OPTIMIZING BUSINESS POTENTIAL: A FRAMEWORK FOR THE IMPLEMENTATION OF CLOUD COMPUTING BY SMES IN THE BOLGATANGA MUNICIPALITY,GHANA

ABSTRACT

Cloud computing has significantly impacted businesses across different scales, presenting advantages that can be harnessed by SMEs in Bolgatanga. However, the effective adoption of cloud services requires a well-defined strategy. SMEs in the Bolgatanga Municipality face challenges in implementing cloud computing due to limited knowledge of its applicability, a lack of expertise, and concerns about perceived high costs, among other factors. It was therefore necessary to develop a framework that can be utilized my SMES in Bolgatanga to implement cloud solutions. The design science research methodology was employed wherean extensive evaluation of existingcloud frameworks was performed. The findings suggest that although current cloud transition models have potential value, their complexity and lack of context applicability make them less suitable. The application of the design science research methodology paved way for the development of a practical framework for successful cloud computing implementation by SMEs in Bolgatanga, Ghana. The newly developed framework would enable SMEs to embrace the benefits of the emerging cloud computing era, reducing costs, and gaining a larger market share.Beyond the immediate benefits, leveraging cloud computing will promote collaboration, agile decision-making, and innovation. Cloud solutions provide scalability and accessibility, allowing SMEs to adapt quickly to market changes, improve customer experiences, and make significant progress in their industries. Implementing cloud computing strategically by SMES in Bolgatanga is therefore not just a technological upgrade but a crucial step towards unlocking substantial business advancements for SMEs.

Keywords: Technology-Organization-Environment (TOE), Cloud Computing, Bolgatanga, Framework

1.INTRODUCTION

Cloud Computing has seen a meteoric rise in the domain of IT in past years. Although the term "Cloud Computing" has become popular, the concept of multiple users sharing computer resources is nothing new. According to [1], the numerous advantages of cloud-based solutions for businesses, indicates the significance of cloud determinants in cloud computing. According to [2], Cloud Computing has the potential to influence a wide range of social and economic activities. Cloud Computing has proven to be advantageous for SMEs. However, despite the numerous benefits associated with cloud technology, [3], highlights that SMEs in developing countries have yet to fully realize the potential of Cloud Computing. In comparison to research conducted in other jurisdictions, there is still limited research into cloud computing, particularly in Africa. [4], affirmed, the rational approach of Cloud Computing and recommended that developing countries like Ghana ought to be excited about the adoption and implementation of Cloud Computing. The critical problem conferred for the developing countries is essential infrastructure for implementation.

The low uptake of cloud services by SMEs is linked to the lack of industry-specific implementation guidelines, as emphasized by [5]. [6] further support this, highlighting the absence of well-defined standards and essential knowledge as significant obstacles for SMEs implementing cloud technologies. In conclusion, while there are frameworks available for cloud computing adoption, it is crucial to consider their limitations and the lack of empirical evidence supporting their effectiveness. This has become incumbent for experts in the domain of information technology to develop framework that can improve SMEs' business operations and competitiveness. The rest of the paper is organized as follows: literature review is presented in section 2, methodology in section 3, Results and findings in section 4, and conclusions, recommendations, and suggestions for future research in section 5

2. LITERATURE REVIEW

2.1The theory of TOE in cloud computing

Cloud computing has become a prominent and influential trend in the modern computing industry. By making computing resources available on-demand over the Internet, cloud computing offers

significant benefits and potential impacts in many areas of economic and social activity around the world. Its inherent properties, such as flexibility and extensibility, have the potential to bring about significant changes in various fields [1].[7], employed the TOE framework to demonstrate that technology adoption issues have increased due to rapid technological progress across all fields. Organizations and governments alike have invested heavily in new technologies that promise to enhance their users' lives. A TOE framework was employed to test a query that examined electronic commerce factors in nine hundred and twenty-six mid-to-small-scale companies in Vietnam [8]. Mobile corporations have been conducting research through the Technology, Organization, and Environment combination. This framework can also be utilized for analyzing hierarchical dynamics that encourage cloud computing within companies. [9], conducted a study that investigated the adoption of cloud computing within manufacturing and services firms. The researchers utilized the Technology-Organization-Environment (TOE) framework to examine the factors influencing the adoption of cloud computing. The study revealed that several variables, including complexity, relative advantage, technological readiness, firm size, and top management support, exerted significant effects on the decision to adopt cloud computing [10], reported that five factors were most influential when deciding whether cloud computing technology would be adopted: security, cost, perceived technical competence, support from top managers, complexity, and government support. These included security, cost-effectiveness, and perceived technical competence.

[11],utilized the TOE framework to conduct semi-structured interviews with small and medium enterprises (SMEs), service providers, and other organizations. The primary factors influencing SME adoption of cloud-based services were compatibility, relative advantage, firm size, uncertainty, geo-restrictions, and trial ability. To build a thorough and impactful framework, this study plans to leverage the well-established Toe framework, known for its effectiveness in diverse situations. The goal is to develop a practical framework applicable not only to small and medium-sized enterprises (SMEs) in Bolgatanga but also beyond. By tapping into the capabilities of the Toe framework, this study aims to present a straightforward and implementable framework that can

significantly aid SMEs. The objective is to empower these businesses with the essential tools and strategies needed to succeed in their specific industries.

2.2ANALYSIS OF EXISTING FRAMEWORKS FOR CLOUD IMPLEMENTATION

[12], developed a conceptual framework for implementing and managing cloud computing environments. The conceptual framework presented by [12], provided valuable insights into how organizations can effectively manage their cloud based systems however, the framework did not highlight the need for a more inclusive approach to cater to the needs of SMEs as the primary focus of the framework is directed towards large organizations, also the framework lack the provision of practical guidance for implementation and management, and the conduct of validation studies to ensure the framework's effectiveness. It falls short in providing explicit instructions, best practices, or specific tools that can be readily applied in practice.

[13], introduced a stepwise framework that addresses common challenges hindering the cloud industry and preventing small and medium-sized enterprises (SMEs) from adopting cloud computing. it Provides actionable recommendations to help small businesses successfully adopt the cloud. Additionally, the framework aims to streamline the cloud adoption process for SMEs by removing ambiguity and clarifying fundamental aspects related to organizational and cloud adoption journeys. However, existing frameworks lack validation to determine how well they can support SMEs cloud adoption. The level of usefulness and effectiveness of this framework in facilitating cloud adoption among SMEs remains unknown due to the absence of validation and verification processes. The framework does not also provide any practical tool to guide the cloud implementation.[14], initiated “A Framework for Strategic Cloud Migration” for the purpose of filling a gap of capturing organizational, technical and economic feasibility for migrating into Cloud and to propose an appropriate strategic approach for Cloud migration.

According to [14], the three feasibility factors lead a given organization to realize whether the organization should move to Cloud or not. In a case where the feasibility support movement to cloud computing to host their IT service, an appropriate approach is then explored by way of migration approach and the actual migration to the Cloud takes place. The assertion of [14], that in

a case where organizational feasibility assessment of an entity towards cloud implementation produces negative outcome such entity cannot proceed further towards discovering how possibly they can implement cloud.

3. METHODOLOGY

The Design Science Research Methodology (DSRM) was employed for this study, the DSRM is a kind of research methodology which aims at developing and evaluating innovative artefacts, in the form of models, frameworks, designs, or prototypes, in order to solve complex and practical problems. According to[15], the process of design science research consists of six steps with four possible research entry points.These include the Problem identification and motivation, Objective and Scope Definition, Design and development, Demonstration, Evaluation, and Communication with the entry points as Problem Centered Initiation, Objective Centered Solution, Design and Development Centered Initiation and Client/ Context Initiation as shown inFigure1

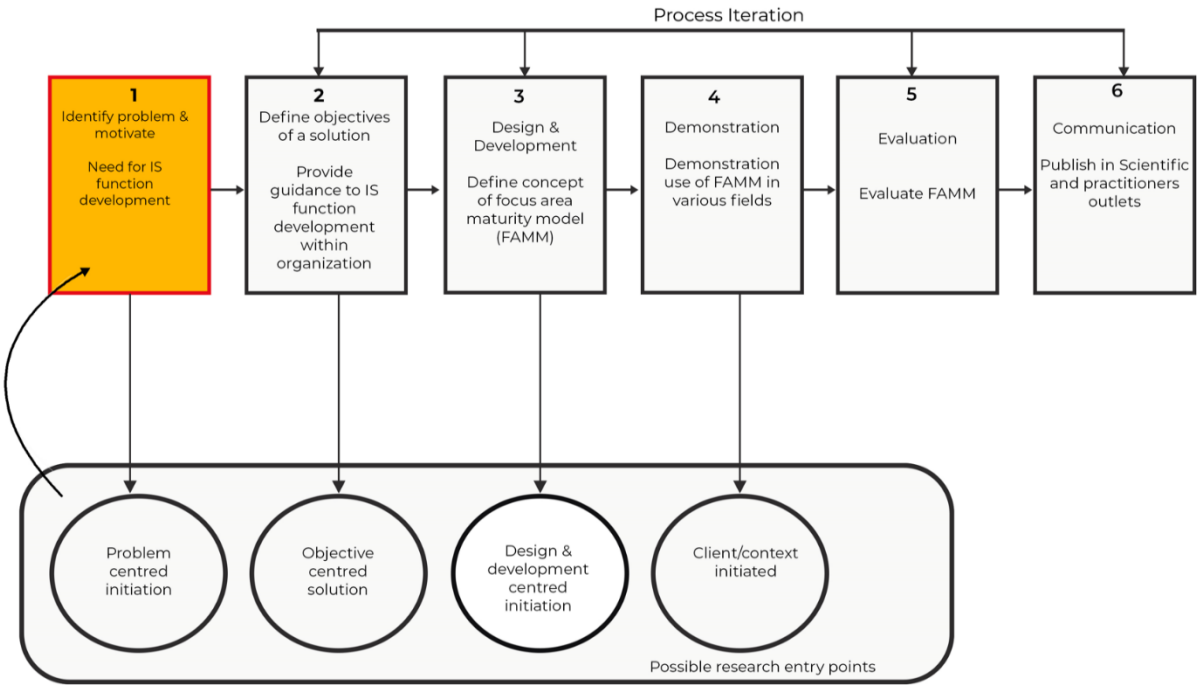

Figure 1 DSRM Process Model (Peffers et al., 2008)

3.1 APPLICATION OF DSRM AND TOE

The DSRM was adopted to create a practical framework for facilitating the successful implementation of cloud computing by SMEs in the Bolgatanga municipality, Ghana with adherence to the DRSM process thus the ***Problem identification and motivation, Objective and Scope Definition, Design and development.*** This study builds upon a foundation of previous empirical work that investigated factors influencing cloud computing implementation by SMEs[16]. The Technology,

organization, and Environment (TOE) framework served as the conceptual lens through which we examined the intricate dynamics of cloud implementation. The TOE framework yielded crucial insights into the determinants of cloud computing implementation in the context of SMEs. Within the Technology dimension, factors such as relative advantage emerged as pivotal. Top Management support was a significant aspect identified in the Organization dimension. Competitive pressure was key factor within the Environment dimension. This discovery is substantiated by previous studies [17,18], which also highlight relative advantage as a significant factor influencing the implementation of cloud technology within the SME sector. Building upon the findings of the TOE framework, we integrated these insights into the design of our Cloud Computing Implementation framework. The TOE framework provided a nuanced understanding of the specific challenges and opportunities associated with cloud implementation in SMEs, shaping our approach to technology design, organizational considerations, and the broader environmental context.

4. RESULTS AND DISCUSSION

The primary aim of the study was to develop a framework that facilitates the successful implementation of cloud computing by SMEs in Bolgatanga. The resulting framework is illustrated in Figure2 below.

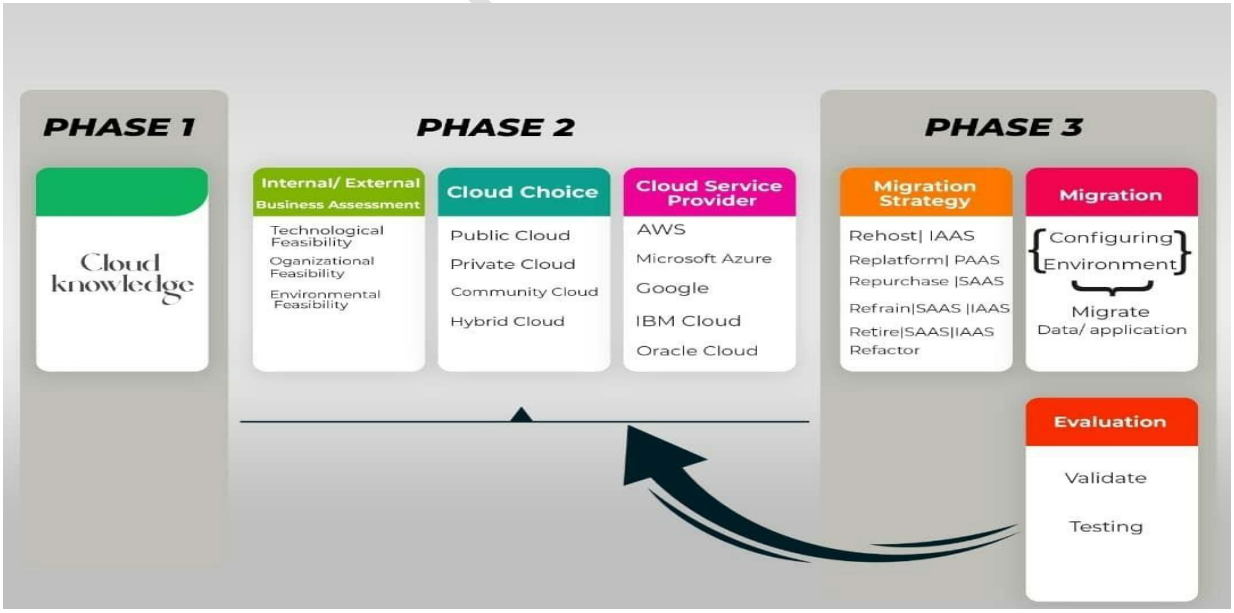

Figure 2: Cloud Implementation Framework for SMEs (CIFS)

4.1 Analysis of the Proposed Cloud Implementation Framework for SMES

Figure2 presentsthe framework which consists of three distinct phases. Phase One focuses on the cloud knowledge requirement for SMEs looking to implement cloud computing. It emphasizes the importance of SMEs acquiring the necessary knowledge about cloud computing to leverage its benefits effectively. In this phase, training sessions are required to bridge the knowledge gap SMEs have towards cloud computing solutions. Moving on to Phase Two, it highlights key components such as Business Assessment, Cloud Choice, and Cloud Service Provider. The Business Assessment component enables SMEs to conduct feasibility studies on their business, including technology feasibility, organizational feasibility, and environmental feasibility, to determine their readiness for cloud implementation. This assessment or feasibility zeros to the internal and external business environment.Once the assessment is complete, SMEs can choose the most suitable cloud deployment model—Public Cloud, Private Cloud, Community Cloud, or Hybrid Cloud— based on their requirements and capacity. The final component in this phase is selecting the cloud service provider. SMEs need to make an informed choice based on the appealing services provided by different providers, as well as cost considerations.

Phase Three focuses on the Migration Strategy, Migration, and Evaluation. The Migration Strategy offers SMEs various migration options based on their current IT infrastructure or resources. These options include Rehost, Refactor, Repurchase, Retire, Refrain, and Replatform, each with its own benefits and considerations. SMEs should carefully evaluate their specific requirements and goals before deciding on the most suitable approach for migrating their applications.

The migration process itself involves several steps. First, configuring the environment involves setting up the necessary infrastructure, resources, and settings to support the migrated application or data. This includes provisioning servers, allocating storage, configuring networking, setting up security measures, and optimizing performance settings. The next step is migrating the data accurately, securely, and efficiently from the source to the target destination.

Once the migration is complete, the Validation phase aims to confirm the reliability, security, and capability of the cloud-based solution to deliver the desired outcomes. This involves activities such as functional

testing, security audits, performance benchmarking, and compliance assessments. Thorough testing, including functional testing, performance testing, security testing, integration testing, and user acceptance testing, is a crucial aspect of the Framework. It helps identify and rectify any defects or shortcomings before deploying the cloud solution, reducing risks and improving overall quality and user satisfaction.

In conclusion, this three-phase the framework provides a structured approach for SMEs to successfully implement cloud computing. By acquiring cloud knowledge, conducting business assessments, making informed cloud and service provider choices, and following a well-defined migration strategy with thorough validation and testing, SMEs can maximize the benefits of cloud computing while minimizing risks and ensuring the reliability of their cloud solutions.

Generally, the framework takes into account the unique technological landscape in the Bolgatanga municipality, ensuring that technology recommendations are in line with the available resources. Recognizing the varying technology requirements among SMEs, the framework suggests scalable solutions to accommodate diverse organizational needs. The approach promotes organizational adaptability, enabling SMEs in Bolgatanga to seamlessly integrate cloud solutions without disrupting existing structures. The framework facilitates capacity building within organizations, addressing skill and knowledge gaps identified through empirical research. The framework supports SMEs in Bolgatanga by providing guidance on navigating and complying with local regulations that impact the adoption of cloud computing.

5.CONCLUSION AND RECOMMENDATIONS

In conclusion, the utilization of the design science research method guided by the TOE framework and enhanced by empirical findings, establishes the groundwork for a strong Cloud Computing Implementation framework specifically designed to meet the distinct requirements of small and medium-sized enterprises (SMEs) in the Bolgatanga municipality. By incorporating insights from prior research, we guarantee that our framework is not only theoretically robust but also highly applicable in practice, providing concrete solutions for SMEs as they navigate the intricate landscape of cloud computing implementation. The development of this practical framework has been a significant outcome of this

research. It serves as a valuable tool for SMEs, offering them a structured approach to navigate the complexities of cloud implementation. and maximize the benefits derived from this transformative technology.

6. FUTURE WORK

In order to enhance the effectiveness and resilience of the established framework, future research initiatives should focus on evaluating its performance and incorporating necessary improvements. This proactive approach is crucial for optimizing the framework to its fullest potential. Given the ever-changing nature of the technological landscape, it is essential to explore the digitalization of the framework. This strategic effort aims to enhance its adaptability to current technological advancements, enabling seamless integration into the digital ecosystems of small and medium-sized enterprises (SMEs). In addition, the evaluation process should include the execution of comprehensive case studies. These studies will provide detailed insights into real-world applications of the framework, offering a nuanced understanding of its practical effectiveness across various contexts.

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