Exploring the Influence of ERP-Supported Business Intelligence on Customer Relationship Management Strategies

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Abstract

In the modern business environment, organizations face the dual challenge of managing complex operations and meeting rising customer expectations. Traditional systems alone are no longer sufficient to ensure efficiency, insight, and customer satisfaction. There is a growing need to explore how integrated enterprise solutions supported by analytical tools can improve customer-oriented strategies and ensure sustainable competitiveness. This paper addresses that need by examining the role of system integration in strengthening decision-making and customer engagement. In this study, ERP-BI integration is analysed as a key enabler for aligning marketing, sales, and service strategies to achieve customer-centric outcomes. Enterprise Resource Planning (ERP) provides an integrated backbone for managing resources and operations, as BI turns raw data into insights that may be used for action. Together, these systems reinforce Customer Relationship Management (CRM) by enhancing customer engagement, improving decision-making, and increasing retention. The use of BI technologies like QlikView, Power BI, and Tableau is also highlighted in the study, along with challenges like data quality, implementation costs, and awareness gaps. Findings indicate that effective integration drives customer satisfaction, loyalty, and long-term organizational competitiveness**.**

Keywords: ERP, Customer Relationship Management (CRM), Customer Service Quality, Business Intelligence (BI), BI Tools, Customer Retention, Service Strategies, Data Integration, CRM Strategies.

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I. INTRODUCTION

The modern association situation is complex and ever-changing. There is a lot of demand on public and private organisations to update upper management on the status of innovation and transformation 1. "A concept which is based on the philosophy of employing a combination of marketing and customers for relationship building" is what Customer Relationship Management (CRM) is all about. The greatest approach to win clients' loyalty is to build relationships with them. The quantity of money spent on a certain brand is influenced by consumer loyalty. There are a lot of companies out there, including banks, insurance companies, and others that offer services that have long

recognised CRM's importance and the ways it can help them attract new customers, keep the ones they already have, and increase the lifetime value of their clients 2.

The market for software solutions connected to business intelligence (BI) is expanding rapidly, and IT leaders have prioritised BI for several years despite challenging macroeconomic conditions. The business intelligence (BI) software industry has been growing steadily in recent years, with the help of new trends like business analytics (BA) and big data management 3 4. Despite the severe macroeconomic circumstances, business intelligence (BI) has been a key priority for IT professionals for several years, and the marketplace for BI-related software solutions is expanding rapidly 5. In this sense, a company-wide software platform that integrates databases is referred to as an ERP system. Accounting, financial reporting, sales, HRM, and supply chain management are just a few examples of functional modules that can be deployed in phases according to operational demands. Moving on from ERPs as an idea to a system, this essay will delve into their evolution.

ERP and BI have emerged as critical strategic tools in today's complicated economy, and their use determines whether a project succeeds or fails. Enterprise resource planning (ERP) software has recently revolutionised businesses by enhancing transparency in finances, streamlining operations in the supply chain, and cutting down on HR procedures and associated overhead. Business intelligence (BI) is a solution and method which managers may use to better comprehend the current state of their company in today's competitive business climate. ERP is anticipated to exhibit greater agility and competitiveness when paired with BI, facilitating the exchange of data and information for the purposes of control and decision-making 6. Since the significance of BI. ERP partners has been widely acknowledged, it follows that in order for an organisation to achieve success in ERP, it must possess and disseminate knowledge on various forms associated with BI processes.

Consequently, well-planned systems can govern and manage resources effectively, reducing the danger of expansion. Enterprise resource planning (ERP) solutions aim to accommodate a wide range of businesses, from service providers to manufacturers 78. In order to manage business processes efficiently and increase the efficacy of the organization's information system, ERP systems establish a connection between these companies' resources and facilitate the exchange of data across their many departments. This is because separate divisions of the organisation cannot operate independently without integration and effective connectivity.

A. Structure of the Paper

The following is the paper's structure: Section II discusses ERP and Business Intelligence integration, while Section III examines their influence on Customer Relationship Management strategies. Section IV highlights key challenges and best practices in ERP-BI-CRM adoption. In Section V, the relevant literature is reviewed, and Section VI concludes the study with findings and future research directions.

II. ERP AND BUSINESS INTELLIGENCE INTEGRATION

The ERP system can handle and store transaction data from a variety of internal and external sources, but it isn't the best data dissemination solution out there. By merging ERP data management with BI analytics, enterprise resource planning (ERP) and business intelligence (BI) system integration improves decision-making capabilities. Figure 1 shows how BI is connected to important enterprise systems including SCM, ERP, and CRM. In order to gain

valuable insights from operational data, supplier data, and customer interaction data, businesses utilise business intelligence (BI) as a base layer.

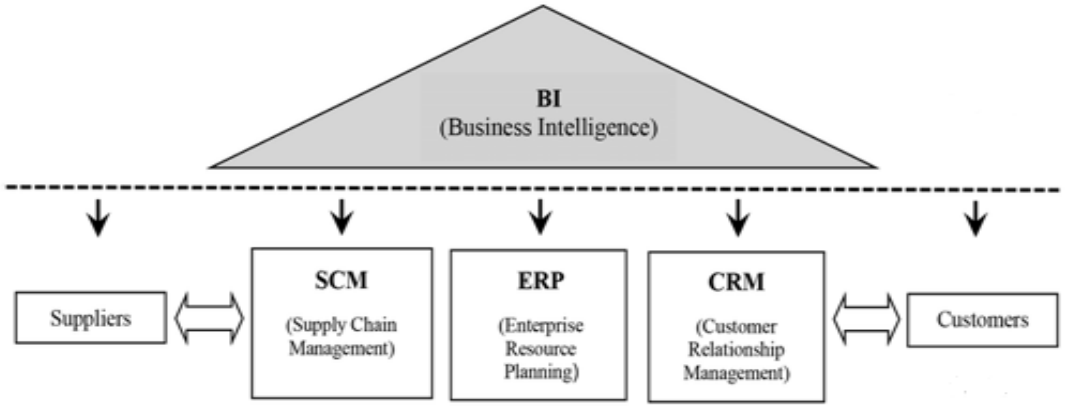


Fig. 1: Integration of BI and ERP

A. Role of ERP as a Data Source for BI

ERP is a software-driven system for managing a company's day-to-day operations. It incorporates all parts of the business, from sales and marketing (via CRM subsystems) to production, inventories, planning, accounting, human resources, and financials. The term "business intelligence" refers to a set of 910. Figure 2 displays the outcomes of an enterprise-wide retrieval, data search, analysis, and explanation process that makes use of structured data from several sources to facilitate managerial decision-making. This significantly reduces the time needed to obtain relevant information about business and makes it easier to use it in the decision-making process. The goal of gaining a competitive edge and the particular information demands of decision makers drive the process of business intelligence, which entails a number of methodical operations.



Fig 2: Role of ERM in Business Intelligence

- Importance of Integration: BI and CRM solutions may only reach their full potential when connected with enterprise resource planning (ERP), a crucial component of most firms' internal IT infrastructure (on-premise approach) 1112. When it comes to managing, processing, delivering, and anticipating outcomes for business activities that extend well beyond the realm of sales, integration is essential.
- Data Sources for Business Intelligence: Internal, external, and personal data are the pillars upon which business intelligence rests. Organisational documentation, customer relationship management records, and transactional data all fall under the category of "internal data," which can shed light on business processes and consumer habits 13. Social media and other external sources provide information on consumer tastes and market tendencies. When combined with other data, personal evaluations make up personal data, which can then be used to make educated decisions.

B. BI Tools and Analytics Leveraging ERP Data

BI tools are high-risk/high return projects and these tools are often expensive to imple-ment (Heinrichs & Lim, 2003). The problem is exacerbated as BI tools are often used on an ad hoc basis and are not well implemented due to poor planning (White, 2006). As a result organisations become data rich and information poor (MacGillivray, 2000). There is a lack of ad-equate development uidelines or frameworks that can aid in the systematic deployment of BI (Liebowitz, 2006). Hence to aid BI tools' deployment, it is important that organisations develop their own BI framework, as it helps to map organisational objectives to functional and individual levels

Business intelligence (BI) tool implementations are typically costly and fraught with high-risk potential rewards. Poor planning leads to haphazard use of business intelligence (BI) tools, exacerbating the problem 14 Consequently, businesses end up with more data than information. The systematic deployment of business intelligence (BI) is hindered by the absence of sufficient development rules or frameworks. To help with the deployment of BI technologies, businesses should create their own BI framework. The significance of these instruments is demonstrated in Figure 3 and explained below.

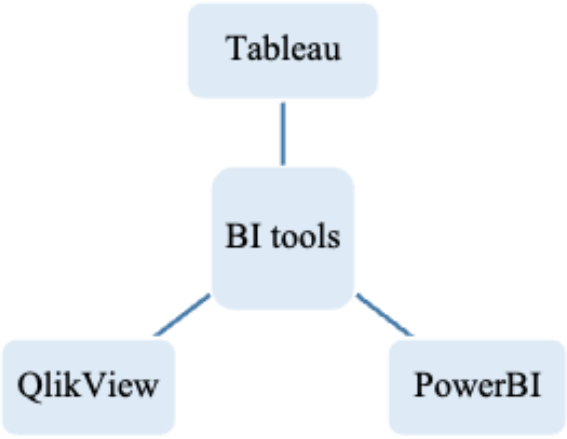


Fig. 3. Business Intelligence Tools

- **Tableau:** One data analysis and visualisation tool that works well with a wide variety of sources is Tableau. The capacity to build interactive dashboards is Tableau's main selling point. Thanks to the visual, user-friendly drag-and-drop interface, these dashboards May be made by those without extensive coding experience. Because it can transform data into visually appealing dashboards with actionable insights, Tableau has become a hit with businesses. Integration

advancements in application development, such as JavaScript APIs and single sign-on applications, allow Tableau to reliably incorporate Tableau analytics into fundamental business operations.

- **Power BI:** Data analysis and the dissemination of insights through dashboards and reports are the primary functions of Microsoft's Power BI range of business analytics tools. Power BI receives user data in a variety of formats, including spreadsheets, text files, databases, and more 15. Datasets are created by applying transformations to user-provided data. Users decide on data transformations. In order to get data ready for additional analysis, this stage organises them into appropriate normalised forms, removes errors and unnecessary data, and fixes formatting.
- **QlikView:** Data visualisation and user-driven business discovery are at the heart of QlikView, a business intelligence platform 1617. It is common practice for organisations to collate data from several sources, the quality of which can vary, and to employ codes that aren't always consistent with one another. Extract-Transform-Load (ETL) tools are necessary for the efficient integration, purification, and standardisation of data in preparation for business intelligence (BI).

Table I outlines ERP-BI integration, emphasizing its role in unifying business operations and supporting analytics through varied data sources. It also notes features such as high costs and poor implementation risks, while highlighting tools like QlikView, Power BI, and Tableau that enhance visualization, data transformation, and discovery for effective decision-making.

TABLE 1: OVERVIEW OF ERP AND BUSINESS INTELLIGENCE INTEGRATION, DATA SOURCES, AND TOOLS

Subsection / Tool	Type	Purpose	Key Points / Features
ERP Overview	Software System	Integrate business operations	Covers CRM, marketing, sales, manufacturing, inventory, finance, HR.
Importance of Integration	Process	Efficient enterprise-wide operations	Integrates BI and CRM with ERP for sales, order processing, delivery, production planning, forecasting.
Data Sources for BI	Data	Support analytics and insights	Internal: transactional, CRM, internal documents External: social media, industry trends Personal: individual evaluations for decision-making
General Challenges	Tools / Framework	Guide BI deployment	High cost, high-risk, often ad hoc; risk of "data rich, information poor"; need BI framework for alignment with objectives.
Tableau	Visualization Tool	Data analysis & dashboards	Drag-and-drop interface, interactive dashboards, JavaScript API, single sign-on.
Power BI	Analytics Tool	Transform and visualize data	Converts spreadsheets, databases, text files into clean datasets; reporting and dashboards.
QlikView	Analytics / Discovery Tool	End-user data exploration	Focuses on business discovery; requires ETL for integrating, cleansing, standardizing multi-source data.

III. INFLUENCE ON CUSTOMER RELATIONSHIP MANAGEMENT STRATEGIES

CRM serves as a strategic tool within organizations to reduce operational costs while simultaneously enhancing performance and profitability 1819 The integration of ERP-supported Business Intelligence (BI) into CRM systems

strengthens this objective by transforming raw organizational data into actionable insights. This not only improves decision-making but also aligns business processes with customer-centric strategies.

CRM systems aid employees by providing timely and accurate information, enabling quick responses to customer inquiries and market changes. With the support of ERP-integrated BI, organizations can effectively segment customers, analyze behavioral patterns, and design tailored marketing strategies. This empowers firms to anticipate customer needs, deliver personalized services, and increase satisfaction levels.

A. CRM and its Types

A procedure, approach, or piece of software or hardware that helps businesses keep track of their connections with clients, vendors, and suppliers is known as customer relationship management (CRM). There some types are shown in Figure 4 and explains below:



Fig 4: Types of CRM

- **Small business CRM:** For smaller businesses with fewer users, to offer the greatest CRM experience possible. The implementation of this CRM type is less complicated, more natural, and less expensive than that of enterprise CRM.
- **Collaborative CRM:** It facilitates the sharing of consumer data across internal stakeholders and across business segments, which improves communication, efficiency, and overall work flow.
- **Service CRM:** Facilitated the integration of marketing and sales efforts with user service assistance. A number of communication points, including active social media, email, chat, and online chat, are additional features.
- **Marketing CRM:** In order to identify targeted consumer categories, create, monitor, and automate email marketing campaigns. Using A/B testing, marketing CRM may standardise procedures and provide real-time analytics.
- **Sales CRM:** to enhance sales and build the pipeline of new leads and users. Specialises in the sales cycle, which includes everything from monitoring leads to finalising transactions.

B. Impact on Customer Service Quality and Retention

One of the most important components of the long-term viability of contemporary service businesses is service quality, according to its definition. The notion of service quality and the almost mathematical relationship between customer happiness and service quality make it possible for this to be a significant promotional strategy, which causes this to be the marketing field of service that is most frequently explored. There is a clear and significant correlation between consumers' willingness to return and the quality-of-service aspects (tangible, reliable, responsive, and guaranteed). In addition, it has been shown that improving the quality of services has a significant impact on customer satisfaction 20. Customers and service providers engage in ongoing dialogue, which is the backbone of any service organisation. An employee's ability to provide services in a pleasant way or their level of knowledge and training can have an impact on clients, as can the experience they have gained in the interaction with consumers.

- **Customer Orientation:** An understanding of consumer wants and needs, as well as a customer-centric focus, are foundational to the marketing mix and the growth of client relationships 21. Being customer-centric is both a cultural phenomenon and a way of behaving. It alludes to the degree to which businesses comprehend and meet the demands of their clients in order to establish long-term partnerships. Furthermore, customer-orientation is an autonomous notion that is crucial for organisations to retain and build long-term relationships with their clients.
- **Customer Centricity:** Developing client loyalty and retaining customers are two of CRM's most essential goals. In an effort to boost customer loyalty, "customer centric" marketing approach is replacing the "one size fits all" model that many companies previously used. This strategy centres on the customer's unique wants and needs 2223. Keep your current consumers as your priority for maximum earnings. According to Drucker, the odds of a corporation doing business with an individual with whom it has no prior relationship are around 7%, whereas the odds of doing business with an individual with whom it has a history of relationships are 25%.

C. Role in Marketing, and Service Strategies

A container holds packaged self-contained, ready-to-deploy parts of applications and, if necessary, middleware and busi-ness logic (in binaries and libraries) to run the applications.

Tools like Docker are built around container engines where containers act as portable means to package applications.

Recognising and building interactional relationships with customers, as well as collecting, developing, and improving information about this external aspect of the business, is the goal of customer relationship management systems. By centralising product manufacturing, production planning, and logistics management, ERP systems help businesses streamline internal operations, which in turn reduces stock levels and increases process efficiency.

- **Organizational Strategy:** All of the company's departments and divisions need to hear the strategic goals that upper management has laid forth for them 24. It is crucial for the organization's top management to make sure that everyone is on board with the organization's key strategic goals and is working to achieve them. Without this, even the most well-thought-out strategy will be useless.
- **Promotion Marketing Strategy:** Many studies have examined the promotion mix and its correlation to market share in an effort to determine whether or not well-executed promotions boost sales and profits 25. When compared to rival initiatives, promotion is comparatively effective. The advertising component of the marketing mix has been the subject of the most studies, with researchers looking at how the corporation may use ads to educate, introduce, remind, and urge consumers to buy more and increase profits.

IV. Challenges and Best Practices in ERP-BI-CRM Adoption

The challenges that face global organizations continue to grow increasingly severe and complex. Operating businesses in a highly competitive environment is challenging; to enhance competitiveness and to satisfy customer needs, organizations seek to improve efficiency and agility

Worldwide organisations are confronted with more complicated and serious problems every day. Businesses face a number of challenges when operating in today's market. In order to stay competitive and meet client demands, organisations are constantly looking for ways to improve efficiency and agility 26 some challenges are discuss below:

Data-Driven Learning: AI and ML models can learn from vast datasets, extracting patterns and relationships that may be dificult to capture through analytical methods. This enables systems to adapt to complex and non-linear

dynamics.

• Real-Time Adaptation: AI algorithms can process data in real-time, allowing for rapid adjustments to control

parameters based on changing conditions. This is crucial for applications where quick responses are essential.

• Robustness: AI-driven adaptive control systems can be more robust to disturbances and uncertainties. They can

learn to compensate for unexpected changes, ensuring system stability and performance

- **Awareness:** Small and medium-sized enterprises (SMEs) often have no idea who ERP systems are or what they can do, and they often have a low level of understanding regarding ERP vendors, applications, etc 27. In their minds, enterprise resource planning (ERP) solutions are a magic wand that can magically fix any quality or process fault issues plaguing their company. ERP improves visibility and transparency by carrying a more systematic method to the execution of business processes.
- **Earlier Implementations:** The much-publicized ERP deployment errors that have bankrupted businesses are no strangers to SMEs. Prior ERP implementations by certain SMEs were unsuccessful. Because of this, SMEs think ERP installations are pointless and may even spell disaster for their businesses.
- **Make Data Sources Easy to Access:** Amounts of data that are accessible and valuable to several organisations, sometimes known as "Big Data," are growing at an alarming rate. Consequently, the conventional, external data warehouses will need to be enlarged in order to incorporate this newly available data 28. In order for users to derive fresh insights, conduct their own analyses, and personalise reports, data must be openly accessible. Power users in a typical BI system spend a lot of time delivering BI solutions to casual users.
- **data selection:** Ensuring the quality of the data utilised is crucial for performing a correct analysis. Consequently, there should be well-defined quality standards for data selection. Determining quality standards which should be considered while selecting data, particularly data from external sources, is one of the obstacles to overcome. A balance between quantity and quality must be maintained while retrieving data from external sources.

V. Literature Review

This review examines recent studies on ERP, BI, and CRM adoption, focusing on critical success factors, system integration, and customer engagement strategies.

Putri, Lubis and Azizah (2020) have studied the ERP implementation's critical success factors (CSF) to find ways to boost the performance system's rollout, particularly in the HR department. For this study, we used the Extended Technology Acceptance Model (TAM). In order to get to the bottom of things, the researchers analysed quantitative data. Using the TAM model as a foundation, several variables have been constructed to define ERP CSF. Every one of the model's variables is crucial to the system's implementation success, as per to the results 29

Correia and Moura, (2019) have detailed the plan for a BI system which will help Navy get a bird's-eye view of their operational data. To achieve the goal, a system had to be designed, developed, and put into action that could take operational data shared by naval units and process, integrate, consolidate, analyse, and visualise it. This data would then be used to make better decisions. Data from an analytical processing system flows into a data warehouse and subsequently a data mart, becoming the basis of the offered business intelligence solution 30.

Jalal, Bahari and Sherief (2019) validated the hypothesised elements impacting healthcare organisations' adoption of Social SCRM in Iraq. The research team used a mixed-method approach, surveying eight Iraqi hospitals and then conducting semi-structured interviews with five of the institutions' top IT and marketing executives. In order to analyse data and determine requirements for the early stage of Social CRM adoption, descriptive statistics and thematic analysis were employed. According to the results of the survey and the interviews, Iraqi healthcare organisations have only implemented a basic level of social CRM within the official framework of a comprehensive strategy and policy 31.

Londoza and Adeyelure (2018) have gathered information through the use of closed-ended surveys that were created utilising the TFO and TOE models. Various stakeholders in the energy utility sector contributed to the data collection process. Statistical Package for the Social Sciences (SPSS) was utilised, to do quantitative analyses on the data we gathered. The study found that power utility companies in South Africa use CRM differently depending on work, technology, environment, organisation, and security factors 32.

Delen, Moscato and Toma (2018) explored the hypothesis that alternative decision outcomes might be produced if knowledge is delivered at the same time as the business choice. The study enriches the BA literature and makes a contribution to descriptive and prescriptive decision theory. Additionally, Research provides insight on the subject of selective perception and the actions of decision makers in response to warnings regarding the potential outcomes of their choices. Using the findings from the research, it suggests ways BA solutions could be enhanced 33.

Li and Wang (2017) studied how a company's social media information strategy in its microblog affected the level of support that customers felt they received and the number of recommendations that customers made. The findings provide valuable insights derived from the empirical examination of 388 legitimate random examples. When it comes to microblog propaganda, the real-time strategy, the information entertainment strategy, and the interactive approach all play a big role in how customers perceive it. Second, word-of-mouth advertising benefits from customers' perceptions of support. The micro-blog platform is greatly impacted by consumer participation, thus businesses should know this 34 (Dias B.L., 2023).

Jayaram and Singal (2017) proposed ERMS paradigm is cost- and time-effective, easy-to-configure, and user-friendly. In addition, the built-in bootstrap foundation makes it easy to adapt to any device or browser. Data migration from the present company system is also an option. Predictive analytics and Data mining applied to the large datasets stored in

the proposed ERMS model's central cloud storage area can yield business intelligence. The company stands to learn a great deal of knowledge about its customers, rivals, and how to manage its business if it adopts the suggested ERMS approach 35.

Table II summarizes recent studies on ERP, BI, and CRM adoption, focusing on critical success factors, decision-making improvements, and customer engagement. The research highlights diverse approaches, and empirical analysis. Key challenges involve integration issues, limited scope, and weak policy frameworks. Future directions emphasize broader validation, practical applications, and adaptable models for wider industry use

TABLE 2: COMPARATIVE ANALYSIS OF RECENT STUDIES ON ERP, BI, AND CRM ADOPTION

Reference	Study On	Approach	Key Findings	Challenges / Limitations	Future Directions
Putri, Lubis & Azizah (2020)	Critical Success Factors (CSF) of ERP implementation	Extended TAM model with quantitative analysis	Variables in TAM model are critical factors influencing ERP success	Focused mainly on human resources; may not cover all organizational contexts	Broader validation across industries; inclusion of qualitative insights
Correia & Moura (2019)	BI solution for Navy operational data	Design & implementation of BI system with data warehouse & data mart	Unified operational data view improves decision-making	Implementation complexity; data integration across naval units	Expansion to real-time analytics; application to wider defense sectors
Jalal, Bahari & Sherief (2019)	Social CRM adoption in Iraqi healthcare	Mixed-method (survey + semi-structured interviews)	Social CRM adoption is superficial with weak policy frameworks	Limited integration; small sample size of hospitals	Develop formal strategies and policies; expand adoption beyond pilot stage
Londoza & Adeyelure (2018)	CRM usage in South African energy utility	TOE + TTF frameworks, quantitative analysis with SPSS	Task, technology, environment, organization, and security affect CRM usage	Industry-specific focus; may not generalize	Extend study to other industries; deeper qualitative exploration
Delen, Moscato & Toma (2018)	Influence of information delivery timing on decisions	Decision theory analysis with BA perspective	Information timing influences decision outcomes and perception	May not capture all decision-making environments	Improve BA solutions with context-aware delivery mechanisms
Li & Wang (2017)	Social media information strategy in micro-blogs	Empirical analysis (388 samples)	Entertainment, real-time, and interactive strategies improve customer support & recommendations	Focus only on micro-blogs; excludes other platforms	Extend to other social media; explore long-term customer loyalty
Jayaram & Singal (2017)	ERMS model with BI integration	Model proposal with cloud + bootstrap + predictive analytics	ERMS model is flexible, low-cost, and beneficial for BI insights	Conceptual proposal; limited real-world testing	Practical implementation and validation across enterprises

VI. CONCLUSION ND FAUTURE WORK

ERP-supported BI serves as a critical enabler for advancing CRM strategies in today's business environment of competition. ERP provides the backbone of integrated operations by connecting finance, human resources, supply chain, and customer-facing activities, while BI transforms this data into actionable insights that guide managerial

decisions. The analysis in this study highlights how ERP-BI integration strengthens CRM strategies by supporting customer-centric approaches, optimizing marketing and service functions, and enabling timely decision-making through advanced analytical tools such as Power BI, Tableau, and QlikView. Organizations adopting this integration achieve improved transparency, better alignment of business processes, and enhanced responsiveness to customer needs. Despite challenges such as data quality issues, high implementation costs, and awareness gaps, the benefits outweigh the risks. Ultimately, ERP-BI-supported CRM emerges as a strategic necessity for achieving sustainable competitiveness and superior customer relationships.

Future research on ERP-supported Business Intelligence (BI) for Customer Relationship Management (CRM) should explore the integration of emerging technologies like ML, AI, and predictive analytics to enhance customer insights and personalization. Real-time data processing and adaptive dashboards can provide organizations with greater agility in responding to customer needs. Expanding the scope to include SMEs will highlight scalability challenges and practical adoption strategies. Comparative researches across regions and industries can also enrich understanding of success factors, helping organizations design more resilient and customer-centric ERP-BI frameworks.

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