

ADDIS ABABA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

"Challenges Affecting the Adaptation and Implementation of ERP Systems in the Ethiopian Construction Industry"

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CHALLENGES AFFECTING THE ADAPTATION AND IMPLEMENTATION OF ERP SYSTEMS IN THE ETHIOPIAN CONSTRUCTION INDUSTRY.

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DECLARATION

This is to certify that the thesis prepared by Fikir Yibeltal, entitled "Challenges Affecting the Adaptation and Implementation of ERP Systems in the Ethiopian Construction Industry: A Mixed-Methods Study" and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Economics complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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(Fikir Yibeltal)

ABSTRACT

Enterprise Resource Planning (ERP) systems have become essential tools for improving organizational integration, operational efficiency, and decision-making processes across various industries. However, the adaptation and implementation of ERP systems remain challenging, particularly in developing countries and project-based industries such as construction. In Ethiopia, construction organizations face various technological, organizational, and human-related challenges that hinder effective ERP adaptation and implementation. Despite the growing adoption of digital technologies, empirical evidence on the factors affecting ERP adaptation and implementation in the Ethiopian construction industry remains limited. Therefore, this study aimed to examine the technological, organizational, and human-related factors affecting ERP adaptation and implementation in the Ethiopian construction industry.

The study was guided by an adapted Technology-Organization-[i]Environment (TOE) framework, focusing on technological, organizational, and human-related factors. A convergent parallel mixed-methods research design was employed to collect and analyze quantitative and qualitative data simultaneously. Quantitative data were collected using structured questionnaires administered to 44 respondents comprising managers, ERP users, and IT personnel from construction organizations. Qualitative data were obtained through semi-structured interviews with participants involved in ERP implementation. Quantitative data were analyzed using descriptive statistics, reliability analysis, correlation analysis, and multiple regression analysis with Jamovi software, while qualitative data were analyzed using thematic analysis. The findings from both datasets were integrated through triangulation.

The findings revealed that technological, organizational, and human-related factors jointly explained 81.4% of the variation in ERP adaptation and implementation. Regression analysis showed that organizational factors had a statistically significant positive influence on ERP adaptation and implementation, while human-related factors had a statistically significant negative influence. Technological factors showed a negative but statistically insignificant effect. The qualitative findings complemented the quantitative results by identifying inadequate ICT infrastructure, limited organizational readiness, insufficient top management commitment,

employee resistance to change, inadequate ERP training, and limited digital skills as major challenges affecting ERP implementation.

The study concludes that successful ERP adaptation and implementation in the Ethiopian construction industry requires strong organizational commitment, effective change management, adequate technological infrastructure, and continuous employee training and capacity development. The findings provide practical implications for construction organizations, ERP vendors, policymakers, and researchers seeking to improve ERP implementation practices and support digital transformation within the Ethiopian construction industry.

Keywords: Enterprise Resource Planning (ERP), ERP Adaptation and Implementation, Construction Industry, Technology-Organization-Environment Framework, Mixed-Methods Research, Ethiopia.

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ABBREVIATIONS

ERP	Enterprise Resource Planning
TOE	Technology - Organization - Environment
ICT	Information and Communication Technology
IT	Information Technology
HR	Human Resources
EFA	Exploratory Factor Analysis
MSc	Master of Science

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

ERP systems are now very useful methods for assisting companies to work better, align different areas, and make decisions beside many industries. Globally organizations use ERP systems to make their business method and processes softer and improves access to real data (Davenport, 1998). Yet, adopting ERP system is quite complicated, costly, and risky so many projects doesn't get the results they dreamed for (Umble et al., 2003).

In developing countries, the challenges are clearer because the access to technology is very less, shortage of money, and limited skilled workers available (Ifinedo, 2011). These limitations have a big influence on how effectively people use and accept ERP systems.

The industry of construction is more complicated because it works on specific projects, has different operations and includes different people and groups (Acar et al., 2005). ERP systems were primarily made for production settings, so mostly they need many changes to work perfectly with the construction processes, that makes the implementation more challenging.

Here in Ethiopia, the construction industry plays a significant role on the economic growth of the country. While it is important, most organizations depend on broken and manual systems, which minimizes how good they work. Even though earlier studies have looked the usage of ERP systems in areas like banking and manufacturing, sufficient research is not available on the construction industry in Ethiopia currently. This leads to insufficient understanding of the challenges in different sectors. Therefore, this research plans to see into the technological, organizational, and human factors that affect the ERP implementation in Ethiopian construction companies.

1.2. Statement of the Problem

ERP systems are now very useful tools that support business works better, attach their operations and give decisions more efficiently in the current business world. ERP systems get together main parts of a business-like finance, purchasing goods, inventory managing, human resource handling,

supply chain organizing and project managing into one central database. In the field of construction, ERP systems are very useful because organizing projects includes very complicated works, more different peoples involved, project sites located in different places, and more of information that needs great coordination and communication in real time. Successfully organizing an ERP system in place can help construction companies plan better projects, reduces their operating expenses, spend resources more effectively, enhance communication between departments, and boost the whole performance of the organization (AlMuhayfith & Shaiti, 2020).

Around the world, most companies have begun using ERP systems to be more competitive and to improve their work. Even the advantages are obvious, placing an ERP system into place is yet the main hardest changes for companies to make, specifically in the developing countries. ERP projects mostly face different issues such as work delays, cost overrun, delaying progress, or failing entirely. This happens because of poor planning, lacking the right technology in place, lacking enough support from top management, and users rejecting the system (Kamhawi. 2007; Ifinedo, 2011). Studies shows that ordering an ERP system is not just a technology related task, its also about how the company and its peoples work together. The system needs better management of changes, workers who are prepared, strong leadership, and organizational commitment (Gupta et al., 2022). Ignoring these factors mostly lowers the chances of adopting ERP systems successfully.

In Ethiopia, the construction industry plays a vital role in increasing the economy and helping to develop the country. The industry is very useful for road building, city developing, home construction, creating industrial parks, and arranging public service facilities. The government of Ethiopia has invested a lot of money into a huge construction project as part of its national development plans such as Homegrown Economic Reform Program. Even with this fast growth economy, Ethiopian construction industry still deals with ongoing issues. Includes project delays, lack of teamwork, insufficient resource management, communication problems, low productivity, and cost overrun. These problems raised the need for combined information systems like ERP to enhance and boost project management and how good organizations work.

Yet, in Ethiopia, creating ERP systems into use in construction companies in is very challenging and not advanced well. One of the great issues is that the country has low and weak ICT infrastructure. Many construction companies don’t depend on internet access, sufficient computer

systems, up-to-date software, and a steady power supply used for successful ERP setup. Regular network disconnection and power cuts can harm how well systems work, make it very hard to access the data, and disturbs the daily activities of the organization. The Ethiopian Ministry of Innovation and Technology (2023) says that poor digital infrastructure and reduced levels of technology readiness are main obstacles to digital change in many areas in Ethiopia, like construction.

The financial limitation problem acts as a significant issue to the introduction of ERP systems into construction companies operating in Ethiopia. ERP introduction is associated with a relatively high initial expenditure for purchasing software and licensing it, developing necessary infrastructure, maintaining and supporting it on an ongoing basis, and conducting training programs. Many Ethiopian construction companies, especially SMEs, face difficulties due to budget restrictions which limit their possibilities for investing into enterprise systems. beside this, the limited availability of foreign currency, price escalation, and increased cost used to import ERP software and hardware create problems and it makes it hard for companies to use ERP systems successfully. yet, ERP implementations get postponed, partially implemented, or not completed at all.

Another main thing that prevents sufficient ERP implementations in construction companies in Ethiopia relates to the shortage of skilled labor and technical competence. ERP installation involves IT specialists, ERP specialists, project managers, and knowledgeable end users who have appropriate ERP skills. There is a severe shortage of personnel with relevant ERP skills and experience in the construction industry in Ethiopia. Employees of some organizations are not competent enough to use ERP systems appropriately. Moreover, construction companies fail to conduct proper training sessions and provide sufficient technical support to employees using ERP systems. Therefore, employees may feel reluctant to adopt ERP software because of change resistance, self-doubts, and job insecurities.

One of the most critical factors causing failure of ERP implementation in Ethiopian construction companies relates to problems inherent in these organizations. Specifically, insufficient support of the ERP project by top managers and their poor commitment play a negative role. Efficient ERP implementation calls for dedicated managers, thorough preparation, proper resources allocation, and effective governance. However, there is usually no active participation of management in ERP projects in Ethiopian construction companies. Furthermore, inefficient change management

strategies, poor communication systems, and lack of action plan may lead to failure of ERP implementation. Besides, organizations may find it hard to fit into current business processes requirements for the ERP implementation.

In addition, there are certain peculiarities of construction industry in Ethiopia that cause difficulties in the implementation of ERP. Example, construction projects require lots of activity and tight deadlines, they are geographically limited and involve different peoples such as contractors, subcontractors, consulting firms, material providers, and government institutions. Therefore, coordination of information process and activities is may be complicated. In particular problems arise when construction companies use different technologies and software solutions. The situation may become even more complicated due to procurement process, corruption and impaired decision making hurt how well organizations work and make it harder to set up ERP.

Inadequate ERP implementation in construction companies may have adverse effects on their functioning and performance. these cases are likely to result in inefficiencies in work duplication, inaccurate reports in information systems, lack of cooperation between departments, long project periods, operation costs increase, and reduction in competitiveness of organizations in the market place. These cases have been known to result into poor project results, hence affecting the viability of construction companies working under the difficult market conditions of Ethiopia.

The few studies that have looked at ERP system application in other industries such as banking, manufacturing, health care, and telecommunications have failed to consider the unique features of the construction industry in relation to ERP deployment. This is because of the distinct nature of the sector, which comprises of unique practices including projects, temporary functional groups, and complex relations between many stakeholders. It means that the existing literature on ERP deployment will be of little help in comprehending what factors could determine successful ERP system implementation in construction firms. Therefore, there is a significant gap in knowledge creation as far as ERP implementation success factors are concerned in the construction industry of Ethiopia.

It will be important to investigate technology, organizational, and human factors involved in ERP system deployment in Ethiopian construction companies. The findings obtained through this study will help construction companies, policymakers, ERP suppliers, and others stakeholders to make

informed decisions regarding successful implementation strategies of ERP system in the construction industry.

1.3. Objectives of the Study

1.3.1 **General Objective**

To investigate the technological, organizational, and human-related factors affecting the adaptation and implementation of Enterprise Resource Planning (ERP) systems in the Ethiopian construction industry.

1.3.2 Specific Objectives

The specific objectives of the study are to:

1. To examine the influence of technological factors on ERP adaptation and implementation in the Ethiopian construction industry.
2. To assess the influence of organizational factors on ERP adaptation and implementation in the Ethiopian construction industry.
3. To evaluate the influence of human-related factors on ERP adaptation and implementation in the Ethiopian construction industry.
4. To identify the most significant factor affecting ERP adaptation and implementation in the Ethiopian construction industry.

1.4 Research Questions

In order to the identified problem, the study is guided by the following research questions:

1. How do technological factors influence ERP adaptation and implementation in the Ethiopian construction industry?
2. How do organizational factors influence ERP adaptation and implementation in the Ethiopian construction industry?
3. How do human-related factors influence ERP adaptation and implementation in the Ethiopian construction industry?
4. Which factor has the greatest influence on ERP adaptation and implementation in the Ethiopian construction industry?

These questions aim to explore not only the types of challenges faced but also the reasons for their presence and possible solutions.

1.5 Research Hypotheses

H1: Technological factors significantly influence ERP adaptation and implementation.

H2: Organizational factors significantly influence ERP adaptation and implementation.

H3: Human-related factors significantly influence ERP adaptation and implementation.

1.6 Significance of the Study

This study is expected to provide both practical and theoretical contributions.

Practical Significance: The results obtained in the course of this investigation may be beneficial to beneficial to construction organizations as a source of useful information on the main difficulties related to ERP adaptation and implementation. Such information will help managers and stakeholders identify problem areas and make reasonable decisions regarding system choice, employee training, and resource allocation. Moreover, the findings will be valuable for policy makers who wish to develop programs and measures aimed at fostering digital transformation and ICT use among enterprises of the construction industry. ERP suppliers and consultants will gain a better understanding of challenges encountered by construction organization in developing countries and thus will be able to deliver services.

Theoretical Significance: in addition to practical importance, this investigation may prove beneficial because of its contribution to the relatively small number of studies dedicated to ERP implementation issues in the construction industry of developing countries. The study extends existing theoretical knowledge by including contextual factors specific to project-oriented enterprises in developing countries. Moreover, the investigation may become a basis for further research on enterprise systems, ICT adoption, and construction management.

1.7. Scope and Delimitation of the Study

This paper explores different challenges related to ERP adaptation and implementation in selected construction companies of Ethiopia. Geographically, the study covers only construction

organizations located in large urban areas where the use of ERP systems is more common than elsewhere. Conceptually, the research considers three key groups of challenges that may hinder ERP adoption and implementation those are technological, organizational and human-related factors. Also, the Technology-Organization-Environment (TOE) framework serves like the theoretical foundation of the research, the empirical analysis is limited to technological, organizational, and human-related factors by their direct influence to ERP implementation challenges in the Ethiopian construction industry. Environmental factors are considered as contextual influences but are not included as independent variables in the study.

1.8. Definition of Terms

To ensure clarity, the following key terms are defined as used in this study:

Enterprise Resource Planning (ERP): the definition of ERP includes any integrated system used by companies for managing their main business activities through a single system (Monk & Wagner, 2012). As per the current study, ERP includes all software systems used by Ethiopian construction companies for integrating activities related to finance, purchasing, human resource management, and project management.

ERP Adaptation: involves the fit between ERP systems and organizational requirements. As per the current study, ERP adoption will be understood as the changes made by construction firms to their organizational processes to make effective use of ERP systems.

ERP Implementation: is theoretically defined as the entire process involved in installing and maintaining ERP systems. For this study, ERP implementation will involve the process followed by the construction companies for implementing ERP systems into their operations.

Technological Factors: includes elements such as system quality, technical infrastructure, and system technicality. For this study, the technological factors include system customization capabilities and compatibility and availability of ICT infrastructure.

Organizational Factors: include internal organizational elements such as top management support, organizational structure, culture and change management. The organizational factors, as per the current study, include management commitment, organizational readiness, and process alignment.

Human-Related Factors: include user skills and attitude towards ERP systems. User related factors as per the current study include the training received by users and user knowledge and attitudes towards ERP systems.

Conceptual Definition: is the explanation of its theoretical meaning using relevant literature and scholarly views. It is the definition of a variable in general terms.

Operational Definition: is the explanation of its application, measurement, or observation. This is the definition of a variable within the research context and variables.

CHAPTER TWO

2. LITERATURE REVIEW

2.1 Introduction

Enterprise resource planning (ERP) technology is one of the most popular technologies among businesses due to its importance in improving efficiency, increasing integration, and facilitating digital transformation efforts. ERP systems represent integrated solutions encompassing different organizational functions such as finance, procurement, human resource management, inventory & project management, allowing real information sharing and making decisions based on this (Monk & Wagner, 2012).

Although ERP systems provide several organizational benefits, many companies face difficulties during the process of ERP. The challenges include complexity and riskiness of the task, experiencing problems related to implementation delay, cost overrun, poor usage, and user rejection (Somers & Nelson, 2001; Umble, Haft, & Ummal, 2003). The project-based industries like construction suffer even more from such issues due to their decentralized character and transience of project structure (Acar, Yılmaz, & Ozen, 2005).

exercising ERP in developing countries like Ethiopia becomes a more complicated work because of the lack of necessary infrastructural facilities, scarcity of qualified workforce, and poor organizational readiness (Kamhawi, 2007). This literature review aims at exploring ERP implementation issues from a theoretical and empirical angle based on the TOE framework analysis.

2.2 Concept of Enterprise Resource Planning (ERP) Systems

ERP refers to integrated, enterprise-wide software packages designed to integrate and automate business processes that involve various functional departments in the organization (Davenport, 1998). Storing and managing data in a unified database system helps minimize data fragmentation and increase organizational transparency.

At the same time, ERP implementation needs more than technical installation. It often requires significant organizational transformations including changing business process and organizational culture (Hammer & Champy, 1993). As mentioned by Davenport (1998), ERP systems impose standardized processes, that do not always coincide with existing organizational practices.

ERP implementation is a complicated procedure in the organizational process that usually starts with the planning phase and evaluation of a vendor. at this stage, the organization evaluates its business needs, analyzes available vendors, estimate implementation costs, and choose the ERP system that suits with organizational goals and operational processes. careful planning is crucial at this stage because poor vendor choice and poorly formulated goals will make the system incompatible and impossible to implement. Organizations must also form project teams, define implementation schedules, and provide necessary resources to facilitate the implementation process (Davenport, 1998).

The next stage is business process analysis; it includes evaluating the current business processes of the organization and mapping them on standardized business processes of the ERP system. It may include some changes to the organization's business processes because ERP is based on industry best practices and requires some changes in the existing processes. According to Hammer and Champy (1993) business process restarting is commonly required during the ERP implementation because it allows making processes compatible with the ERP system. Otherwise, employees may resist to the new system and processes will not be optimized and effective.

System configuration and customization is performed after the business process analysis. The main goal is to adjust the system according to the needs of the organization, such as workflow definitions, security access, report settings, and other aspects of its use. Sometimes, customization of the system is required in order to integrate it into the organization successfully. However, excessive customization leads to the increase of implementation costs and difficulty in maintaining the system in the future. That is why, according to Umble et al. (2003), proper customization is important to achieve.

Another key step involves data migration, that refers to the transferring of information from the current systems into the new ERP system. The data migration phase includes data cleansing,

validation, transformation, and integration. Low-quality data can negatively affect the functioning of the ERP system and the decision-making process. According to Umble et al. (2003), erroneous data migration is one of the main reasons behind the problems encountered in ERP implementations because such errors can negatively impact the organizational operations after the introduction of an ERP system.

Training and change management present other necessary steps in the ERP implementation process. It is important that employees are trained to understand the features of the system and adopt the new workflow. Change management efforts are planned to minimize potential resistance, increase user acceptance, and prepare organizations to use the ERP system effectively. Nah et al. (2001) state that user training and proper communication are two main elements for the successful ERP implementation since employees always resist any changes associated with their normal way of working.

Finally, the last step in the ERP implementation process includes after implementation support and maintenance. After adopting an ERP system, the organization needs to continuously control its performance, solve any technical problems, give user support, and conduct upgrades. After implementation support makes sure that the ERP system will function properly for a long time and that organizations can benefit from the use of ERP systems (Somers & Nelson, 2001).

In summary, effective ERP implementation depends on the proper management of the process. If the organization can't manage the planning, process alignment, system configuration, data migration, training, and post-implementation support processes effectively, then ERP implementation may face various challenges and negatively influence the success of the process (Umble et al., 2003).

2.3 Theoretical Framework: Technology, Organization, Environment (TOE)

2.3.1 Overview of TOE Framework

The TOE framework by Tornatzky and Fleischer (1990) describes the process through which organizations adopt new technologies. The TOE model suggests that adoption decisions depend

on three main contextual aspects: Technological Context, Organizational Context, and Environmental Context.

The Technology-Organization-Environment (TOE) framework, developed by Tornatzky and Fleischer (1990), was selected because ERP implementation is an organizational innovation rather than an individual technology acceptance issue. Unlike models such as the Technology Acceptance Model (TAM) or the Unified Theory of Acceptance and Use of Technology (UTAUT), which primarily explain individual users' behavioral intentions, the TOE framework examines organizational technology adoption by considering technological, organizational, and environmental contexts. Since ERP implementation in construction companies involves organizational readiness, technological infrastructure, management commitment, and external influences, TOE provides a comprehensive theoretical foundation for investigating the determinants of ERP implementation.

The TOE model has been widely used in the literature on ERP (Zhu et al., 2003; Oliveira & Martins, 2011). This framework is a sound base to conduct ERP research since ERP systems require profound organizational changes and transformation.

Table 1 Overview of TOE Framework

Framework	**Focus**	**Limitation for Your Study**
TAM	Individual user acceptance	Does not adequately explain organizational readiness or ERP implementation.
UTAUT	Individual behavioral intention	Focuses on users rather than organization-wide implementation.
DOI	Innovation diffusion	Less emphasis on organizational capability and implementation processes.
TOE	Organizational technology adoption	Suitable because ERP implementation involves technological, organizational, and contextual factors.

2.3.2 Justification for selecting the TOE framework

The Technology-Organization-Environment (TOE) framework, developed by Tornatzky and Fleischer (1990), was selected as the theoretical foundation for this study because it provides a comprehensive perspective for examining technology adoption at the organizational level. ERP implementation is an organizational innovation that involves technological capabilities, organizational readiness, management commitment, and interactions with the external environment. Therefore, a framework that considers organizational contexts is more appropriate than models designed to explain individual user behavior.

Alternative technology adoption theories, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), primarily focus on individual users' perceptions, behavioral intentions, and technology acceptance. While these models are useful for studying user adoption, they do not adequately capture organizational factors that influence enterprise-wide ERP implementation. Since ERP implementation requires organizational planning, resource allocation, leadership commitment, and coordination across multiple departments, the TOE framework provides a broader and more suitable theoretical basis for this study.

Consequently, the TOE framework was selected because it enables the simultaneous examination of technological, organizational, and contextual factors that influence ERP implementation within Ethiopian construction companies.

2.3.3 Adaptation of the TOE Framework for the Present Study

Although the original TOE framework includes the environmental context, this study adopts an adapted TOE perspective by emphasizing human-related factors. This adaptation is supported by ERP implementation literature, which consistently identifies user competence, training, change management, communication, and resistance to change as major determinants of ERP implementation success. Because this study investigates internal implementation challenges within Ethiopian construction companies, human-related factors provide greater explanatory value than external environmental pressures.

ERP implementation is not merely a technological project but a complex organizational change initiative. Successful implementation depends heavily on employee competence, user training, change management, communication, ERP knowledge, and users' willingness to adopt new business processes. Numerous ERP implementation studies have identified these human-related factors as critical determinants of ERP implementation success. For example, Umble et al. (2003) emphasized that effective training and change management are essential for successful ERP implementation. Similarly, Ifinedo (2011) reported that user competence and organizational support significantly influence ERP success, while more recent ERP implementation studies continue to identify employee readiness, user participation, resistance to change, and organizational learning as major predictors of implementation success.

Furthermore, previous ERP implementation research has demonstrated that researchers frequently extend or adapt established theoretical frameworks to reflect the specific context of their studies, particularly where internal organizational and behavioral factors have greater explanatory power than external environmental factors. In the Ethiopian construction industry, ERP implementation challenges are primarily associated with inadequate user training, limited ERP knowledge, insufficient digital skills, resistance to organizational change, and weak organizational readiness rather than competitive pressure or regulatory requirements. These context-specific characteristics justify emphasizing human-related factors as a separate analytical dimension.

Therefore, this study adapts the TOE framework by retaining the technological and organizational contexts while incorporating human-related factors as an independent construct. This adaptation provides a more appropriate theoretical lens for examining ERP adaptation and implementation in Ethiopian construction companies because it better captures the internal organizational realities affecting ERP implementation success.

2.3.4 Technological Context

The technological context is one of the three dimensions of the Technology-Organization-Environment (TOE) framework proposed by Tornatzky and Fleischer (1990). It refers to both the internal and external technological resources available to an organization that influence the adoption and implementation of technological innovations. Within the context of Enterprise

Resource Planning (ERP) implementation, technological factors include system complexity, compatibility with existing business processes, ICT infrastructure readiness, system integration capability, and the level of customization required. These factors collectively determine an organization's technological readiness and significantly influence the success of ERP implementation.

Previous studies consistently identify technological readiness as a critical determinant of ERP implementation success. Although researchers have examined different technological characteristics, there is broad agreement that organizations with adequate technological capabilities are more likely to achieve successful ERP implementation. The literature highlights system complexity, compatibility, ICT infrastructure, integration capability, and customization as the most influential technological factors affecting ERP implementation outcomes.

System complexity is widely recognized as one of the major technological challenges in ERP implementation. ERP systems integrate multiple organizational functions, including accounting, procurement, human resource management, inventory management, and project management, into a single information system. While this integration improves organizational efficiency, it also increases implementation complexity because organizations must redesign business processes, train employees, and acquire specialized technical expertise. Bradford and Florin (2003) reported that greater system complexity increases implementation risk, project cost, and implementation time, suggesting that organizations require sufficient technical capability and planning to manage complex ERP projects successfully.

Another important technological factor is system compatibility. ERP systems are generally designed based on standardized business processes, which may not fully align with existing organizational practices. Previous studies indicate that higher compatibility between ERP functionalities and organizational business processes facilitates implementation and reduces organizational resistance. Hong and Kim (2002) found that organizations with greater process compatibility experience more successful ERP implementation because they require fewer modifications to either the ERP system or existing business processes. Conversely, poor compatibility often results in increased implementation costs, process redesign, and implementation delays.

The availability of adequate ICT infrastructure is also consistently identified as a prerequisite for successful ERP implementation. Reliable computer hardware, communication networks, databases, and internet connectivity provide the technological foundation required for ERP systems to operate effectively. This issue is particularly significant in developing countries, where inadequate ICT infrastructure remains a major implementation challenge. AboAbdo et al. (2020) emphasized that insufficient ICT infrastructure negatively affects ERP system performance and reduces the likelihood of successful implementation. These findings suggest that organizations should strengthen their technological infrastructure before undertaking ERP implementation projects.

Similarly, system integration capability plays a vital role in ERP implementation. One of the primary objectives of ERP systems is to integrate data and business processes across different organizational departments. However, integration with legacy systems and existing software applications often presents technical difficulties that may reduce data consistency and operational efficiency. Therefore, organizations with stronger system integration capabilities are generally more successful in implementing ERP systems than those with fragmented information systems.

Customization has also received considerable attention in ERP implementation research. Organizations frequently modify ERP software to accommodate their specific operational requirements and industry practices. Although customization may improve system usability, excessive modification increases implementation complexity, project cost, and future maintenance requirements. Umble et al. (2003) argued that organizations should carefully balance customization with the standardized functionalities provided by ERP systems to maximize implementation success while minimizing implementation risks.

Within the construction industry, technological challenges are often more complex because construction projects involve dynamic and project-based operations such as procurement, scheduling, budgeting, cost control, and project monitoring. Consequently, ERP systems must effectively support changing project requirements while maintaining organizational integration. Olawumi and Chan (2022) observed that misalignment between ERP functionalities and construction business processes frequently creates implementation difficulties, limiting organizations' ability to fully utilize ERP capabilities.

In summary, the reviewed literature demonstrates strong agreement that technological factors significantly influence ERP implementation success. Although researchers emphasize different technological characteristics, they consistently conclude that technological readiness including system compatibility, manageable system complexity, adequate ICT infrastructure, integration capability, and appropriate customization is essential for successful ERP implementation. However, most existing studies have been conducted in developed economies and manufacturing environments, while empirical evidence from the Ethiopian construction industry remains limited. This research therefore seeks to address this gap by examining how technological factors influence ERP adaptation and implementation within Ethiopian construction companies.

2.3.5 Organizational Context

The organizational context, as proposed by Tornatzky and Fleischer (1990), refers to the internal characteristics, resources, and capabilities of an organization that influence the adoption and implementation of technological innovations. Within the Technology–Organization–Environment (TOE) framework, organizational factors represent an organization's readiness and capacity to implement Enterprise Resource Planning (ERP) systems successfully. These factors include top management support, organizational culture, resource availability, organizational size, and change management practices. Since ERP implementation affects virtually every business function, strong organizational commitment and effective coordination are essential for successful implementation.

The existing literature consistently identifies organizational factors as among the most influential determinants of ERP implementation success. Although different studies emphasize different organizational dimensions, there is broad consensus that organizations with strong leadership commitment, adequate resources, supportive organizational cultures, and effective change management practices are more likely to implement ERP systems successfully. These findings suggest that organizational readiness plays a critical role in determining ERP implementation outcomes.

Among the organizational factors, top management support is widely regarded as one of the most critical success factors. ERP implementation requires substantial financial investment, strategic planning, and organizational transformation, making continuous management commitment

essential throughout the implementation process. Somers and Nelson (2001) and Nah et al. (2001) identified top management support as a key determinant of ERP implementation success, emphasizing that committed leadership facilitates resource allocation, strategic decision-making, effective communication, and employee motivation. Furthermore, management involvement helps resolve implementation challenges, coordinate organizational activities, and promote user acceptance of the new system.

Another important organizational factor is organizational culture, which influences employees' attitudes toward innovation and organizational change. ERP implementation often requires organizations to redesign existing business processes and adopt standardized procedures, making employee acceptance of change particularly important. Previous studies indicate that organizations with flexible, innovative, and collaborative cultures generally experience smoother ERP implementation than organizations characterized by resistance to change. Conversely, organizations with rigid cultures often encounter implementation delays, lower user acceptance, and reduced system utilization. These findings demonstrate that organizational culture significantly influences the effectiveness of ERP implementation.

Resource availability has also been consistently identified as a prerequisite for successful ERP implementation. ERP projects require considerable financial investment, technological infrastructure, skilled personnel, user training, and continuous technical support. Organizations with adequate financial and human resources are generally better positioned to manage implementation challenges and maintain ERP systems over time. Ifinedo (2011) reported that organizational preparedness in terms of financial capability and skilled human resources significantly improves ERP implementation success, particularly in developing countries where resource constraints are common.

Similarly, change management plays a crucial role in facilitating successful ERP implementation. Because ERP systems fundamentally alter organizational workflows, reporting structures, communication processes, and employee responsibilities, organizations must effectively manage the transition from existing practices to new ERP-enabled processes. Previous research highlights employee communication, stakeholder participation, user training, leadership commitment, and organizational support as essential components of successful change management. Bag et al.

(2021) argued that organizations that effectively manage organizational change experience higher user acceptance, greater employee satisfaction, and more sustainable ERP implementation outcomes, whereas inadequate change management frequently contributes to implementation failure.

The literature also recognizes organizational size as an important factor influencing ERP implementation. Larger organizations generally possess greater financial resources, more advanced technological infrastructure, and specialized technical expertise that facilitate ERP implementation. However, their complex organizational structures, multiple business units, and geographically dispersed operations often increase implementation complexity. In contrast, smaller organizations may benefit from simpler organizational structures but frequently face financial and technological constraints that limit their ERP implementation capacity.

Within the construction industry, organizational challenges are particularly significant because construction companies typically operate across multiple project sites while coordinating diverse stakeholders and temporary project teams. Maintaining standardized business processes, effective communication, procurement activities, financial reporting, and project coordination across multiple locations presents considerable organizational challenges. Consequently, organizational readiness, strong leadership, effective communication, and coordinated management practices become increasingly important for successful ERP implementation within construction organizations.

In summary, the reviewed literature consistently demonstrates that organizational factors significantly influence ERP implementation success. Although previous studies emphasize different organizational dimensions, they collectively conclude that top management support, organizational culture, resource availability, change management, and organizational size contribute substantially to successful ERP implementation. However, much of the existing evidence is derived from manufacturing industries and developed countries, while empirical studies focusing on organizational challenges affecting ERP implementation within the Ethiopian construction industry remain limited. Therefore, this study seeks to address this contextual gap by examining the influence of organizational factors on ERP adaptation and implementation in Ethiopian construction companies.

2.3.6 Environmental Context

The environmental context, as proposed by Tornatzky and Fleischer (1990), refers to the external conditions surrounding an organization that influence the adoption and implementation of technological innovations. Within the Technology-Organization-Environment (TOE) framework, environmental factors include industry competition, government regulations, technological development, customer requirements, supplier support, and the overall business environment. These external conditions shape organizational decisions regarding technology adoption and determine the extent to which organizations are motivated or pressured to implement Enterprise Resource Planning (ERP) systems.

Previous studies consistently suggest that environmental factors influence ERP adoption by creating external pressures and opportunities for organizational innovation. Although researchers emphasize different environmental dimensions, they generally agree that competitive pressure, regulatory requirements, supplier support, and external technological infrastructure encourage organizations to adopt integrated information systems in order to improve operational efficiency and maintain competitiveness.

One of the most widely discussed environmental factors is competitive pressure. Organizations operating in highly competitive markets are continuously required to improve efficiency, reduce operational costs, and enhance decision-making capabilities. ERP systems support these objectives by integrating organizational processes and providing timely access to information across departments. Previous studies indicate that increasing market competition encourages organizations to adopt ERP systems as a strategic response to changing customer demands and industry digitalization. This relationship is particularly important in industries where operational efficiency and project performance determine competitive advantage.

Government regulations and institutional policies also influence ERP adoption decisions. Organizations frequently implement ERP systems to improve financial reporting, procurement management, taxation compliance, and organizational transparency. In many developing countries, government initiatives promoting digital transformation and ICT development further encourage organizations to invest in enterprise information systems. However, inconsistent

regulatory environments and limited institutional support may reduce the effectiveness of these initiatives and create additional implementation challenges.

Another important environmental factor is supplier and consultant support. ERP vendors and implementation consultants provide technical expertise, user training, software customization, maintenance services, and post-implementation support throughout the ERP implementation process. Oliveira and Martins (2011) emphasized that strong supplier support significantly improves ERP implementation success, particularly in developing countries where organizations often have limited internal technical expertise. Consequently, effective collaboration between organizations and ERP vendors contributes to smoother implementation and long-term system sustainability.

The broader technological ecosystem also affects ERP implementation. Reliable internet connectivity, access to ICT service providers, and the availability of skilled technical professionals create an enabling environment for successful ERP implementation. Conversely, inadequate technological infrastructure and limited external technical support remain major barriers to ERP implementation in many developing countries, restricting both implementation effectiveness and long-term system utilization.

Within the construction industry, environmental factors influence ERP implementation through increasing market competition, client expectations, supplier relationships, and project collaboration requirements. Construction companies operate within dynamic business environments that require effective coordination among clients, consultants, contractors, subcontractors, and suppliers. Consequently, external pressures encourage organizations to adopt ERP systems to improve project coordination, financial transparency, procurement management, and organizational performance.

Although the original TOE framework considers environmental context as one of the three dimensions influencing organizational technology adoption, this study adapts the framework by emphasizing technological, organizational, and human-related factors in the empirical analysis. This adaptation is supported by ERP implementation literature, which consistently identifies employee competence, user training, change management, communication, and resistance to change as critical determinants of ERP implementation success (Umble et al., 2003; Ifinedo, 2011;

Bag et al., 2021). Furthermore, the primary objective of this study is to investigate internal organizational challenges affecting ERP adaptation and implementation within Ethiopian construction companies. Since the identified research problem primarily concerns organizational readiness and employee capability rather than external environmental pressures, human-related factors provide greater explanatory value for achieving the study objectives. Nevertheless, environmental factors remain important contextual influences and are therefore discussed within the theoretical framework even though they are not included as independent variables in the empirical model.

In summary, the reviewed literature demonstrates that environmental factors influence ERP adoption by shaping the external conditions under which organizations operate. Competitive pressure, government regulations, supplier support, and technological infrastructure have all been identified as important environmental determinants of ERP adoption. However, because this study focuses on internal organizational implementation challenges within Ethiopian construction companies, the empirical investigation emphasizes technological, organizational, and human-related factors while treating environmental factors as contextual influences.

2.4 ERP Implementation: Global Evidence

Enterprise Resource Planning (ERP) systems have been widely adopted across industries to improve organizational integration, operational efficiency, information sharing, and strategic decision-making. Numerous studies have reported that ERP systems enable organizations to integrate core business functions, including finance, procurement, human resource management, inventory management, and project management, into a unified information system. Although ERP implementation offers substantial organizational benefits, global evidence consistently indicates that successful implementation remains a complex organizational undertaking influenced by technological, organizational, and human-related factors.

The existing literature demonstrates broad agreement that ERP implementation extends beyond software installation and represents a fundamental organizational transformation. Davenport (1998) argued that ERP systems improve organizational coordination by integrating business processes through a centralized information platform, thereby enhancing communication, collaboration, and decision-making across departments. However, the author also emphasized that

organizations must often redesign existing business processes to align with ERP functionalities, making organizational change an essential component of successful implementation. This perspective is supported by subsequent studies, which recognize ERP implementation as both a technological and organizational change initiative rather than merely an information technology project.

Previous research also identifies project management as a critical determinant of ERP implementation success. Effective ERP implementation requires clear project objectives, strong leadership, continuous monitoring, stakeholder coordination, and effective communication throughout the implementation process. Conversely, inadequate project management contributes to implementation delays, budget overruns, poor communication, and increased project risk. Similarly, Umble et al. (2003) highlighted the importance of effective project planning and emphasized that data migration from legacy systems represents one of the most significant technical challenges affecting ERP implementation. Poor-quality data migration can reduce system performance, compromise information accuracy, and negatively influence organizational decision-making.

Another recurring theme in the literature is the importance of organizational fit between ERP systems and existing business processes. Bradford and Florin (2003) reported that organizations achieve greater ERP implementation success when the system aligns with organizational processes, strategic objectives, and organizational culture. Higher organizational fit promotes user satisfaction, increases system acceptance, and improves ERP performance, whereas poor alignment often results in implementation difficulties, user resistance, and reduced system utilization.

More recent studies have further expanded the understanding of ERP implementation by positioning ERP systems as essential components of digital transformation initiatives. Gupta et al. (2021) argued that modern ERP systems support organizational innovation through data analytics, automation, digital integration, and real-time decision-making capabilities. This demonstrates that ERP implementation is increasingly viewed as a strategic investment that enables organizations to improve competitiveness and respond more effectively to changing business environments.

Overall, the global literature consistently indicates that successful ERP implementation depends on the interaction of technological readiness, organizational capability, effective project management, and employee acceptance. While researchers emphasize different success factors, there is general consensus that ERP implementation requires strong leadership, adequate organizational resources, effective change management, user training, and well-developed technological infrastructure. However, much of the existing evidence has been generated from developed countries and manufacturing organizations. Consequently, there is limited empirical evidence regarding ERP implementation challenges within the Ethiopian construction industry, highlighting the need for the present study to examine these factors within its specific organizational and industrial context.

2.5 ERP Implementation in the Construction Industry

The implementation and utilization of Enterprise Resource Planning (ERP) systems are strongly influenced by the unique characteristics of the construction industry. Unlike manufacturing industries, which often operate within repetitive and standardized production environments, construction organizations manage temporary, project-based activities involving multiple stakeholders, changing requirements, geographically dispersed operations, and complex resource coordination. These characteristics create additional challenges for ERP implementation because ERP systems are generally designed around standardized processes, centralized information management, and consistent organizational structures. Therefore, successful ERP adoption in construction requires careful adaptation of ERP functionalities to align with industry-specific operational conditions.

A major characteristic of the construction industry is its project-based nature. Construction companies execute multiple projects simultaneously, with each project involving different clients, contractors, consultants, suppliers, locations, and resource requirements. Consequently, construction organizations require integrated information systems capable of supporting project planning, cost control, procurement management, scheduling, and resource allocation. However, early ERP systems were primarily developed for industries with stable and repetitive processes and were often unable to fully address the flexible and dynamic requirements of construction organizations without significant modifications. Acar et al. (2005) emphasized that the mismatch

between traditional ERP structures and construction processes creates difficulties in ERP adoption because construction activities are decentralized, flexible, and highly dependent on project-specific requirements.

Another important challenge is the temporary organizational structure of construction projects. Construction projects typically involve temporary teams consisting of project managers, engineers, subcontractors, suppliers, and consultants who collaborate for a limited period before the project is completed. This temporary nature makes it difficult to maintain consistent processes, ensure continuous knowledge sharing, and standardize information management across different projects. Since ERP systems depend on stable organizational procedures and continuous data flow, frequent changes in project teams and working environments may reduce ERP effectiveness. Therefore, organizational factors such as process standardization, leadership support, and internal coordination become critical determinants of successful ERP implementation in construction companies.

The fragmented stakeholder structure of construction projects also creates significant information management challenges. Effective construction performance requires continuous collaboration among different parties involved in design, procurement, finance, and project execution. ERP systems are expected to improve coordination by integrating information related to purchasing, financial management, inventory, human resources, and project activities. However, differences in stakeholder objectives, working methods, and information-sharing practices may limit effective ERP utilization. Poor communication, inconsistent data exchange, and resistance from users can reduce the expected benefits of ERP systems. This highlights the importance of human-related factors, including user acceptance, training, and willingness to adopt new digital processes.

Furthermore, decentralized decision-making is a common feature of construction organizations and represents another challenge for ERP implementation. Construction projects are frequently executed across different locations, requiring site managers and engineers to make operational decisions independently based on project conditions. While this flexibility supports project execution, it may create inconsistencies in data entry, reporting procedures, procurement activities, and resource management practices. Shi and Halpin (2003) noted that difficulties in process

standardization can negatively affect ERP implementation because ERP systems rely on integrated processes and centralized information structures.

Customization requirements represent another major issue affecting ERP adoption in the construction industry. Construction companies often require ERP systems to support industry-specific activities such as project cost estimation, contract administration, procurement tracking, budgeting, scheduling, and site resource management. Although customization can improve system compatibility with organizational needs, excessive customization may increase implementation complexity, maintenance costs, and technical risks. Therefore, construction organizations must maintain an appropriate balance between adopting standard ERP functionalities and modifying systems according to specific project requirements.

Recent studies further demonstrate that ERP implementation can significantly improve construction project performance when technological capabilities are aligned with organizational requirements. Marzouk and Enaba (2021) found that ERP systems can enhance cost management, budgeting accuracy, and project scheduling when construction processes are effectively integrated with system capabilities. This suggests that ERP success depends not only on technological availability but also on organizational readiness and effective process alignment. Similarly, Olawumi and Chan (2022) highlighted that integrating ERP systems with existing construction management applications remains a major technological challenge. Construction companies often rely on multiple software platforms for project planning, design management, procurement, and scheduling, and integrating these systems with ERP platforms may create problems related to data inconsistency, duplication of information, and limited interoperability.

Overall, the literature indicates that ERP implementation in the construction industry is more complex than in many other sectors due to project-based operations, temporary organizational structures, fragmented stakeholder relationships, decentralized decision-making, and high customization requirements. Successful ERP adoption requires a combination of technological readiness, organizational capability, and human acceptance. While previous studies have examined ERP challenges in construction contexts, limited empirical research has investigated these challenges within the Ethiopian construction industry. This study therefore contributes to existing

knowledge by examining the technological, organizational, and human-related factors influencing ERP adaptation and implementation among construction organizations in Ethiopia.

2.6 ERP Implementation in Developing Countries

Enterprise Resource Planning (ERP) implementation in developing countries differs considerably from that in developed economies because organizations operate under distinct technological, financial, institutional, and organizational conditions. Although ERP systems offer substantial benefits, including improved organizational integration, information sharing, operational efficiency, and decision-making, organizations in developing countries often encounter additional barriers that limit successful implementation. These barriers frequently result in implementation delays, cost overruns, reduced system utilization, or complete project failure. Consequently, ERP implementation in developing countries requires organizations to address contextual challenges that extend beyond the technical aspects of the system.

A major challenge consistently identified in the literature is the inadequacy of information and communication technology (ICT) infrastructure. Successful ERP implementation depends on reliable hardware, stable internet connectivity, sufficient data storage, secure network infrastructure, and continuous technical support. However, many developing countries continue to experience limitations in these areas, reducing the reliability and effectiveness of ERP systems. Kamhawi (2007) argued that inadequate technological infrastructure remains one of the most significant barriers to ERP implementation because unstable internet services, unreliable electricity supply, and limited technological resources negatively affect system performance, accessibility, and long-term sustainability. These findings demonstrate that technological readiness is a fundamental prerequisite for successful ERP adoption.

Financial constraints represent another important barrier to ERP implementation in developing economies. ERP projects require substantial investment in software acquisition, infrastructure development, system customization, employee training, maintenance, and technical support. However, organizations in developing countries often operate under limited financial resources, making it difficult to sustain ERP implementation throughout the project lifecycle. Budget limitations may reduce the scope of implementation, delay project completion, or restrict post-

implementation support, ultimately limiting the benefits obtained from ERP systems. These findings suggest that organizational financial capability is a critical determinant of ERP implementation success.

The literature also highlights the importance of external technical support and vendor capability. Successful ERP implementation depends not only on organizational readiness but also on continuous support from experienced vendors for system customization, troubleshooting, software updates, and user training. Nevertheless, many developing countries have limited access to qualified ERP vendors and industry-specific technical expertise. As a result, organizations often rely on foreign consultants, increasing implementation costs and extending project timelines. Weak vendor support therefore represents both a technological and organizational challenge affecting ERP sustainability.

Another recurring theme in the literature is organizational readiness. Ifinedo (2011) found that organizations with strong managerial commitment, adequate financial resources, skilled employees, and effective planning are significantly more likely to achieve successful ERP implementation. Organizational readiness enables firms to allocate resources effectively, manage technological change, and support employees throughout the implementation process. Conversely, inadequate planning, limited management support, and poor change management frequently contribute to implementation difficulties and lower system utilization.

Recent studies further emphasize the growing importance of human capabilities in ERP implementation. AlBar and Hoque (2022) reported that employees' digital competence significantly influences ERP adoption because technologically skilled employees adapt more quickly to new systems and utilize ERP functionalities more effectively. Conversely, limited digital literacy increases user resistance, operational errors, and underutilization of ERP capabilities. These findings demonstrate that human-related factors, particularly user competence, training, and change acceptance, are essential for achieving successful ERP implementation.

Similarly, AboAbdo et al. (2020) argued that technological readiness remains a major challenge for organizations in developing countries, particularly within the construction sector. Many construction companies continue to experience difficulties related to infrastructure limitations,

system integration, interoperability, and insufficient technological capability. Because construction organizations depend heavily on project coordination, information sharing, and collaboration among multiple stakeholders, these technological limitations can substantially reduce the effectiveness of ERP systems.

Overall, the literature suggests that ERP implementation in developing countries is influenced by the interaction of technological, organizational, financial, and human-related factors. While technological infrastructure provides the foundation for ERP implementation, organizational readiness, financial capacity, skilled employees, and effective vendor support collectively determine long-term implementation success. Despite increasing research on ERP implementation in developing economies, relatively limited empirical evidence exists regarding the Ethiopian construction industry, where infrastructure constraints, organizational capability, and human resource limitations continue to affect digital transformation initiatives. Therefore, the present study seeks to address this gap by examining the technological, organizational, and human-related factors influencing ERP adaptation and implementation in Ethiopian construction organizations.

2.7 Human-Related Factors in ERP Implementation

Human-related factors are widely recognized as critical determinants of ERP implementation success because the effectiveness of ERP systems depends largely on how employees accept, utilize, and adapt to new technologies. Although ERP systems provide advanced technological capabilities, implementation success ultimately depends on users' willingness to embrace organizational change and integrate new business processes into their daily activities. Consequently, many researchers argue that ERP implementation is as much a human and organizational challenge as it is a technological one.

One of the most consistently identified human-related challenges is user resistance to change. Employees frequently resist ERP implementation because they fear changes to established work practices, increased job complexity, reduced autonomy, or uncertainty regarding new technologies. Nah et al. (2001) identified user resistance as one of the most common causes of ERP implementation failure, emphasizing that resistance can significantly delay implementation, reduce system utilization, and limit organizational benefits. These findings demonstrate that

effective change management is essential for encouraging employee acceptance throughout the implementation process.

The literature also consistently emphasizes the importance of education and training in improving ERP implementation outcomes. Effective training enables employees to understand system functionalities, perform business processes accurately, and develop confidence in using ERP applications. Somers and Nelson (2001) reported that comprehensive user training significantly improves system acceptance and utilization by reducing uncertainty and increasing employee competence. Similarly, Bradford and Florin (2003) found that positive employee attitudes toward ERP systems contribute significantly to successful implementation outcomes. These studies suggest that organizations should view training as a continuous organizational investment rather than a one-time implementation activity.

Recent research has expanded the discussion by highlighting the growing importance of digital competence and organizational readiness for change. As organizations continue to adopt digital technologies, employees are expected to possess higher levels of technological knowledge and adaptability. Dwivedi et al. (2020) argued that resistance to technological change remains a significant challenge affecting digital transformation initiatives worldwide. Employees with stronger digital skills adapt more effectively to ERP systems, while limited technological competence often contributes to operational errors, lower system utilization, and reduced implementation success.

These human-related issues are particularly important within the construction industry, where employees often possess diverse educational backgrounds, varying levels of digital literacy, and different levels of experience with information systems. Construction projects also involve multidisciplinary teams working across multiple locations, making communication, collaboration, and knowledge sharing more complex. Consequently, successful ERP implementation requires organizations to invest in employee training, change management programs, continuous technical support, and user participation throughout the implementation process.

Overall, the literature demonstrates that human-related factors including user acceptance, resistance to change, employee training, digital competence, and organizational readiness play a fundamental role in ERP implementation success. While technological infrastructure and

organizational capability provide the foundation for ERP implementation, the long-term effectiveness of ERP systems ultimately depends on employees' willingness and ability to utilize the system effectively. Therefore, human-related factors constitute one of the key dimensions examined in the present study.

2.8 ERP Implementation in Ethiopia

Enterprise Resource Planning (ERP) systems have received increasing attention in Ethiopia as organizations pursue digital transformation to improve operational efficiency, information integration, and organizational decision-making. Over the past decade, ERP systems have been adopted across several sectors, including manufacturing, banking, telecommunications, higher education, and public institutions. This growing adoption reflects increasing recognition of digital technologies as strategic resources for enhancing organizational performance and competitiveness (Ifinedo, 2011; Gupta et al., 2021).

Despite this increasing adoption, ERP implementation in Ethiopia continues to face significant challenges. Similar to other developing countries, Ethiopian organizations frequently encounter inadequate ICT infrastructure, limited financial resources, shortages of skilled personnel, and insufficient management commitment during ERP implementation. These challenges often result in implementation delays, underutilization of ERP functionalities, increased operational costs, and failure to achieve the anticipated organizational benefits. Collectively, these findings suggest that successful ERP implementation depends on the combined influence of technological readiness, organizational capability, and human-related factors.

The literature further emphasizes that organizational readiness is a critical determinant of ERP implementation success. Organizations that demonstrate strong top management commitment, allocate sufficient financial and human resources, and implement effective change management strategies are more likely to achieve successful ERP implementation. Conversely, inadequate leadership support, poor organizational planning, and limited employee involvement frequently contribute to implementation challenges and reduced system effectiveness (Umble et al., 2003; Ifinedo, 2011).

These challenges are particularly important within the Ethiopian construction industry, where project-based operations, geographically dispersed worksites, decentralized decision-making, and

complex stakeholder coordination increase the need for integrated information systems. Construction companies require efficient information sharing, resource coordination, procurement management, and project monitoring to improve project performance. However, empirical studies specifically examining ERP implementation challenges within Ethiopian construction organizations remain limited. Consequently, there is insufficient evidence regarding how technological, organizational, and human-related factors jointly influence ERP implementation in this context.

Therefore, this study seeks to address this empirical gap by investigating the technological, organizational, and human-related factors affecting ERP adaptation and implementation in the Ethiopian construction industry. The findings are expected to provide context-specific evidence that can support construction companies, ERP vendors, policymakers, and researchers in improving ERP implementation practices within Ethiopia

2.9 Research Gap

A review of the existing literature reveals several specific gaps in ERP implementation research. First, although ERP implementation has been extensively studied in developed countries and industries such as manufacturing, banking, and public institutions, limited empirical evidence exists regarding ERP implementation challenges within the Ethiopian construction industry. The construction sector has unique operational characteristics, including project-based activities, multiple stakeholders, temporary project teams, and decentralized decision-making processes, which may create ERP implementation challenges different from those experienced in other industries. Therefore, the specific factors influencing ERP implementation success in Ethiopian construction firms remain insufficiently explored.

Second, previous ERP studies have largely focused on technological and organizational factors, while human-related factors have received comparatively less attention. In particular, limited research has examined how employee resistance to change, ERP knowledge, digital skills, and training deficiencies influence ERP adaptation and implementation within Ethiopian construction organizations. This creates a knowledge gap regarding the role of human-related challenges in ERP implementation outcomes.

Third, existing studies have often investigated individual ERP implementation factors separately rather than examining the combined effects of technological, organizational, and human-related factors within an integrated framework. Consequently, the relative contribution and combined influence of these factors on ERP implementation outcomes remain unclear, particularly in the context of developing countries and construction industries.

Fourth, ERP implementation studies in Ethiopia have mainly adopted either quantitative or qualitative research approaches. Limited studies have applied a mixed-methods approach that combines statistical evidence with practical experiences from ERP users and stakeholders. As a result, a comprehensive understanding of both measurable factors and contextual challenges affecting ERP implementation is still lacking.

Therefore, this study addresses these identified gaps by empirically examining the technological, organizational, and human-related factors affecting ERP adaptation and implementation in selected Ethiopian construction firms using a mixed-methods approach. The study contributes to the existing body of knowledge by providing context-specific evidence on ERP implementation challenges in the Ethiopian construction industry and offering practical insights for improving ERP implementation success.

2.10 Conceptual Framework

Based on the TOE framework and previous ERP implementation literature, this study proposes a conceptual framework consisting of three independent variables: technological factors, organizational factors, and human-related factors. Technological factors include system complexity, compatibility, ICT infrastructure, and integration capability. Organizational factors comprise top management support, financial readiness, organizational culture, and change management. Human-related factors include user training, ERP knowledge, IT skills, and resistance to change.

These three constructs are hypothesized to influence ERP adaptation and implementation in Ethiopian construction companies. The conceptual framework provides the basis for developing the study hypotheses, designing the research instruments, and empirically testing the relationships between the independent variables and ERP implementation outcomes.

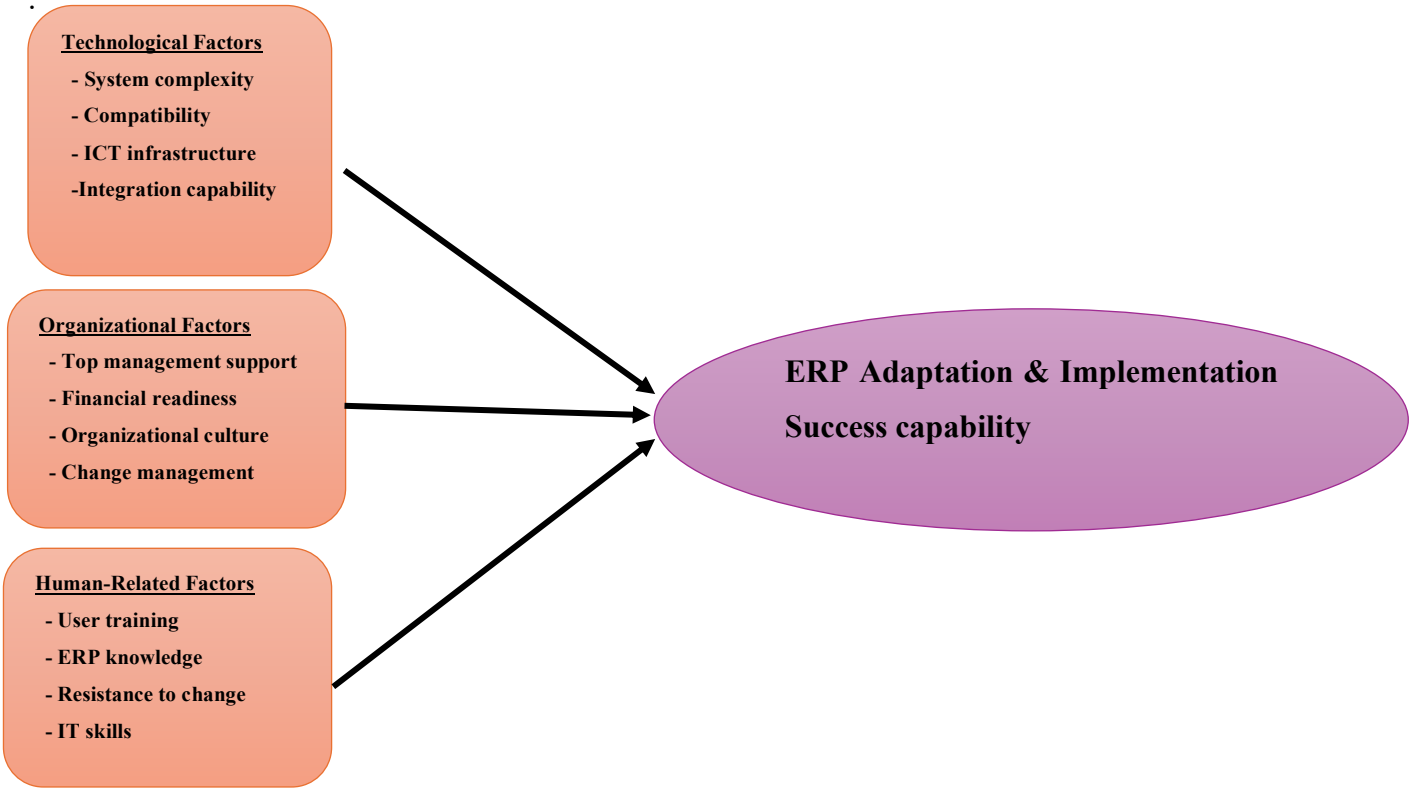


Figure 1 Conceptual framework of the study (Own Model)

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Research Design and Approach

This study employed a mixed-methods research approach because ERP implementation is a multidimensional organizational phenomenon that cannot be adequately understood using quantitative or qualitative methods alone. The quantitative component was used to measure the relationships between technological, organizational, and human-related factors and ERP implementation, while the qualitative component provided a deeper understanding of participants' experiences, perceptions, and organizational challenges during ERP implementation. By integrating quantitative and qualitative findings through a convergent parallel design, the study achieved a more comprehensive understanding of ERP implementation challenges in Ethiopian construction companies.

This method simultaneously includes the use of more than one methodology. Both quantitative and qualitative data are collected in this design. Their analysis is conducted separately but they are integrated in the interpretation stage. For this research, this methodology is the best approach because it can combine statistical findings with detail descriptions about the adaptation and implementation of ERP in construction firms. the quantitative section takes an explanatory method to view how factors like technological, organizational and human attached to the success of adapting and implementing ERP systems. the qualitative method is suitable because this research plans to find out how ERP implementation is affected by independent variables.

The qualitative section is used to view closely at the views & experiences, that individuals face when adopting ERP systems. It used semi-structured interviews to collect detail information that sum up to the results collected from numbers.

The study uses both inductive and deductive reasoning methods. The inductive method is used in the qualitative section to catch new problems and the situations related to ERP system in a practical way. On the other hand, the deductive method is used in the quantitative part where hypothesis and variables test from theories about ERP implementation in the construction industry in Ethiopia.

Quantitative data is collected using questionnaires, and qualitative data is gathered with semi-structured interviews. Using this both methods make the research more reliable, trustworthy and complete.

3.2 Study Area and Population

The study focuses at construction companies working in different areas and cities of Ethiopia that started using ERP systems. Those are chosen because peoples there have ERP practices that is already there within their organizations so it was easy to get peoples who answer the questions.

3.3 Sample Size Determination

A total of **50 questionnaires** were distributed to employees who were directly involved in ERP implementation across the selected construction companies. The participants were intentionally selected because they possessed relevant knowledge and practical experience regarding ERP implementation. Of the 50 questionnaires distributed, 44 valid responses were returned, representing an 88% response rate, which was considered adequate for the quantitative analysis.

For the qualitative component, purposive sampling was employed to select five key informants, with one participant representing each department involved in ERP implementation. The participants were selected based on their roles and experience in ERP planning, implementation, management, or technical support. Their experience enabled them to provide rich and detailed insights that complemented the quantitative findings.

The sample size was determined based on the availability of employees directly involved in ERP implementation and their accessibility during the data collection period. Since the study sought responses from individuals with specialized knowledge of ERP implementation rather than the general workforce, purposive sampling was considered the most appropriate technique for identifying participants capable of providing relevant and reliable information.

3.4 Sampling Techniques

This study employed purposive sampling for both the quantitative and qualitative components because the research focused on individuals with direct knowledge and experience of ERP implementation in Ethiopian construction companies. Purposive sampling is appropriate when

participants are intentionally selected based on their expertise and ability to provide information relevant to the research objectives.

For the quantitative component, purposive sampling was used to select managers, ERP users, IT professionals, procurement personnel, finance staff, and other employees directly involved in ERP implementation. These participants were chosen because they possessed practical experience and sufficient knowledge of the ERP implementation process within their organizations. A total of 50 questionnaires were distributed, and 44 valid responses were returned and used for statistical analysis. This approach ensured that the quantitative data reflected the views of individuals actively engaged in ERP implementation.

For the qualitative component, purposive sampling was also employed to select five key informants, with one participant representing each relevant department involved in ERP implementation. These participants were selected because they held key responsibilities and had extensive experience in ERP planning, implementation, management, or technical support within their respective departments. Conducting semi-structured interviews with representatives from different functional areas enabled the study to capture diverse perspectives on the technological, organizational, and human-related challenges affecting ERP implementation. This approach enhanced the depth and credibility of the qualitative findings by ensuring that the information was obtained from knowledgeable and information-rich participants.

3.5 Data Sources

Both primary and secondary resources are used in the research. The primary data collected by using organized questionaries and semi-structured interviews with employees and managers in the construction companies who are part of the ERP implementation. The secondary data collected from books, journals and articles, organizational reports, documents and other academic and institutional publications related to ERP systems and construction.

3.6 Data Collection Instruments

To gather numerical data a well-organized questionnaire is distributed for individuals who are part of the ERP implementation and works in the chosen construction companies. The questionnaire is created only of questions that have specific answers. Those answers are measured on a five-point

Likert scale. On this scale, 1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree and 5 – Strongly agree. This survey conducted to evaluate the technology, company related, people related aspects and the outcomes of adapting and implementing ERP systems.

3.6.2 Interview Guide

To gather the qualitative information, a semi-structured interview is used from important people who have a real experience with ERP implementation. The interviews focus at what participants go through when using ERP, what challenges they faced during the process, how organizations re ready to adopt the system, and what methods they used to overcome the problems that came during implementation. This method allows the researcher to collect detail information and context that increase the numerical results.

3.7 Validity and Reliability

To ensure the trustworthiness of the study, both validity and reliability processes are carefully addressed throughout the research.

3.7.1 Validity

Different methods are used to make the research tools are reliable. Validity of content is confirmed by asking experts and supervisors to view the questionnaire and interview guide to make sure they are clear, sufficient, and relevant. Explanatory Factor Analysis is used to evaluate construct validity to check if the items of measurement exactly reflect the planned concepts. Also to make the study results more believable and complete we use both numbers and words in our findings.

3.7.2 Reliability

To measure internal consistency Cronbach's Alpha is used to assess reliability. A value of 0.70 or higher is considered acceptable.

Plus, prior to the main data collection a pilot study is conducted to improve clarity and insure the questionnaire reliability.

3.8 Data Analysis Methods

3.8.1 Quantitative Data Analysis

From the questionnaire, the numbers gathered are examined by using the Jamovi statistical software. Descriptive statistics such as percentage, frequency, mean and standard deviation are used to summarize the respondents' demographic details and the main variables of the study. Besides that, related to the dependent variable a correlation analysis is done to view how strangely the independent variable.

The research observes at the major things that can influence results, those are technological, organizational and human related factors. The main focus of the research is how the listed factors affect the adaptation and implementation of ERP construction companies. To evaluate how the independent variables impact the results we use multiple regression analysis. And the hypothesis of the study is tested using significance level of 5% ($\alpha = 0.05$).

3.8.2 Qualitative Data Analysis

The qualitative data is gathered through semi-structured interviews with selected key respondents who have on hand experience with the implementation of ERP in construction companies. Those are it managers, ERP coordinators, managers, and experienced staffs who work or worked with ERP system.

The interviews viewed at important problems related to using ERP systems. This states if the technology is ready, if management was supportive, employees feeling about the change, if the training was enough, and difficulties within the company that would affect how good the ERP system is adopted and worked.

Thematic analysis is used to examine the collected data. The interview recordings are translated directly as it is said and reviewed closely to make sure, we finally understand the information. The qualitative data collected is organized and grouped into main categories based on the themes and ideas that show up usually. The different groups are combined into broad themes that show the experiences by using ERP, the difficulties faced, the organizational preparedness, and strategies they use with in construction companies. The findings help to clear, support, and give context for the quantitative results that get from the data.

The methodological choices adopted in this study were guided by the research objectives and the nature of the research problem. A mixed-methods approach was selected to combine the strengths of quantitative and qualitative research. The convergent parallel design enabled both types of data to be collected during the same phase and integrated during interpretation. Purposive sampling ensured that participants possessed practical ERP implementation experience. Structured questionnaires provided standardized quantitative data for statistical analysis, while semi-structured interviews generated detailed qualitative insights. Reliability analysis, descriptive statistics, correlation analysis, and multiple linear regression were employed because they are appropriate statistical techniques for examining relationships among variables and testing the proposed hypotheses.

3.9 Ethical Considerations

Before starting to collect data approval for ethical standards is secured. Respondents are informed properly about why the research is being conducted, which is completely voluntary, and that they can exit the study any time they want without facing any negative effects. All participants give their consent before the questionnaire if hand out to then and carried out interviews. The privacy of the participants is kept by the study by not including their personal information in the research and by ensure the information gathered is only used for academic reasons. Ethical approval is assured prior to data collection.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND DISCUSSION

4.1 Introduction

This chapter presents the findings, analysis and discussion of the collected data from participants about the issues that affect how ERP is adapted and implemented in the construction industry in Ethiopia. It covers demographic details, basic statistics, reliability analysis, correlation analysis, regression analysis and qualitative findings from interviews. These findings are shown in tables and explained accordingly to the goals of the study and the research questions. And also, the qualitative findings are described to explain and support the quantitative results.

4.2 Quantitative Findings

A total of 50 questionnaires were distributed to respondents from selected construction companies. from these, 44 questionnaires were successfully completed and returned, having a response rate of 88%. The returned questionnaires were screened and found suitable for further statistical analysis.

4.2.1 Demographic Characteristics of Respondents

Demographic information is gathered to know about the backgrounds of the people who participated. This assisted us check if the individuals have enough knowledge and experience with using ERP systems in construction companies. Those factors considered were gender, age, education level, job position, work experience and experience with ERP systems.

4.2.1.1 Gender of Respondents

Both men and women participants are included in the research. Most of the people who answered the questionnaire were male workers.

Table 2 Gender Distribution of Respondents

Gender	**Frequency**	**Percentage**
Male	24	54%

Gender	Frequency	Percentage
Female	20	46%
Total	44	100%

4.2.1.2 Age Distribution of Respondents

Most peoples were in the age group considered that actively working. That shows that the respondents were engaged in the organization and using the ERP system.

Table 3 Age Distribution of Respondents

Age Category	Frequency	Percentage
20–30 Years	36	81.8%
31–40 Years	8	18.1%
Above 40 Years	0	
Total	44	100%

4.2.1.3 Educational Level of Respondents

Most peoples in the survey had bachelor's degrees, this clears that they had enough education to grasp the organizational processes related to ERP.

Table 4 Educational Level of Respondents

Educational Level	Frequency	Percentage
Diploma	-	-

Educational Level	Frequency	Percentage
Bachelor's Degree	36	81.8%
Master's Degree	5	11.3%
PHD	3	6.8%
Total	44	100%

4.2.1.4 Position of Respondents

The study includes people from different job roles, like managers, technical workers, and ERP system users.

Table 5 Position of Respondents

Position	Frequency	Percentage
Senior Managers	8	18.8%
Project Manager	7	15.9%
IT Staff	6	13.6%
ERP Users	23	52.3%
Total	44	100%

4.2.1.5 Years of Work Experience

Peoples who answered the questionnaire had years of experience in organizations, which enables them to give trustworthy insights about the difficulties of using ERP systems.

Table 6 Years of Work Experience

Experience Category	Frequency	Percentage
Less than 2 Years	7	15.9%
2–5 Years	29	65.9%
6–10 Years	2	4.5%
Above 10 Years	6	13.9%
Total	44	100%

4.2.2 Reliability Analysis

Reliability analysis was conducted to view how consistent the measurement tools used in the study were. It was measured using Cronbach's Alpha coefficient. As Hair et al. (2010) state that a Cronbach's Alpha score of 0.70 or higher is considered acceptable for research in social sciences.

Table 7 Reliability Analysis Results

Variables	Number of Items	Cronbach's Alpha	Interpretation
Technological Factors	7	0.813	Good
Organizational Factors	7	0.917	Excellent
Human-Related Factors	7	0.748	Acceptable
ERP Implementation	7	0.929	Excellent

The reliability analysis results indicate that all study variables achieved Cronbach's Alpha values above the recommended threshold of 0.70, demonstrating acceptable internal consistency

reliability. Organizational Factors exhibited excellent reliability (α = 0.917), while ERP Implementation also demonstrated excellent internal consistency (α = 0.929). In addition, Technological Factors showed good reliability (α = 0.813), whereas Human-Related Factors demonstrated acceptable reliability (α = 0.748). These results indicate that the measurement instrument was sufficiently reliable and appropriate for subsequent statistical analyses.

4.2.3 Descriptive Analysis of Study Variables

Descriptive statistics is used to view on how respondents view the technological, organizational, and human-related factors that affect the adaptation and implementation of ERP systems. The analysis used average scores and standard deviations based on a five-point Likert scale.

Table 8 Descriptive Statistics

Variables	**Mean**	**Standard Deviation**
Technological Factors	2.95	0.728
Organizational Factors	3.60	0.901
Human-Related Factors	2.87	0.569
ERP Implementation	3.70	0.984

The descriptive analysis revealed that Organizational Factors had the highest mean score (M = 3.60), indicating that respondents generally agreed that organizational factors play a significant role in ERP adaptation and implementation. Since the mean value is above the midpoint of 3.0, respondents perceived factors such as top management support, organizational readiness, and effective change management as important contributors to successful ERP implementation. ERP Implementation also recorded a relatively high mean score (M = 3.70), suggesting that respondents generally agreed that ERP systems had been successfully adapted and implemented within their organizations. In contrast, Technological Factors (M = 2.95) and Human-Related Factors (M = 2.87) recorded moderate mean scores, indicating that respondents perceived technological and

human-related issues as moderate challenges affecting ERP adaptation and implementation in construction companies.

4.2.4 Correlation Analysis

A correlation analysis is conducted to show how technological, organizational, human-related factors, ERP implementation, and performance of the organizational are connected to each other.

Table 9 Correlation Matrix

Variables	**TF_Mean**	**OF_Mean**	**HF_Mean**	**ERP_Mean**
TF Mean	-			
OF Mean	-0.621***	-		
HF Mean	-0.587***	0.719***	-	
ERP Mean	-0.582***	0.888***	0.542***	-

Note: *p < 0.05, **p <0.01, ***p < 0.001

The correlation analysis revealed significant relationships among the study variables. Organizational Factors showed a strong positive correlation with ERP Adaptation and Implementation ($r = 0.888$, $p < 0.001$), indicating that higher levels of top management support, organizational readiness, effective communication, and change management are associated with more successful ERP implementation. Human-Related Factors also demonstrated a moderate positive correlation with ERP Implementation ($r = 0.542$, $p < 0.001$), suggesting that employee knowledge, training, digital competence, and user acceptance contribute positively to ERP adaptation and implementation.

In contrast, Technological Factors exhibited a significant negative correlation with ERP Implementation ($r = –0.582$, $p < 0.001$). This finding indicates that greater technological challenges, such as system complexity, inadequate ICT infrastructure, integration difficulties, and data migration problems, are associated with lower levels of ERP adaptation and implementation. Overall, the correlation analysis suggests that organizational and human-related factors positively

influence ERP implementation, whereas technological challenges negatively affect the successful adaptation and implementation of ERP systems in construction companies.

4.2.5 Regression Analysis

To examine the effect of technological, organizational, and human-related factors multiple regression analysis was conducted on ERP adaptation and implementation.

4.2.5.1 Model Summary

Table 10 Model Summary

Model	R	R^2
1	0.902	0.814

The regression model gives an R^2 value of 0.814, this tells that technology, organization, and people related factors together count for 81.4% of the differences in how ERP is adapted and implemented. This shows that the model is very good on telling the results of ERP implementation in the construction industry in Ethiopia.

4.2.5.2 ANOVA Results

Table 11 ANOVA Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	18.515	3	6.172	89.26	<0.001
Residual	7.737	40	0.193		
Total	26.252	43			

The ANOVA results shows that the regression model is statistically significant ($F = 89.26$, $p<0.001$). so that, this factors together really impact on the wellness on how ERP systems are adjusted and done.

4.2.5.3 Regression Coefficients

Table 12 Regression Coefficients

Variables	Beta	t-value	Sig.
Technological Factors	-0.102	-1.13	0.264
Organizational Factors	0.991	9.45	<0.001
Human-Related Factors	-0.231	-2.28	0.028

The regression analysis outcomes shows that organizational factors have a strong positive and statistically significant influence on ERP use (β =0.991, $p < 0.001$). This tells that having management support, readiness of an organization, being financially stable, and changes management will really help construction companies get used to and successfully implement ERP systems.

Technological factors gave a negative but statistically insignificant effect on ERP implementation (β =-0.102, p =0.264). This tells that even if there are technological problems, they didn't have a high impact on how ERP was used in the companies we looked at.

Human-related factors stated a statistically significant negative effect on ERP implementation (β =-0.231, p =0.028). This tells that when employees are resistant to change, they have insufficient knowledge about ERP systems, want limited digital skills, and don’t get enough training, it can affect how well ERP is put into practice in construction companies.

Table 13 Hypothesis

Hypothesis	Result	Decision
H1: Technological factors significantly affect ERP implementation.	p = 0.264	**Rejected**
H2: Organizational factors significantly affect ERP implementation.	p < 0.001	**Accepted**

Hypothesis	Result	Decision
H3: Human-related factors significantly affect ERP implementation.	p = 0.028	**Accepted**

Based on the regression analysis, H2 and H3 were supported because their p-values were less than 0.05, while H1 was not supported because its p-value exceeded the 0.05 significance level.

4.3 Qualitative Findings

Qualitative data was gathered through semi-structured interviews with selected participants who were directly affected in the implementation and use of ERP systems in construction companies. The interviews results were analyzed using thematic analysis, concerned on the main areas of the study, which include technological, organizational, and human-related factors that affect the success of ERP adaptation and implementation.

4.3.1 Technological Factors

As shown from the interview result, technology problems had a high impact on how construction companies put ERP systems into place. Many respondents said that insufficient ICT infrastructure, system integration challenges, and compatibility issues had a bad impact on how the ERP system was used.

Respondents also point out that for workers who have limited technical knowledge and experience on ERP, the complexity of the system make it even harder. This result suggests that technology readiness and have the right infrastructure are crucial for adapting and implementing ERP systems successfully.

4.3.2 Organizational Factors

The interview results showed that organizational factors like top management support, organizational readiness, wellness of organizational work and financial resource availability highly affect the success of ERP implementation.

One ERP project coordinator explained:

"Support from top management play a crucial role in the process of implementing the ERP system." Management helped to assign the budget, approved training programs, and motivated employees to utilize the system.

Participants also mentioned that poor teamwork between departments and delays in making decisions by management slowed down the progress of implementation and impacted how efficiently operations ran.

Another person said that “some business processes weren’t clearly set up before the ERP was put in place, which made it harder to customize and launch the system.”

The results indicate that being dedicated to organization, having good communication, and getting management involved are key factors that determine the success of ERP implementation in construction companies.

4.3.3 Human-Related Factors

Peoples who took the interviews said that challenges like employee’s resistance to change, insufficient knowledge about ERP systems, and limited training made it harder to successfully place ERP system.

One finance officer explained:

At first, a lot of employees were against the ERP implementation because they felt more at ease with the old manual system. Some employees were worried that the new system would lead to more supervision and responsibility for their work.

Similarly, an HR officer stated:

"Training on the ERP system was given, but it wasn't enough for all the employees." Some departments got thorough training, whereas others just had a basic introduction.

Participants also mentioned that having fewer technical skills made employees less confident in utilizing ERP modules properly during the first stages of implementation.

The results show that ongoing training for employees, providing technical help, and getting employees involved are key factors for successfully adapting and implementing ERP systems.

4.4 Discussion of Quantitative & Qualitative Findings

As the quantitative result showed in this study organizational factors affect how ERP systems are adopted and successfully implemented in the construction industry of Ethiopia. Management support, readiness of organization, finance and better change management are highly increase the outcomes of ERP implementation. Top management support is one of the most essential factors for implementing ERP system successfully.

As shows by the regression analysis, technological factors indicated a negative relationship with ERP implementation ($\beta = -0.102$), but the effect is not statistically significant ($p = 0.264$). This suggests that even though challenges such as system complexity, inadequate ICT infrastructure, and compatibility issues may create challenges during ERP implementation, they were not found to be significant predictors of ERP implementation success among the construction companies included in this study. Therefore, technological factors appeared to have a relatively lower influence compared to organizational and human-related factors.

Human-related factors found to have high effect on the ERP implementation results. Employee resistance, skills shortage and insufficient knowledge on ERP systems can affect the adaptation & implementation of ERP system. These outcomes agree with Dwivendi and others in 2020, outlining employee preparation, training, and technology skill is essential during changes involves technology.

As discovered in the research ERP implementation highly increases performance of organization. Effective implementation increases coordination, operational integration, decision making process with construction firms.

The qualitative response outcomes show that technology, organization and people related factors affect how construction companies adapt the ERP system.

In addition, outcomes viewed that employee resistance, lack of knowledge, and training shortage affect how well ERP systems are place in construction companies.

The interview results show that successfulness of ERP implementation, it is essential to have strong support from the organization, technology setup, continued development of employee skills.

4.5 Triangulation Analysis of Quantitative and Qualitative Findings

The present study employed a convergent parallel mixed-methods design in which quantitative and qualitative data were collected simultaneously, analyzed independently, and integrated during interpretation. Triangulation was conducted to compare the findings from both datasets and determine whether they converged, complemented one another, or revealed differences. The integrated analysis provides a more comprehensive understanding of the technological, organizational, and human-related factors affecting ERP adaptation and implementation in the Ethiopian construction industry.

4.5.1 Triangulation of Technological Factors

The quantitative findings indicated that technological factors moderately influenced ERP adaptation and implementation, with respondents identifying issues related to ICT infrastructure, system integration, ERP customization, and data migration as important implementation challenges. These findings suggest that although organizations have made progress in adopting ERP systems, technological limitations continue to affect implementation success.

The qualitative findings supported these results. Interview participants reported that inadequate ICT infrastructure, difficulties integrating ERP with existing applications, unreliable internet connectivity, and technical problems during data migration frequently delayed ERP implementation. Several participants also explained that ERP customization increased implementation complexity and required additional technical expertise.

The convergence of the quantitative and qualitative findings indicates that technological readiness remains a significant determinant of ERP adaptation and implementation. Both datasets consistently demonstrate that improving ICT infrastructure, strengthening system integration, and providing adequate technical support would enhance ERP implementation within Ethiopian construction organizations.

4.5.2 Triangulation of Organizational Factors

The quantitative analysis showed that organizational factors had a strong influence on ERP adaptation and implementation. Respondents generally agreed that top management commitment, organizational readiness, effective communication, and resource availability contributed significantly to ERP implementation success.

Similarly, interview participants emphasized that leadership commitment, project planning, organizational coordination, and change management were essential for successful ERP implementation. Participants explained that organizations with active managerial involvement and adequate resource allocation experienced fewer implementation challenges than organizations with limited management support.

The findings from both datasets therefore converge, indicating that organizational capability plays a critical role in ERP implementation. This suggests that successful ERP implementation requires not only technological investment but also strong leadership, effective communication, sufficient financial resources, and organizational readiness.

4.5.3 Triangulation of Human-Related Factors

The quantitative findings revealed that human-related factors significantly influenced ERP adaptation and implementation. Respondents acknowledged the importance of employee training, ERP knowledge, digital competence, and user acceptance while recognizing that resistance to change remained a challenge.

The qualitative findings reinforced these results. Interview participants explained that employees who received adequate training adapted more easily to ERP systems, whereas limited digital skills and resistance to organizational change reduced user acceptance and slowed implementation. Participants also noted that continuous training and user involvement improved employee confidence and encouraged effective system utilization.

The convergence of both datasets demonstrates that human-related factors are essential for successful ERP implementation. The findings indicate that organizations should strengthen employee training, improve digital competence, and implement effective change management strategies to reduce resistance and increase ERP adoption.

4.5.4 Overall Triangulation

Overall, the quantitative and qualitative findings were highly consistent. Both datasets identified technological, organizational, and human-related factors as the primary determinants of ERP adaptation and implementation in Ethiopian construction organizations. While the quantitative data measured the extent to which these factors influenced ERP implementation, the qualitative

findings provided detailed explanations of how and why these factors affected implementation outcomes.

The integration of the two datasets strengthens the credibility of the study by demonstrating that similar conclusions were reached using different research methods. The qualitative findings complemented the quantitative results by providing contextual explanations for the statistical patterns observed in the survey. Consequently, the triangulated findings provide stronger evidence that successful ERP implementation in the Ethiopian construction industry depends on the combined influence of technological readiness, organizational capability, and human-related factors.

Table 14 Triangulation of Findings

Research Construct	**Quantitative Findings**	**Qualitative Findings**	**Integrated Interpretation**
Technological Factors	ICT infrastructure, system integration, customization, and data migration influenced ERP implementation.	Participants reported inadequate infrastructure, integration challenges, and technical difficulties.	Both datasets confirm that technological readiness is essential for successful ERP implementation.
Organizational Factors	Management support, organizational readiness, communication, and resource allocation significantly influenced ERP implementation.	Interviewees emphasized leadership commitment, planning, and organizational coordination.	Both datasets consistently identify organizational capability as a major determinant of ERP implementation.
Human-Related Factors	Training, ERP knowledge, digital skills, and user acceptance influenced ERP implementation.	Participants highlighted employee resistance, limited digital competence, and insufficient training.	The findings converge, indicating that human-related factors play a critical role in ERP adaptation and implementation.

Research Construct	Quantitative Findings	Qualitative Findings	Integrated Interpretation
ERP Adaptation and Implementation	Survey respondents reported that implementation depends on technological, organizational, and human-related factors.	Interview participants confirmed that all three factors jointly influence implementation success.	Both datasets support the conceptual framework and demonstrate that ERP implementation is a multidimensional organizational process.

4.5 Chapter Summary

This chapter presented and analyzed the quantitative and qualitative findings of the study on the factors affecting ERP adaptation and implementation in the Ethiopian construction industry. The quantitative analysis included reliability testing, descriptive statistics, correlation analysis, multiple regression analysis, and hypothesis testing. The reliability analysis confirmed that the measurement instrument was reliable, with all constructs achieving Cronbach's Alpha values above the recommended threshold of 0.70. The descriptive statistics indicated that Organizational Factors had the highest mean score, suggesting that respondents perceived management commitment, organizational readiness, and effective change management as the most influential factors affecting ERP implementation. Correlation analysis revealed significant relationships among the study variables, while the regression analysis demonstrated that Organizational Factors had a significant positive effect on ERP implementation, Human-Related Factors had a significant negative effect, and Technological Factors had a negative but statistically insignificant effect.

The chapter also presented the qualitative findings obtained through semi-structured interviews. The interview results highlighted challenges related to ICT infrastructure, system integration, top management commitment, organizational readiness, employee training, digital competence, and resistance to change. These findings provided detailed explanations of the issues identified through the quantitative analysis.

Finally, a triangulation analysis was conducted to integrate the quantitative and qualitative findings. The results showed a high level of convergence between the two datasets, confirming that technological, organizational, and human-related factors jointly influence ERP adaptation and implementation in the Ethiopian construction industry. The qualitative findings complemented the quantitative results by providing contextual explanations for the statistical relationships identified in the survey. The integrated findings therefore strengthen the validity and credibility of the study and provide a comprehensive understanding of the factors affecting ERP implementation. The next chapter discusses these findings in relation to previous empirical studies, the theoretical framework, and the study objectives.

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CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the major findings, conclusions, recommendations, limitations of the study, and suggestions for future research on the factors affecting ERP adaptation and implementation in the Ethiopian construction industry. The chapter is based on the findings obtained from the quantitative and qualitative analyses presented in Chapter Four. It also integrates the findings from both datasets through triangulation to provide a comprehensive understanding of the factors influencing ERP adaptation and implementation.

5.2 Summary of Findings

The main objective of this study was to examine the factors affecting ERP adaptation and implementation in the Ethiopian construction industry. Specifically, the study investigated the influence of technological, organizational, and human-related factors on ERP adaptation and implementation.

The demographic analysis indicated that the respondents possessed adequate educational qualifications, work experience, and knowledge of ERP systems, suggesting that they were capable of providing reliable information regarding ERP implementation in construction companies.

The reliability analysis confirmed that the measurement instrument was reliable, as all study variables achieved Cronbach's Alpha values above the recommended threshold of 0.70, demonstrating acceptable to excellent internal consistency.

The descriptive analysis revealed that Organizational Factors recorded the highest mean score (M = 3.60), indicating that respondents perceived top management support, organizational readiness, effective communication, resource availability, and change management as the most influential factors affecting ERP adaptation and implementation. ERP Implementation also recorded a relatively high mean score (M = 3.70), suggesting that respondents generally agreed that ERP systems had been successfully implemented within their organizations. Technological Factors (M

= 2.95) and Human-Related Factors (M = 2.87) recorded moderate mean scores, indicating that respondents perceived technological and human-related issues as moderate challenges affecting ERP implementation.

The correlation analysis revealed significant relationships among the study variables. Organizational Factors showed a strong positive correlation with ERP Implementation, indicating that improvements in organizational readiness, management support, and change management are associated with more successful ERP implementation. Human-Related Factors also demonstrated a significant positive relationship with ERP Implementation. In contrast, Technological Factors exhibited a significant negative relationship with ERP Implementation, indicating that technological challenges such as inadequate ICT infrastructure, system complexity, and integration difficulties negatively affect ERP adaptation and implementation.

The regression analysis indicated that Organizational Factors had a statistically significant positive effect on ERP adaptation and implementation, making them the strongest predictor of successful ERP implementation. Human-Related Factors had a statistically significant negative effect, suggesting that employee resistance, inadequate training, and limited digital competence hinder ERP implementation. Although Technological Factors showed a negative relationship with ERP implementation, their effect was not statistically significant after controlling for the other variables.

The qualitative findings complemented the quantitative results by providing detailed explanations of the challenges experienced during ERP implementation. Interview participants identified inadequate ICT infrastructure, system integration difficulties, limited top management commitment, insufficient organizational readiness, employee resistance to change, inadequate ERP training, and limited digital skills as major barriers to successful ERP implementation.

Finally, the triangulation analysis demonstrated a high level of convergence between the quantitative and qualitative findings. Both datasets consistently identified technological, organizational, and human-related factors as key determinants of ERP adaptation and implementation. The qualitative findings provided contextual explanations for the statistical results, thereby strengthening the validity and credibility of the study.

5.3 Conclusion

Based on the findings of the study, it can be concluded that ERP adaptation and implementation in the Ethiopian construction industry are influenced by the combined effects of technological, organizational, and human-related factors.

Among these factors, Organizational Factors emerged as the most influential determinant of ERP implementation success. The study demonstrated that top management commitment, organizational readiness, effective communication, adequate resource allocation, and change management significantly enhance the successful adaptation and implementation of ERP systems. Organizations that possess these capabilities are more likely to implement ERP systems effectively and achieve their intended implementation objectives.

The study also found that Human-Related Factors significantly influence ERP implementation. Employee resistance to change, inadequate ERP knowledge, limited digital competence, and insufficient training negatively affect ERP adaptation and implementation. Therefore, continuous employee training, user involvement, and effective change management are essential for improving user acceptance and ensuring successful ERP implementation.

Although Technological Factors were negatively associated with ERP implementation, their effect was not statistically significant in the regression analysis. Nevertheless, both the quantitative and qualitative findings indicate that inadequate ICT infrastructure, system integration challenges, and technical limitations remain important barriers that organizations should address to facilitate successful ERP implementation.

The triangulation of quantitative and qualitative findings confirmed that successful ERP adaptation and implementation require the combined influence of organizational readiness, technological capability, and human resource preparedness. Therefore, construction companies should adopt a comprehensive approach that integrates strong leadership commitment, adequate technological infrastructure, employee capacity development, and effective change management to improve ERP implementation outcomes.

5.4 Recommendations

Based on the findings and conclusions of the study, the following recommendations are proposed to improve ERP adaptation and implementation in the Ethiopian construction industry:

5.4.1 Recommendations for Construction Firms

Construction companies should strengthen top management commitment throughout the ERP implementation process. Senior management should provide clear strategic direction, allocate adequate financial and human resources, and actively monitor ERP implementation activities to ensure successful system adoption.

Organizations should also enhance their organizational readiness by establishing effective project planning, communication, and change management practices. These measures will help reduce employee resistance and facilitate the smooth adoption of ERP systems across different organizational units.

Although technological factors were not statistically significant in the regression analysis, the qualitative findings revealed that inadequate ICT infrastructure, system integration challenges, and technical support limitations continue to affect ERP implementation. Therefore, construction companies should invest in improving ICT infrastructure, strengthening system integration capabilities, and providing reliable technical support to ensure effective ERP implementation.

Construction firms should also provide continuous ERP training and capacity-building programs to improve employees' digital competence, ERP knowledge, and confidence in using the system. Regular training and user support can reduce resistance to change and increase user acceptance of ERP systems.

5.4.2 Recommendations for Employees and ERP Users

Employees should actively participate in ERP training programs and continuously develop their digital skills to improve their ability to use ERP systems effectively. Increasing user competence will enhance system utilization and reduce implementation challenges.

ERP users should also participate actively during system implementation by providing feedback and working collaboratively with management, ERP vendors, and technical support teams. Such

participation can improve system customization, increase user acceptance, and contribute to successful ERP adaptation and implementation.

5.4.3 Recommendations for ERP Vendors

ERP vendors should provide continuous technical support, user training, and system maintenance throughout the implementation process. They should also customize ERP solutions to meet the operational requirements of construction companies while minimizing unnecessary system complexity. Furthermore, vendors should strengthen collaboration with client organizations to ensure timely problem resolution and successful system integration.

5.4.4 Recommendations for Policy Makers and Industry Stakeholders

Government institutions and industry stakeholders should promote digital transformation within the construction sector by improving national ICT infrastructure and encouraging the adoption of modern information systems. Policies that support digital innovation, workforce capacity development, and technology investment should be strengthened to facilitate ERP implementation across construction organizations.

Professional associations, universities, and training institutions should also collaborate with construction companies to provide ERP-related training and professional development programs that improve digital skills and organizational readiness.

5.5 Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. First, the study was conducted using a relatively small sample of construction companies in Ethiopia, which may limit the generalizability of the findings to other industries or countries.

Second, the study relied primarily on self-reported data collected through questionnaires and semi-structured interviews. As a result, the responses may have been influenced by the participants' personal perceptions and experiences.

Third, the study employed a cross-sectional research design, where data were collected at a single point in time. Consequently, the study could not assess changes in ERP adaptation and implementation over an extended period.

Finally, the study focused only on technological, organizational, and human-related factors affecting ERP adaptation and implementation. Other potentially important factors were beyond the scope of this research.

5.6 Suggestions for Future Research

Future studies should examine ERP adaptation and implementation in other industries within Ethiopia to enable comparisons across different sectors and improve the generalizability of the findings.

Researchers are also encouraged to conduct longitudinal studies to examine how ERP adaptation and implementation evolve over time and to assess the long-term sustainability of ERP systems within organizations.

Future research may investigate additional factors influencing ERP adaptation and implementation, such as organizational culture, environmental factors, government policies, vendor support, technological innovation capability, cybersecurity, and digital transformation readiness.

Finally, future researchers may employ larger sample sizes and include organizations from different regions of Ethiopia to provide a broader understanding of ERP implementation challenges and success factors.

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Appendix

Part I. Quantitative Data Collection Questionnaire

Questionary

Introduction

I am a graduate student in the department of Economics at Addis Ababa University College of Business and Economics. Currently, I am undertaking research entitled "*Challenges Affecting the Adaptation and Implementation of ERP Systems in the Ethiopian Construction Industry*". The main purpose of this questionnaire is to gather information about the specific factors that are currently affecting the ERP adoption and implementation in construction companies operating in Ethiopia and also the outcome of this study will be used for academic purposes only. Therefore, your genuine response to the questions is vital for the quality and successful completion of the study. The accuracy of the information you provide highly determines the reliability of the study.

Thank you in advance for your unreserved cooperation!!!

Section A: Demographic Information

1. Gender

☐ Male

☐ Female

2. Age

☐ 20 -30

☐ 31- 40

☐ 41- 50

☐ 50+

3. Education Level

☐ Diploma

☐ Bachelor's Degree

☐ Master's Degree

☐ PhD

4. Position

☐ Senior Manager

☐ Project Manager

☐ IT Staff

☐ ERP User

5. Years of Experience

☐ Less than 2 years

☐ 2-5 years

☐ 6-10 years

☐ 10 years and above

6. ERP Experience

☐ Less than 1 year

☐ 1-3 years

☐ 4-6 years

☐ 6 years and above

Scale for Sections B – F

(1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree)

Section B - Technological Factors

Statement	1	2	3	4	5
The ERP system is complex to use					
The ERP system is compatible with our business processes					
The organization has adequate ICT infrastructure					
Integration with other systems is difficult					
ERP customization is challenging					
System errors frequently occur					
Data migration to ERP was difficult					

Section C: Organizational Factors

Statement	1	2	3	4	5
Top management supports ERP implementation					
Adequate financial resources are allocated					
Business processes are well defined					
The organization is ready for digital transformation					
Change management practices are effective					

Communication during ERP implementation is clear					
Organizational culture supports ERP adoption					

Section D: Human-Related Factors

Statement	**1**	**2**	**3**	**4**	**5**
Employees have sufficient ERP knowledge					
Adequate training is provided					
Users are comfortable using ERP					
There is resistance to ERP among employees					
Employees have good IT skills					
Training programs are effective					
Users are motivated to use ERP					

Section E: ERP Adaptation and Implementation

Statement	**1**	**2**	**3**	**4**	**5**
ERP has been successfully implemented in our organization					
ERP is effectively integrated into daily organizational activities					
Employees regularly use ERP in their work					
ERP implementation objectives have been achieved					

ERP processes are well integrated into organizational operations					
ERP is widely adopted across the organization.					
ERP implementation is successful					

Section F: Open - Ended Questions

What challenges did you face during ERP implementation?

_____

What solutions do you recommend?

_____

Part II. Qualitative Data Collection

INTERVIEW QUESTIONS

Semi-Structured Interview Questions

The following interview questions were prepared to collect qualitative data regarding the factors affecting ERP adaptation and implementation in the Ethiopian construction industry.

Section A: Technological Factors

1. What technological challenges did your organization encounter during ERP adaptation and implementation?
2. How adequate are your organization's ICT infrastructure, system integration capabilities, and technical support for ERP implementation?

Section B: Organizational Factors

3. How did top management commitment influence ERP adaptation and implementation?
4. What organizational factors (such as resource availability, communication, project management, and organizational culture) affected ERP implementation?

Section C: Human-Related Factors

5. How did employee resistance influence ERP adaptation and implementation?
6. How effective were employee training programs and digital skills in supporting ERP implementation?

Section D: General Questions

7. Among the technological, organizational, and human-related factors, which had the greatest influence on ERP adaptation and implementation in your organization? Why?
8. What recommendations would you provide to improve the technological, organizational, and human-related aspects of ERP adaptation and implementation in Ethiopian construction companies?

Note to Participants

The information gathered from this interview are only for academic use. All answers will be kept private and will only be used for this research study.