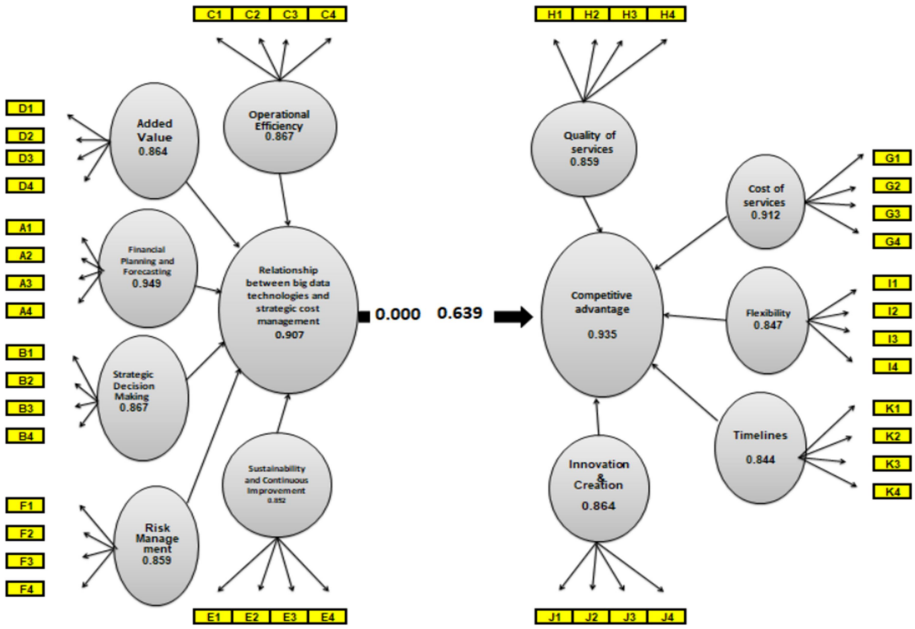


Figure 3. Path and results of testing the main hypothesis
Source: Designed by the researcher using SmartPLS results.

The table 4 shows the results of the main hypothesis test using the Smart-Pls program:

Table 4. Results of the Main Hypothesis test

Path	Original sample (Bata)	Standard deviation (STDEV)	T statistics	P value
Relationship between big data technologies and Strategic cost management > Competitive advantage	0.639	0.064	9.984	0.000

Source: Prepared by the researcher using SmartPLS results.

Figure 3 displays the path analysis used to test the main hypothesis. As shown in Table 4, the path coefficient (β = 0.639) is positive and significant, with a t-value of 9.984 and a p-value of 0.000, which is well below the 0.05 threshold. The standard deviation (0.064) suggests a low variance, confirming the precision of the estimation.Based on these results, the main hypothesis is accepted, indicating that the integration of big data technologies with strategic cost management has a strong positive influence on enhancing competitive advantage.Table 5 below presents the R-square value of 0.416, indicating that 41.6% of the variance in competitive advantage is explained by the independent variable. The F-square value of 0.703 suggests a substantial effect size (above the 0.35 threshold), further confirming the model's explanatory power.

Table 5 Explanation and influence coefficients for the main hypothesis

F-square	R-square	Path
0.703	0.416	Relationship between big data technologies and Strategic cost management > Competitive advantage

Source: Prepared by the researcher using SmartPLS results.

Interpretation: These findings emphasize that leveraging big data in strategic cost management contributes significantly to enhancing competitive advantage. This is achieved through improved service personalization, cost analysis, innovation, and sustainability practices that respond to customer preferences and market demands.

First Sub-Hypothesis

There is a statistically significant impact of the relationship between the use of big data technologies and strategic cost management on the cost of services provided. The path is shown in the figure below for the purpose of testing the hypothesis:

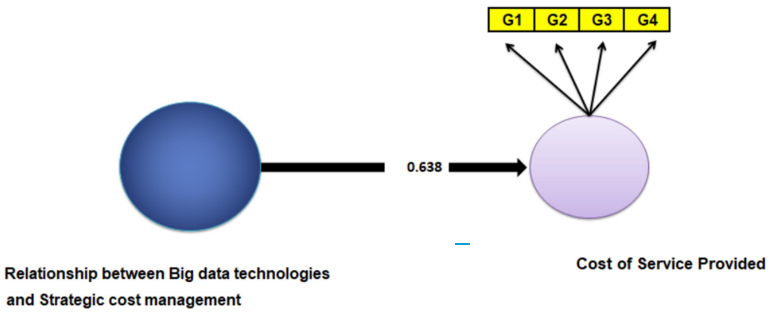


Figure 4. Results of the path test of the First sub-hypothesis
Source: Designed by the researcher using SmartPLS results.

Table 6 below shows the test results of the first sub-hypothesis based on the Smart-Pls program:

Table 6. Results of the first sub-hypothesis test

Path	Original sample (Bata)	Standard deviation (STDEV)	T statistics	P value
Relationship between big data technologies and Strategic cost management > Cost of Service provided	- 0.638	0.067	9.522	0.000

Source: Prepared by the researcher using SmartPLS results.

Figure 4 illustrates the testing of this hypothesis. According to Table 6, the path coefficient is Negative (β = - 0.638), with a t-value of 9.522 and a p-value of 0.000, indicating a strong and statistically significant Negative effect.

The standard deviation (0.067) confirms the reliability of the estimate.

Hence, this hypothesis is accepted.

Table 7 below shows that the R-square value is 0.413, suggesting that 41.3% of the variance in service costs is explained by the independent variables. The F-square value of 0.683 reflects a large effect size, indicating a substantial influence.

Table 7. Explanation and influence coefficients for the first sub-hypothesis

F-square	R-square	Path
0.683	0.413	Relationship between big data technologies and Strategic cost management > Cost of Service provided

Source: Prepared by the researcher using SmartPLS results.

Interpretation: These results indicate that applying big data technologies in strategic cost management contributes significantly to reducing service costs by enhancing operational efficiency and eliminating unnecessary expenditures. The integration also aids in identifying cost wastage and optimizing resource allocation.

Second Sub-Hypothesis

There is a statistically significant impact of the relationship between the use of big data technologies and strategic cost management on the quality of services provided. The path is shown in the figure below for the purpose of testing the hypothesis:

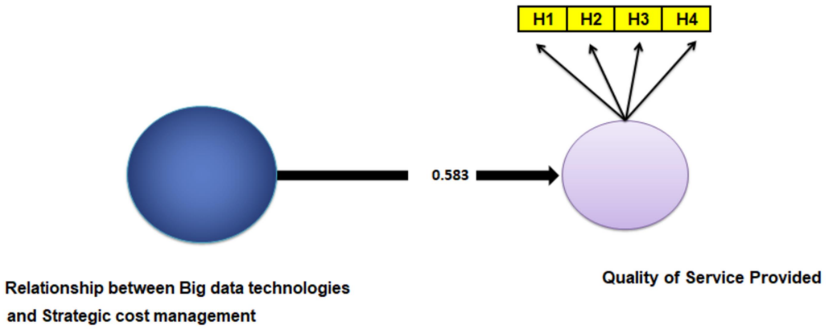


Figure 5. Results of the path test of the Second sub-hypothesis
Source: Designed by the researcher using SmartPLS results.

Table 8. below shows the test results of the second sub-hypothesis based on the Smart-Pls program:

Table 8. Results of the Second sub-hypothesis test

Path	Original sample (Bata)	Standard deviation (STDEV)	T statistics	P value
Relationship between big data technologies and Strategic cost management > Quality of Service provided	0.583	0.071	8.211	0.000

Source: Prepared by the researcher using SmartPLS results.

Figure 5 depicts the model path for this hypothesis. Table 8 reveals a positive path coefficient (β = 0.583), t-value of 8.211, and p-value of 0.000, indicating a strong and significant positive relationship.

The standard deviation of 0.071, the estimate is considered stable.

Therefore, the hypothesis is accepted.

Table 9 reports an R-square of 0.330 and an F-square of 0.489. These values reflect a medium level of explained variance and a large effect size, respectively.

Table 9. Explanation and influence coefficients for the Second sub-hypothesis

F-square	R-square	Path
0.489	0.33	Relationship between big data technologies and Strategic cost management > Quality of Service provided

Source: Prepared by the researcher using SmartPLS results.

Interpretation: The findings suggest that leveraging big data enhances service quality by improving service delivery, understanding customer needs, and optimizing cost control and planning. Organizations can allocate more resources to improving services that align with customer expectations.

Third Sub-Hypothesis

There is a statistically significant impact of the relationship between the use of big data technologies and strategic cost management on the Flexibility required to respond to market dynamics. The path is shown in the figure below for the purpose of testing the hypothesis:

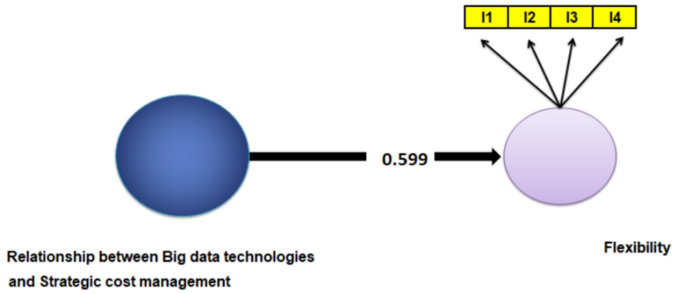


Figure 6. Results of the path test of the Third sub-hypothesis
Source: Designed by the researcher using SmartPLS results.

Table 10 below shows the test results of third sub-hypothesis based on the Smart-Pls program:

Table 10. Results of the Third sub-hypothesis test

Path	Original sample (Bata)	Standard deviation (STDEV)	T statistics	P value
Relationship between big data technologies and Strategic cost management > Flexibility	0.599	0.083	7.216	0.000

Source: Prepared by the researcher using SmartPLS results.

Figure 6 presents the path analysis for this hypothesis. Table 10 shows a path coefficient (β = 0.599), a t-value of 7.216, and a p-value of 0.000, confirming the significance of the relationship.

The standard deviation (0.083) suggests stability in the estimate.

Thus, this hypothesis is accepted.

According to Table 11, the R-square value is 0.379, meaning that 37.9% of the variance in market flexibility is explained by the model. The F-square value of 0.384 represents a large effect size.

Table 11. Explanation and influence coefficients for the Third sub-hypothesis

F-square	R-square	Path
0.384	0.379	Relationship between big data technologies and Strategic cost management > Flexibility

Source: Prepared by the researcher using SmartPLS results.

Interpretation: The integration of big data and strategic cost management plays a crucial role in enhancing organizational responsiveness and Flexibility. This integration supports predictive analytics for market trends, facilitating quicker and more effective decision-making in dynamic environments.

Fourth Sub-Hypothesis

There is a statistically significant impact of the relationship between the use of big data technologies and strategic cost management on the Innovation in Service provided. The path is shown in the figure below for the purpose of testing the hypothesis:

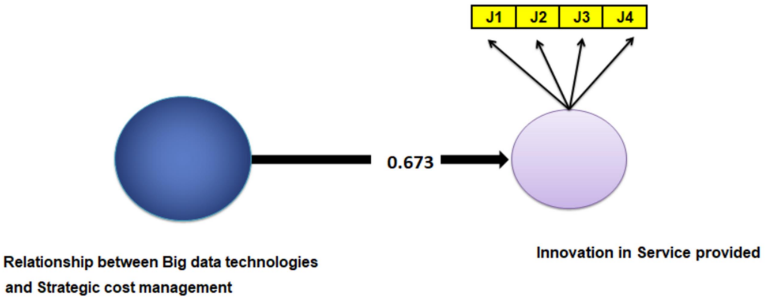


Figure 7. Results of the path test of the Fourth sub-hypothesis
Source: Designed by the researcher using SmartPLS results.

Table 12 below shows the test results of the fourth sub-hypothesis based on the Smart-Pls program:

Table 12. Results of the Fourth sub-hypothesis test

Path	Original sample (Bata)	Standard deviation (STDEV)	T statistics	P value
Relationship between big data technologies and Strategic cost management > Innovation in Service provided	0.673	0.064	10.515	0.000

Source: Prepared by the researcher using SmartPLS results.

As shown in Figure 7 and Table 12, the path coefficient is (β = 0.673) with a t-value of 10.515 and a p-value of 0.000. The standard deviation (0.064) indicates high precision in estimation.

These statistics validate the hypothesis.

Thus, this hypothesis is accepted.

Table 13 shows an R-square of 0.459 and an F-square of 0.668, confirming that the relationship explains a moderate-to-high proportion of variance in innovation outcomes with a substantial effect size.

Table 13. Explanation and influence coefficients for the Fourth sub-hypothesis

F-square	R-square	Path
0.668	0.459	Relationship between big data technologies and Strategic cost management > Innovation in the Service provided

Source: Prepared by the researcher using SmartPLS results.

Interpretation: Big data and strategic cost management foster innovation by enabling data-driven idea generation and resource reallocation. This combination nurtures an environment conducive to creativity, aligning innovation with customer needs and emerging trends.

Fifth Sub-Hypothesis

There is a statistically significant impact of the relationship between the use of big data technologies and strategic cost management on the Timeliness of Service provided and

responsiveness to customer preferences. The path is shown in the figure below for the purpose of testing the hypothesis:

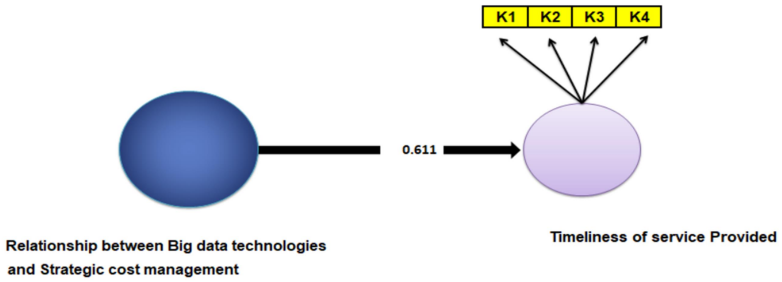


Figure 8. Results of the path test of the fifth sub-hypothesis
Source: Designed by the researcher using SmartPLS results.

Table 14 below shows the test results of Fifth sub-hypothesis based on the Smart-Pls program:

Table 14. Results of the Fifth sub-hypothesis test

Path	Original sample (Bata)	Standard deviation (STDEV)	T statistics	P value
Relationship between big data technologies and Strategic cost management > Timeliness of Service provided	0.611	0.058	10.534	0.000

Source: Prepared by the researcher using SmartPLS results.

Figure 8 and Table 14 show a path coefficient of (β = 0.611), a t- value of 10.534, and a p-value of 0.000, supported by a low standard deviation (0.058), all indicating a strong and statistically significant effect.

Therefore, this hypothesis is accepted.

Table 15 reports an R-square of 0.444 and an F-square of 0.609, reflecting a moderate level of explanatory power and a substantial impact

Table 15. Explanation and influence coefficients for the Fifth sub-hypothesis

F-square	R-square	Path
0.609	0.444	Relationship between big data technologies and Strategic cost management > Timeliness of Service provided

Source: Prepared by the researcher using SmartPLS results.

Interpretation: These results highlight how big data integration into cost management accelerates service processes and responsiveness. This is achieved by enabling real-time data access, optimizing strategic decisions, and improving customer satisfaction through Timeliness and tailored service delivery.

5. Conclusion

The relationship between the use of big data technologies and strategic cost management significantly contributes to enhancing competitive advantage. This is achieved by increasing the expected added value from data, enabling the provision of better services based on in-depth data and cost analysis as well as customer preferences. It also supports continuous improvement in cost management strategies. Furthermore, the integration of big data technologies with strategic cost management supports strategic decision-making processes, especially those related to pricing and service development. Additionally, this relationship fosters innovation capabilities that ensure sustainability. Moreover, this relationship enhances operational efficiency and accelerates strategic decision-making, thereby enabling the timely delivery of services. This ultimately leads to greater customer satisfaction and contributes to achieving competitive advantage. In addition, the synergy

between big data technologies and strategic cost management also supports performance measurement and efficiency analysis. This results in overall performance improvement compared to competitors. Furthermore, strategic cost management enables the conversion of big data benefits into measurable outcomes through enhanced utilization of modern technologies. Finally, strategic cost management plays a role in analyzing external risks (such as economic changes and government policies) by leveraging big data technologies. Moreover, advanced analytical tools offered by big data enable effective cost monitoring, allowing for rapid response to any deviations. It is crucial to invest in the supporting digital and analytical infrastructure to apply big data technology and advanced analytics. Apart from this, special initiatives can be taken to equip the people functioning in the banking sector with big data technologies to have an optimum implementation of it, to improve their strategic decision-making process, operational efficiency, and to have the advanced analytics facility to support performance measurement and risk management. Furthermore, big data technologies should be employed in parallel with strategic cost management as a tool for cost planning and control, to achieve service quality and improve operational efficiency. This also helps foster an environment of innovation and creativity that supports continuous improvement, enabling banks to improve internal processes, enhance customer satisfaction, and ultimately gain competitive advantage. In addition, banks and related entities required to put into some big data technology and partial on the importance. Infrastructure need to be developed in partnership with professional and academic institutions and awareness campaigns and workshops have to be held to attune itself with the developments in this area. Moreover, the Central Bank needs to issue regulatory laws and legislation of big data technologies to ensure the good use of these technologies in the banking institutions and the positive alignment of these technologies to recent developments in the business environment. Finally, efforts should be made to enhance integration between big data technologies and strategic cost accounting systems by upgrading systems, improving data flow, and establishing internal policies that promote innovation and digital transformation in the areas of cost and financial analysis, while fostering a culture of data-driven performance. Research can be beneficial in different economic sectors to fill the gap in knowledge; thus, future studies can go ahead from the banking sector in Iraq to cover different economic sectors in other countries. Future studies may overcome many of these limitations. In addition, the same researcher has recommended exploring the influence of the current research variables on other dependent variables like operational performance, strategic decision processes, or pricing policies of the products. While this study makes important contributions to the existing literature, it has some limitations. A possible limitation is that the results may be specific to the Iraqi environment and may not be generalizable.

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