Hungarian University of Agriculture and Life Sciences

Doctoral School of Economic and Regional Sciences

INVESTIGATION OF KEY FACTORS AFFECTING CLOUD COMPUTING ADOPTION IN SYRIA

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1 INTRODUCTION

In the face of intense market competition and a significantly changing business environment, firms have increasingly been compelled to adopt advanced information technologies (IT) to improve their business operations (Pan and Jang, 2008; Sultan, 2010). As of late, cloud computing has emerged as a leading paradigm in information technology as its utilization is perceived as a significant area for IT innovation and development (Armbrust *et al.*, 2010; Ercan, 2010; Goscinski and Brock, 2010). Cloud computing has become central to many domains of IT, including applications, operating systems, enterprise software, and other technological solutions for firms (Armbrust *et al.*, 2010).

Gartner (Gartner, 2009) defined cloud computing as a style of computing where highly scalable IT capabilities are provided as a service to external users via web technologies. Erdogmus (Erdogmus, 2009) described cloud computing as a pool of highly scalable, virtualized infrastructure suitable for hosting end-user applications that are charged by utilization. (Sultan, 2010) characterized IT capacities that are delivered and consumed in real time over the Internet. Many computing models have aimed to deliver a utility computing vision, and these incorporate cluster computing, grid computing, and, more recently, cloud computing (Buyya *et al.*, 2009; Armbrust *et al.*, 2010).

Cloud computing services, such as enterprise resource planning (ERP), enable users to communicate simultaneously with numerous servers and to exchange data among them (Hayes, 2008). Additionally, network technology and telecommunication have been advancing quickly; they include 3G, FTTH, and WiMAX. Cloud computing services provide users with robust technical support, which can generate significant user demand (Buyya *et al.*, 2009; Pyke, 2009). In this manner, cloud computing offers versatility and adaptability to meet on-demand market needs.

Companies are seeking to align their business processes and their information systems in order to meet their needs with trading partners (Ercan, 2010). In high-tech enterprises, pervasive data transformation practices have become essential for improving operational effectiveness. Developing cloud computing capabilities is crucial for gaining competitive advantage, as the way industries engage with clients is rapidly evolving. It is also becoming an increasingly necessary component of organizations' business strategies (Pyke, 2009). The diffusion of cloud computing has become a major area of research since it empowers firms to execute information exchanges along the value chain (e.g., distribution, finance, manufacturing, sales, customer service, data sharing, collaboration with partners) (Gartner, 2009; Pyke, 2009). Cloud computing will be adopted by organizations that are likely to utilize a hybrid approach involving on-premises, public, and private cloud services where appropriate (Goscinski and Brock, 2010). The concept of private cloud computing involves organizations deploying key enabling technologies (such as virtualization and multi-tenant applications) to create their own private cloud environment. At that point, individual business units pay the IT department for using standardized services under agreed-upon chargeback mechanisms. For some organizations, this approach is less disruptive than a full migration to the Public Cloud. This approach can make it easier to hand over individual services to third-party providers in the future (Ercan, 2010).

1.1 Research Motivation

The information technology (IT) sector is characterized by rapid evolution and continuous innovation, driven by the global demand for more efficient, scalable, and cost-effective solutions. As organizations strive to improve their operational efficiency and service delivery, the adoption of emerging technologies has become a key strategy in achieving these goals. In recent years, organizations have increasingly turned to cloud technologies to modernize their IT infrastructure. Cloud computing allows users to access computing resources such as servers, storage, and software over the internet, eliminating the need for extensive physical infrastructure and enabling real-time, on-demand service provision.

Cloud computing presents numerous practical advantages for organizations that make it particularly valuable in today’s digitally driven environment. These include cost reduction, as it removes the capital expenditure associated with traditional IT infrastructure; scalability, allowing businesses to increase or decrease resources based on demand; flexibility and mobility, enabling users to access systems from any location; faster deployment, reducing time-to-market for services; and automatic updates and maintenance, lowering the burden on internal IT teams. These features collectively contribute to enhanced agility and competitiveness, particularly for small and medium-sized enterprises (SMEs) and startups that may lack the resources for large-scale IT operations. As organizations around the world accelerate their digital transformation efforts, cloud computing continues to play a central role in reshaping business models, enabling innovation, and supporting remote work environments.

In the context of Syria, the adoption of cloud computing is becoming not only beneficial but increasingly necessary. Following years of conflict, Syria is entering a phase of economic rebuilding and institutional restructuring. This period is expected to stimulate a resurgence of business activities across various sectors, particularly within the technology and services industries. As companies seek to modernize operations and meet new demands, cloud-based platforms present a strategic opportunity to overcome traditional limitations in infrastructure, reduce costs, and improve service delivery. Furthermore, cloud solutions offer the potential to support remote collaboration, e-commerce, digital education, and e-government services, all of which are vital for sustainable growth in the post-conflict era.

Nevertheless, the transition toward cloud adoption in Syria is not without challenges. While the benefits of cloud computing are well-documented globally, local conditions pose specific barriers that need to be carefully considered. Decision-makers in Syrian organizations often cite concerns about data security, privacy, regulatory uncertainty, limited internet infrastructure, and lack of technical expertise. These issues can lead to hesitation or delay in adopting cloud technologies, especially in environments where trust in digital systems is not yet fully established.

Moreover, there is a notable absence of academic and empirical research focused on cloud computing in Syria. Most existing studies on cloud adoption are conducted in developed countries or relatively stable emerging markets, with limited applicability to Syria's unique political, economic, and technological context. As a result, there is a significant knowledge gap in understanding the specific needs, perceptions, and decision-making processes of Syrian businesses regarding cloud computing.

This research is therefore driven by the urgent need to bridge this knowledge gap by exploring the critical factors influencing cloud adoption in Syria. By generating context-specific insights, the study aims to support informed decision-making, policy development, and strategic planning among Syrian organizations, IT professionals, and service providers. Ultimately, the findings of this research will contribute to a tailored framework for cloud computing adoption that aligns with Syria's current realities and future aspirations, helping to pave the way for a more resilient, digitally empowered economy.

1.2 Research Problem

Although cloud computing has achieved widespread global adoption and is now considered a cornerstone of modern digital infrastructure, its implementation within Syria remains both limited and poorly understood. In many countries, cloud technologies have accelerated innovation, streamlined operations, and supported new digital business models. However, this global momentum has not been equally reflected in Syria, where the uptake of cloud computing remains sporadic and hindered by a range of contextual challenges. Existing academic literature on cloud computing adoption primarily focuses on developed economies or offers generalized findings from broader developing regions. These studies often overlook the complex and unique socio-political, economic, and technological landscape that characterizes countries like Syria.

Syria is currently undergoing a significant phase of economic and institutional transformation, which introduces new possibilities alongside notable obstacles. As businesses attempt to modernize and align with global trends, the adoption of cloud-based technologies could play a critical role in enabling scalable growth, enhancing service delivery, and fostering innovation. However, the Syrian business ecosystem still faces considerable barriers. Among the most prominent are limited internet and ICT infrastructure, ongoing economic instability, sanctions and trade restrictions, and gaps in digital literacy and workforce training. These issues not only complicate technology adoption but also raise questions about long-term sustainability, data sovereignty, and security.

Such barriers may significantly influence the behavioural intention, perceived usefulness, and organizational readiness to adopt cloud computing technologies in Syria. For instance, organizations may hesitate to transition to cloud platforms due to fears of data breaches, dependency on foreign service providers, or lack of local support expertise. Additionally, regulatory ambiguity concerning data protection and IT governance further complicates the decision-making process for both private enterprises and public institutions.

Despite these pressing concerns, there is a notable absence of localized, empirical research that specifically examines the factors impacting cloud computing adoption in Syria. Most available studies fail to capture the nuanced interplay between cultural attitudes, infrastructural limitations, political constraints, and business priorities that influence technology adoption in fragile or post-conflict settings. Without robust data and analysis grounded in the Syrian context, policymakers, IT leaders, and business owners lack the insights necessary to develop effective strategies for cloud integration.

This research seeks to address this critical gap in knowledge by systematically exploring and analyzing the key factors that either facilitate or hinder the adoption of cloud computing within Syrian organizations. Through a comprehensive investigation grounded in established theoretical frameworks, the study aims to generate context-specific findings that can inform practical adoption models, policy recommendations, and capacity-building initiatives.

Ultimately, this research will contribute to building a foundation for Syria's digital transformation by supporting more informed, strategic, and sustainable adoption of cloud-based technologies across sectors.

1.3 Research Objectives

This study aims to investigate the key factors influencing the adoption of cloud computing technologies within Syrian business organizations and to evaluate how these factors shape organizational decision-making. The specific objectives of the research are as follows:

1. To examine the current extent of cloud computing adoption among organizations in Syria.
2. To identify the main factors that influence cloud adoption decisions in the Syrian context.
3. To assess the levels of awareness, readiness, and willingness among Syrian firms to implement cloud-based technologies.
4. To evaluate the perceived benefits and concerns, such as security, cost, and scalability, from the perspective of organizational decision-makers.

Although extensive research exists on cloud computing adoption in other regions, there remains a clear gap in the literature concerning the specific conditions affecting adoption in Syria. In particular, little is known about how factors such as security concerns, regulatory frameworks, perceived usefulness, and system functionality impact decision-making in this context. This study seeks to address that gap by providing context-specific insights that can inform future research, policy, and practice.

2 LITERATURE REVIEW

2.1 Cloud Computing Definition

According to the U.S. National Institute of Standards and Technology (NIST), cloud computing is defined as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., servers, networks, storage, services, and applications) that can be quickly provisioned and delivered with minimum management effort or service provider cooperation (Mell and Grance, 2009)

Cloud computing is described by (Rader, 2012) as the execution of business operations using off-premises, shared computing infrastructure. This concept has emerged as a result of advancements in technology, including virtualization, hardware improvements, service delivery models, and distributed computing over the internet.

Cloud computing reduces capital investment by shifting infrastructure costs to subscription-based models, making it attractive to resource-constrained organizations. However, numerous scholars have highlighted privacy and security as the two most critical challenges associated with its adoption (Jadeja and Modi, 2012; Kshetri, 2013; Liu *et al.*, 2013).

Botta (Botta *et al.*, 2016) stated that cloud-based solutions enable both users and businesses to access vast computing power at a significantly lower cost. This is achieved by shifting various Information Technology (IT) functions, including business applications, services, and data storage, to the cloud, allowing companies to minimize expenses associated with technology implementation and usage.

2.2 Cloud Computing Characteristics

Cloud Computing has five characteristics as shown in Figure 1:
The defining characteristics of cloud computing highlight the key developments that set it apart from traditional IT systems. According to (Mell and Grance, 2011), cloud computing is structured around five essential attributes that enable its dynamic scalability, cost-efficiency, and ubiquitous accessibility. These characteristics serve as the foundation for delivering cloud services in a flexible, scalable, and measured manner (Buyya *et al.*, 2009; Zhang, Cheng and Boutaba, 2010)

. Understanding these core features is critical for analyzing how cloud computing transforms organizational practices, supports digital innovation, and addresses technological demands across diverse sectors (Marston *et al.*, 2011). These characteristics are elaborated in the following sections.

- On-demand self-service:

It is one of the fundamental characteristics that defines cloud computing and differentiates it from traditional IT infrastructure models. This means users whether individuals or organizations can independently access computing resources... without needing to contact the service provider directly (Mell and Grance, 2011).
This self-service model enables users to access and control IT resources through web-based portals or APIs, enabling a rapid and flexible response to changing demands (Shoaib and Das, 2014). For instance, a developer may instantly deploy a virtual machine or increase storage capacity through a cloud dashboard, without needing approval or configuration from an IT administrator. This level of control helps organizations respond quickly to changing needs, avoid delays in launching new services, and use their computing resources more efficiently (Buyya, Garg and Calheiros, 2011).

On-demand self-service also supports cost-efficiency, as users can scale usage up or down based on actual demand, avoiding the expense of maintaining idle infrastructure. It shifts the paradigm from capital expenditure (CapEx) to operational expenditure (OpEx), making high-performance computing accessible without large capital investment (Armbrust *et al.*, 2010; Zhang, Cheng and Boutaba, 2010).

Furthermore, this feature enhances time-to-market for digital services, as it removes dependencies on manual provisioning or internal IT bottlenecks. Organizations can thus focus on innovation and responsiveness, which is especially beneficial in dynamic sectors such as software development, e-commerce, education, and healthcare (Segun-Filade *et al.*, 2024).

However, the effectiveness of on-demand self-service also depends on factors such as user training, intuitive interfaces, and transparent metering mechanisms, which ensure that users can manage resources confidently and efficiently(Buyya *et al.*, 2009).

- Broad network access:

This feature highlights how cloud services are made available over the internet the internet using standard protocols and platforms (Mell and Grance, 2011). This means that cloud resources (such as virtual machines, storage, or applications) can be accessed remotely from a wide range of devices, including desktops, laptops, smartphones, tablets, and thin clients, regardless of the user's physical location.

This characteristic plays a crucial role in providing widespread access to computing services, making cloud solutions inherently flexible and scalable. Through broad network access, cloud computing supports mobility, remote work, and real-time collaboration, which are especially valuable for geographically dispersed teams and organizations with dynamic work environments (Zhang, Cheng and Boutaba, 2010).

Moreover, broad network access ensures that services are platform-independent and interoperable, as they are delivered over commonly accepted networking standards such as HTTP, REST, and SOAP. This allows users to interact with cloud applications via web browsers or client apps without the need for complex installation processes or specialized hardware.

In academic research, broad network access is often discussed in relation to its role in enhancing availability and accessibility, especially in sectors like education (cloud-based learning platforms), healthcare (telemedicine), and government services (e-governance portals). It also facilitates elastic computing, as users can easily connect to cloud services on demand, further strengthening the utility and responsiveness of cloud environments (Buyya *et al.*, 2009; Marston *et al.*, 2011).

However, the effectiveness of broad network access is contingent on the quality and reliability of the network infrastructure. In developing or post-conflict regions like Syria, limitations in broadband penetration, inconsistent internet connectivity, and cybersecurity concerns can hinder the practical benefits of this characteristic. Therefore, while broad network access is a major advantage of cloud computing in theory, its full potential can only be realized in environments with robust and secure network infrastructures (Armbrust *et al.*, 2010).

- Resource pooling:

Cloud providers can use this approach to serve multiple clients by adjusting resources based on demand to serve multiple customers (tenants) using a multi-tenant model, where computing resources are dynamically assigned and reassigned according to user demand (Mell and Grance, 2011). In this model, physical and virtual resources such as storage, processing power, memory, and network bandwidth are centrally managed and abstracted from users through virtualization technologies. This abstraction enables the seamless sharing and allocation of resources across various clients without compromising performance or security.

The concept of resource pooling allows cloud providers to maximize resource utilization and efficiency, as the same infrastructure can support numerous users simultaneously. It also supports location independence, meaning customers generally do not have control over or knowledge of the exact physical location of the resources they are using. Instead, they can specify higher-level location constraints (e.g., data should remain within a particular country or region for regulatory compliance)(Chaturvedi and Rashid, 2017).

From an academic standpoint, resource pooling is often associated with economies of scale and cost-effectiveness, as it reduces the need for organizations to invest in dedicated infrastructure (Buyya *et al.*, 2009). It also enables elastic scalability, since pooled resources can be rapidly allocated or deallocated in response to workload fluctuations (Zhang, Cheng and Boutaba, 2010). These advantages make cloud computing useful for small organizations lacking dedicated IT infrastructure.

However, while resource pooling increases efficiency and accessibility, it also raises security and privacy concerns, particularly in multi-tenant environments where data from different organizations may reside on the same physical servers. Ensuring data isolation, secure access controls, and compliance with regulatory frameworks becomes essential for maintaining trust in shared cloud infrastructures (Subashini and Kavitha, 2011).

In regions like Syria, the benefits of resource pooling are especially significant. Given the limitations in local infrastructure and funding, pooled cloud resources offer a scalable and cost-effective way to meet growing IT demands (Farzali and Kanaan, 2012). At the same time, reliability, internet bandwidth, and trust in service providers remain potential barriers that must be addressed for successful cloud adoption

- Rapid elasticity:

This is a core characteristic of cloud computing that refers to the ability to quickly scale computing resources automatically in response to workload changes , in response to workload changes or user needs (Mell and Grance, 2011). This means that from the user’s perspective, available resources seem almost limitless and can be scaled up instantly when needed, which distinguishes cloud environments from traditional IT infrastructures, where capacity planning and hardware acquisition can be time-consuming and costly.

Rapid elasticity is widely seen as one of the most valuable features of cloud computing, This scalability supports consistent service delivery during peak demand periods (Zhang, Cheng and Boutaba, 2010). It supports use cases where demand can fluctuate significantly, such as e-commerce traffic spikes, data analytics workloads, or seasonal business cycles. For example, a company can increase server capacity during peak shopping seasons and automatically reduce it afterward, paying only for what was used an approach that promotes cost-efficiency and operational agility(Coutinho *et al.*, 2014).

From a technical perspective, rapid elasticity is enabled through virtualization technologies and orchestration tools, which allow for the dynamic allocation and deallocation of resources in real time. These processes are typically managed by cloud service providers and are abstracted from the end user, who interacts with a simplified interface or API (Armbrust *et al.*, 2010). Users can thus scale their applications seamlessly without worrying about the underlying hardware limitations.

Rapid elasticity is also central to the concept of cloud-native application development, where applications are designed to scale horizontally, adding more instances of a service rather than upgrading individual servers. This capability supports high availability, fault tolerance, and load balancing, all of which are crucial for delivering resilient services at scale (Blessing, 2025; Olusegun, Rank and Ade, 2025).

Despite its benefits, elasticity introduces challenges related to resource prediction, billing transparency, and system stability. Poorly designed auto-scaling mechanisms may lead to under-provisioning or over-provisioning, affecting performance or incurring unnecessary costs (Buyya *et al.*, 2009). Moreover, organizations must ensure that their applications and architectures are capable of adapting to elastic environments.

In the context of developing or post-conflict countries like Syria, rapid elasticity offers critical value. It allows institutions with limited resources to scale operations temporarily for specific projects or services without investing in permanent infrastructure. This is particularly advantageous for educational platforms, healthcare systems, or governmental services that need to respond to surges in user activity with limited IT budgets.

- Measured Service:

This key feature allows cloud providers to track, manage, and optimize how resources are used by leveraging a metering capability at some level of abstraction (e.g., storage, processing, bandwidth, or active user accounts) (Mell and Grance, 2011). This feature allows users to track usage clearly, which is why it underpins the popular pay-as-you-go pricing approach used in most cloud services.

Through measured service, cloud systems monitor usage in real time and provide detailed usage reports to customers. These reports help consumers understand how resources are being utilized, forecast costs, and optimize their consumption. From the provider’s perspective, measured service enables efficient resource allocation, billing automation, and quality of service (QoS) assurance, especially in multi-tenant environments (Buyya *et al.*, 2009).

In cloud computing, metering technologies are typically integrated into the service architecture to collect data about how much of a service each consumer is using. This model is especially relevant in Syria, where budget limitations make predictable billing models highly beneficial for public and private sector organizations (Zhang, Cheng and Boutaba, 2010). For example, Infrastructure-as-a-Service (IaaS) providers often charge based on virtual machine uptime, data storage volume, or bandwidth consumed, while Software-as-a-Service (SaaS) models may use subscription-based metering based on the number of active users or usage frequency.

Measured service enhances cost predictability and operational transparency, making cloud services especially attractive to small and medium enterprises (SMEs) and organizations operating under budget constraints. It also encourages efficient usage, since organizations are financially motivated to avoid overprovisioning or leaving unused resources running (Armbrust *et al.*, 2010).

However, the measured service model introduces challenges as well. Customers must be able to trust the accuracy and fairness of metering systems, and providers must ensure security, reliability, and consistency in measurement. Additionally, discrepancies between usage patterns and billing transparency can lead to customer dissatisfaction or disputes, particularly in complex environments involving microservices, autoscaling, or hybrid deployments (Marston *et al.*, 2011).

In the context of developing countries or resource-constrained settings like Syria, measured service provides a cost-effective pathway to cloud adoption. Organizations can begin with small-scale usage and scale up gradually based on actual need and affordability. This approach reduces the upfront investment risks commonly associated with traditional IT infrastructure and allows for greater flexibility in financial planning.

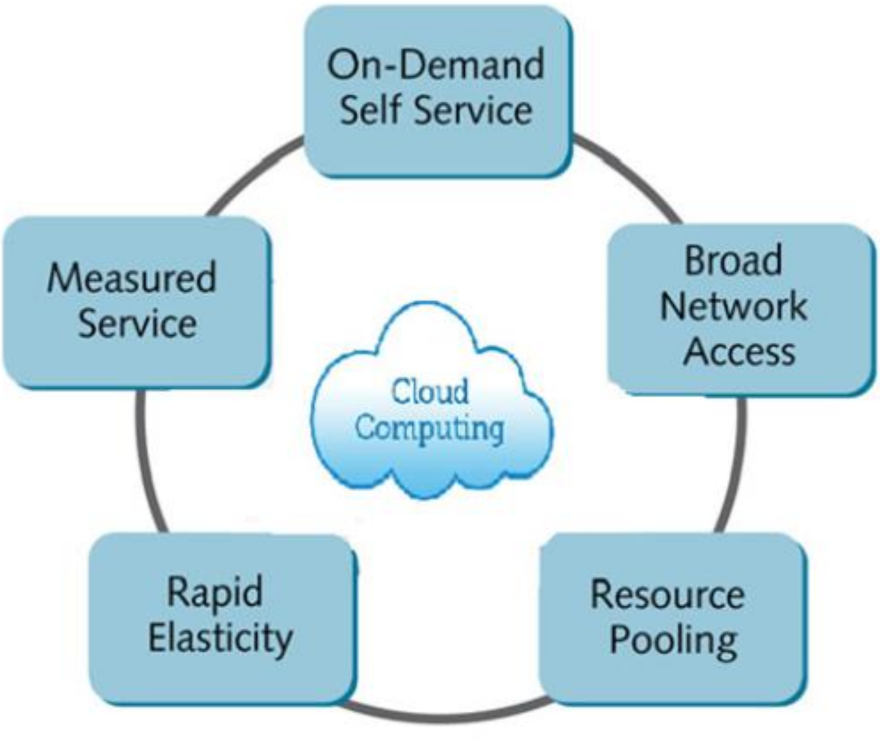

Figure 1: Essential Characteristics of Cloud Computing (Perera and Meedeniya, 2012)

2.3 Cloud Computing Service Models

Cloud computing is a modern service model built upon recent technological innovations. The primary service models include.

- Software as a Service (SaaS): is a software delivery paradigm where the software is hosted off-premise and delivered using the web. The method of payment follows a subscription model (MCSI, 2009). SaaS assists firms by allowing them to focus on core business functions rather than support services such as IT infrastructure management, software maintenance, and system updates, as a result, many firms adopting SaaS for business applications like sales force automation, finance, and internet business (Dubey and Wagle, 2007). In a Forrester survey, the sales-force automation application was the top-ranked application being utilized as SaaS (Godse and Mulik, 2009). Gartner (2022) projects SaaS to remain the largest cloud segment, reaching $208 billion in 2023 (Gartner, 2022).
  The hosting domain refers to the platform environment where cloud applications run, which users can access through various networks or devices (e.g., via a web browser, mobile device, etc.). SaaS users (cloud consumers) typically do not have control over the underlying cloud infrastructure. SaaS often employs a multi-tenancy architecture, meaning different customers' applications and data are organized in a single logical environment on the cloud provider's servers. This approach achieves economies of scale and optimizes aspects like security, speed, availability, maintenance, and disaster recovery. Examples of SaaS include SalesForce.com, Google Mail, Google Docs, and so forth. According to Flexera's 2021 report, 92% of enterprises use a multi-cloud strategy, combining SaaS, PaaS, and IaaS deployments (Flexera, 2021).

- Platform as a Service (PaaS): PaaS provides a comprehensive cloud-based development and deployment environment that supports the entire software development lifecycle, including design, development, testing, deployment, and maintenance of applications (Zhang, Cheng and Boutaba, 2010; Mell and Grance, 2011) Unlike SaaS, which delivers ready-to-use applications to end-users, PaaS is intended for developers and IT professionals, offering them the tools and infrastructure needed to build and manage custom applications on the cloud (Raines and Pizette, 2010).

  PaaS environments abstract the complexities of infrastructure management, such as servers, storage, and networking, allowing developers to focus solely on the application logic and functionality. These platforms typically include an integrated set of tools such as programming languages, application frameworks, databases, configuration management tools, version control systems, and testing services (Armbrust *et al.*, 2010).

As a result, PaaS accelerates application development, promotes collaboration among development teams, and reduces time-to-market.

One of the distinguishing features of PaaS is that it supports both completed and in-progress applications, making it ideal for agile and DevOps workflows, where continuous integration and continuous delivery (CI/CD) are central. This contrasts with SaaS, which provides fully developed, deployed, and managed applications with no access to the underlying development tools or codebase. In other words, SaaS is for consuming applications, whereas PaaS is for building them(Paraiso, Merle and Seinturier, 2014; Shahin *et al.*, 2018).

Examples of popular PaaS offerings include Google App Engine, Microsoft Azure App Services, Heroku, and Red Hat OpenShift. These platforms allow developers to deploy scalable web applications without managing the underlying hardware or software stack. Google App Engine, for instance, enables developers to deploy applications using languages like Python, Java, or Go, with automatic scaling, integrated data storage, and built-in monitoring. Statista (2024) reports that IaaS now represents over a quarter of the global cloud market, underscoring its critical role in modern cloud ecosystems (Statista Research Department, 2024).

PaaS has been studied for its ability to reduce operational costs, simplify resource provisioning, and support innovation, especially in small and medium-sized enterprises (SMEs) and startups that lack extensive IT infrastructure (Chappell, 2008; Buyya *et al.*, 2009). Furthermore, PaaS facilitates multi-tenant architectures and service reuse, which are crucial for building scalable and maintainable cloud-native applications.

However, PaaS is not without limitations. One concern is vendor lock-in, as applications developed on a specific PaaS platform may rely on proprietary services, making it difficult to migrate to another provider. Additionally, developers must rely on the platform's supported programming languages and tools, which may limit flexibility in some scenarios (Marinos and Briscoe, 2009).

- Infrastructure as a Service (IaaS): IaaS delivers virtualized computing infrastructure such as servers, storage, networking, and other essential IT resources over the internet on a pay-per-use basis (Mell and Grance, 2011). This model enables cloud consumers to directly access and manage IT resources without the need to invest in or maintain physical hardware.

IaaS is particularly appealing to developers, system administrators, and businesses that require high levels of control and customization over their computing environments. Users can install and manage operating systems, deploy applications, and configure settings to match their specific needs. Unlike PaaS or SaaS, where certain layers of the stack are abstracted or managed by the provider, IaaS provides the lowest-level access to resources while still abstracting the physical infrastructure (Dass, Parida and Moharana, 2023).

A critical enabler of IaaS is virtualization, which allows physical hardware to be logically partitioned into multiple independent virtual machines (VMs). Each VM operates as a self-contained computing environment, isolated from both the physical host and other VMs. This flexibility enables cloud providers to dynamically provision and de-provision computing resources to meet fluctuating demand in an on-demand fashion (Buyya *et al.*, 2009). Cloud consumers benefit from the ability to scale infrastructure up or down instantly, based on workload requirements.

It is important to distinguish virtualization from multi-tenancy. While both concepts involve sharing resources, multi-tenancy refers to an application-level architecture that allows multiple users (or tenants) to run separate instances of the same application within a shared environment. In contrast, virtualization provides hardware-level abstraction, offering users fully isolated environments, which enhances security, performance, and configuration independence (Sultana, 2016).

IaaS is often used to support:

- Web hosting and large-scale websites
- Data backup and disaster recovery
- Software testing and development environments
- High-performance computing (HPC) tasks

Prominent examples of IaaS providers include Amazon Web Services (AWS) EC2, Microsoft Azure Virtual Machines, Google Compute Engine, and IBM Cloud Infrastructure. For instance, Amazon EC2 (Elastic Compute Cloud) allows users to create and configure virtual servers on-demand, select from a wide range of instance types, and scale resources dynamically across global regions (Juve *et al.*, 2010a; IBM, 2025).

From a business and academic standpoint, IaaS offers significant advantages such as cost efficiency, operational flexibility, and rapid deployment, making it especially suitable for startups, SMEs, research institutions, and governments transitioning to digital platforms (Armbrust *et al.*, 2010; Zhang, Cheng and Boutaba, 2010). IaaS transforms capital expenditure (CapEx) into operating expenditure (OpEx), enabling organizations to pay only for the resources they use and thereby reducing waste and risk.

However, IaaS adoption also comes with challenges. Users are responsible for securing their own applications, operating systems, and data, and may face complexities related to compliance, interoperability, and vendor lock-in. In contexts such as Syria and other emerging economies, IaaS offers a promising path to digital transformation, but its success depends on factors such as network reliability, data sovereignty, and organizational readiness (Vaile *et al.*, 2013; Opara-Martins, Sahandi and Tian, 2016; Nattakarn Phaphoom *et al.*, 2017).

- Desktop as a Service (DaaS): is a cloud computing model that provides users with virtual desktop environments hosted in the cloud and accessible via the internet. It enables organizations to offer secure, scalable, and device-agnostic desktop experiences to end-users without the need to maintain physical infrastructure on-premise (Rittinghouse and Ransome, 2017). Through DaaS, users can access their full desktop, including files, applications, and settings, from any device or location using remote access protocols.

  Built on top of Infrastructure as a Service (IaaS), DaaS abstracts and manages the underlying hardware, while offering a ready-to-use operating system and software environment to end users. This makes it ideal for supporting remote workforces, educational institutions, or organizations with fluctuating desktop requirements. Providers such as Amazon WorkSpaces, Microsoft Azure Virtual Desktop, and Citrix DaaS are commonly used for delivering virtual desktop solutions at scale (Juve *et al.*, 2010b; Campus Technology, 2023; Fernando, 2024).

From an enterprise IT perspective, DaaS offers significant benefits, including cost efficiency, centralized maintenance, enhanced security, and business continuity. It eliminates the need for purchasing, maintaining, and upgrading desktop hardware while ensuring that software updates and backups are managed centrally by cloud providers. Additionally, it supports modern IT strategies such as Bring Your Own Device (BYOD) and zero-trust security, which are increasingly important in today’s distributed work environments (Buyya, Vecchiola and Selvi, 2013).

However, it is essential to note that DaaS is also used in academic and industry literature to refer to Data as a Service (DaaS) or Database as a Service (DBaaS), a related but distinct cloud service offering. In this context, DaaS describes the on-demand delivery of virtualized data storage and database services, often regarded as a specialized subset of IaaS (Rajesh, Swapna and Reddy, 2012; Zheng, 2018).

Traditional enterprise database systems typically require significant upfront investments in dedicated servers, software licenses, and ongoing IT support. In contrast, Data-as-a-Service models enable organizations to pay only for the storage and processing resources they actually use, thus offering a more flexible and cost-effective alternative. This approach reduces dependency on local infrastructure and simplifies database access through API-based or service-based interfaces (Zissis and Lekkas, 2012).

In addition to standard storage systems such as RDBMS and file systems, modern DaaS platforms often provide table-style abstractions designed for high scalability and performance, which can store and retrieve massive volumes of data in a compressed timeframe. These platforms are particularly suited for big data analytics and cloud-native applications that require rapid access to large datasets far beyond the capabilities of traditional business RDBMS. Examples of such DaaS implementations include Amazon S3, Google BigTable, Amazon DynamoDB, and Apache HBase (Chang *et al.*, 2008; Neves and Bernardino, 2015; Elhemali and et al., 2022).

These solutions allow organizations to manage large-scale data workloads, run real-time analytics, and integrate structured and unstructured data from multiple sources making DaaS an essential part of modern data-driven decision-making and cloud-native application development.

Figure 2 presents a visual overview of the four main cloud computing service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Desktop as a Service (DaaS)

Figure 2: Cloud Computing Service Model (Shutterstock, 2022)

- Function as a Service (FaaS): is a cloud computing execution model that allows developers to run discrete blocks of code, called functions, in response to events without the complexity of managing and maintaining server infrastructure (Adzic and Chatley, 2017; Baldini *et al.*, 2017) Often referred to as serverless computing, FaaS abstracts all operational concerns such as server provisioning, maintenance, and scaling, enabling developers to focus purely on writing business logic.

In the FaaS model, functions are stateless, lightweight, and triggered by external events such as HTTP requests, database updates, file uploads, or scheduled events. Unlike traditional cloud models where billing is based on reserved infrastructure, FaaS uses a granular billing system, where users are charged only for the compute resources consumed during function execution (Hellerstein *et al.*, 2018). This makes FaaS highly cost-effective for applications with intermittent workloads or unpredictable demand.

A distinctive advantage of FaaS is its automatic elasticity: the platform dynamically manages scaling up or down based on incoming request volume. However, this model also introduces challenges such as cold start latency (delay when functions are invoked after being idle) and the need for fine-grained orchestration for complex workflows (Liu *et al.*, 2025).

Prominent FaaS providers include AWS Lambda, Google Cloud Functions, Microsoft Azure Functions, and IBM Cloud Functions. Use cases for FaaS range from real-time file processing, IoT backend management, chatbots, and lightweight APIs to building highly modular microservices architectures (Jonas *et al.*, 2019).

From an academic perspective, FaaS is increasingly recognized as a pivotal enabler of agile software delivery, continuous integration/continuous deployment (CI/CD) practices, and cloud-native architectures, offering significant advantages in speed, cost, and operational simplicity (Li *et al.*, 2021; Wen *et al.*, 2022).

- Backend as a Service (BaaS): also known as Mobile Backend as a Service (MBaaS), is a cloud computing service model that offers developers pre-configured backend functionalities such as data storage, user authentication, server-side logic, cloud messaging, and application programming interfaces (APIs) (Sill, 2016). Rather than designing and managing backend infrastructure manually, developers can leverage BaaS platforms to integrate essential server-side services seamlessly into their applications, thus significantly accelerating the development lifecycle and reducing operational overhead.

  BaaS platforms expose critical backend features through Software Development Kits (SDKs) and APIs, enabling developers to focus primarily on front-end development and user experience design while delegating infrastructure management to the service provider (Pahl, 2015). Typical services offered by BaaS include user management, real-time database synchronization, push notifications, social media integrations, cloud storage, analytics, and even serverless computing capabilities. These functionalities are critical for ensuring that modern applications are responsive, scalable, and capable of supporting dynamic user interactions (Gessert, 2017).

  Several prominent BaaS providers have emerged in the industry, including Firebase by Google, AWS Amplify by Amazon Web Services, Backendless, and Kinvey by Progress.

These platforms are particularly popular in the development of mobile applications, single-page web applications, and Internet of Things (IoT) solutions, where rapid iteration cycles, cross-platform support, and seamless backend connectivity are essential for success (Martín, Custodio and Montero, 2019). By abstracting backend complexity, BaaS significantly reduces the time-to-market for software products, allows small teams to achieve scalable results, and minimizes the need for specialized backend expertise.

While Backend-as-a-Service (BaaS) offers numerous advantages, its adoption is accompanied by several challenges. A key concern is vendor lock-in, where transitioning applications from one BaaS provider to another can involve significant technical complexity and financial cost (Opara-Martins, Sahandi and Tian, 2016) . Additionally, concerns regarding data security, compliance with regulatory standards (such as GDPR), and limited backend customization options may hinder adoption in industries with strict data governance requirements. Some BaaS platforms may not provide the flexibility needed for highly specialized or enterprise-grade applications. Strategically, BaaS aligns closely with agile and DevOps methodologies by supporting rapid prototyping, continuous integration, and continuous delivery (CI/CD) practices (Rasthofer *et al.*, 2015; Moyón *et al.*, 2021; Issaoui, Örtensjö and Islam, 2023). It is particularly valuable for startups, SMEs, and projects operating under resource constraints, allowing them to deliver feature-rich applications without incurring the heavy infrastructure investments traditionally required for backend development (Martín, Custodio and Montero, 2019). As cloud-native application development continues to rise, BaaS is expected to play an increasingly vital role in enabling innovation and reducing barriers to entry for new digital services.

2.4 Cloud Computing Deployment Model

In recent years, four primary cloud deployment models have been defined within the cloud computing community as shown in Figure 3:

- Private Cloud :

Refers to a cloud infrastructure that is provisioned exclusively for use by a single organization, offering the benefits of cloud computing such as scalability, automation, and flexibility while retaining greater control and customization over security, governance, and data management (Mell and Grance, 2011). The infrastructure may be managed internally by the organization or hosted and operated by a third party, but in either case, it is logically and physically isolated from other organizations, distinguishing it from public or hybrid cloud models.

The private clouds are often deployed by organizations that require enhanced data protection, regulatory compliance, or high levels of customization, particularly when managing sensitive or mission-critical operations. Several factors motivate the implementation of private cloud environments, each aligning with organizational, technical, and strategic objectives.

First, private clouds enable firms to leverage and optimize existing in-house IT assets. Organizations with substantial prior investments in hardware, networking, and data centers may find it more cost-effective to build a private cloud over rearchitecting their infrastructure for public cloud compatibility. Virtualization and resource pooling technologies allow these firms to dynamically allocate internal resources, improving efficiency and reducing waste (Zhang, Cheng and Boutaba, 2010).

Second, security and trust are major drivers behind private cloud adoption. Organizations operating in sectors such as healthcare, finance, defense, or government often manage highly sensitive data that must comply with strict data protection laws (e.g., GDPR, HIPAA). The isolation and direct control offered by private clouds reduce the risk of data leakage, unauthorized access, and jurisdictional exposure, making them more aligned with internal compliance frameworks (Subashini and Kavitha, 2011).

Third, data transfer costs remain a significant challenge when moving large volumes of data from on-premise systems to public cloud environments. As highlighted by (Armbrust *et al.*, 2010), data ingress and egress fees imposed by public cloud providers can accumulate quickly, particularly for organizations handling big data, frequent analytics, or streaming workloads. By maintaining a private cloud, organizations minimize dependency on external data flows, reducing operational costs and avoiding latency issues.

Fourth, private clouds offer full control over mission-critical applications that must remain within the organization’s firewall. In some cases, performance, policy enforcement, or integration with legacy systems require fine-grained configuration and oversight, which are more achievable within a private infrastructure. This level of control supports strategic flexibility, giving organizations the ability to implement custom security policies, access rules, and SLAs (Service Level Agreements) tailored to their specific requirements (Marinos and Briscoe, 2009).

Finally, private clouds are widely used in academic and research settings. Universities and research institutions often build private cloud environments to support teaching, experimentation, simulation, and innovation. These platforms provide a secure and controlled setting where students and researchers can develop, test, and deploy applications without the cost or restrictions of public cloud usage (Buyya, Vecchiola and Selvi, 2013). Moreover, academic clouds are often designed to be modular and open-source, enabling collaboration and reproducibility across institutions.

Despite their benefits, private clouds do come with challenges such as higher upfront costs, complexity in setup and maintenance, and limitations in elasticity compared to public cloud services. However, for organizations with specific compliance, performance, and control requirements, private cloud remains a strategic alternative to fully public environments or hybrid models.

- Community cloud:

Is a cloud deployment model in which several organizations with shared objectives, values, or operational requirements collaboratively use and manage a common cloud infrastructure. These organizations may belong to a specific industry, sector, or consortium such as healthcare institutions, government bodies, research universities, or financial cooperatives that require similar levels of data privacy, security, compliance, and performance. Community cloud infrastructures are designed to balance the benefits of cloud scalability and cost efficiency with the need for collaborative governance and trust.

In this model, the infrastructure may be hosted internally by one of the participating organizations or outsourced to a third-party provider, but it is always intended for use by the defined community. The shared environment facilitates a sense of collective ownership, encourages resource pooling, and supports joint policy development and enforcement. According to the National Institute of Standards and Technology (Mell and Grance, 2011), the community cloud model promotes cost sharing, centralized security management, and greater customization for member organizations compared to public cloud solutions.

One of the distinguishing features of community clouds is their ability to merge technical, legal, and social requirements into a unified infrastructure. These clouds are typically governed by collaborative agreements that define data governance rules, compliance standards (e.g., HIPAA, GDPR, CJIS), and service-level expectations. This ensures that all member organizations benefit from consistent regulatory adherence and coordinated infrastructure planning (Zhang, Cheng and Boutaba, 2010).

(Marinos and Briscoe, 2009) conceptualize Community Cloud Computing as an alternative architectural paradigm that blends principles from multiple disciplines including cloud computing, grid computing, digital ecosystems, and green computing. The model emphasizes decentralization, resource sharing, and sustainability, while maintaining alignment with the original vision of the Internet as a democratic, interoperable, and collaborative space. In this sense, community cloud models reflect the ideals of distributed autonomy and collective innovation.

For example, a consortium of public universities may develop a community cloud to support academic research, share educational resources, and provide student services. Similarly, a network of hospitals could use a community cloud to store and exchange electronic health records (EHRs) while maintaining compliance with healthcare regulations and ensuring data confidentiality.

Academically, community clouds are often seen as a middle ground between the high control and cost of private clouds and the low control but high scalability of public clouds. They are particularly effective for use cases involving cross-organizational collaboration, federated identity management, and sector-specific compliance.

However, implementing a community cloud poses unique challenges. These include governance complexity, as multiple stakeholders must reach consensus on operational policies; variable funding contributions; and potential issues related to performance isolation among users. Additionally, as with any shared environment, ensuring security, data segregation, and accountability is essential to maintaining trust among participating organizations (Subashini and Kavitha, 2011).

Nonetheless, when well-designed, community clouds offer a balanced solution for groups that require customized infrastructure, inter-organizational collaboration, and joint cost sharing, while still reaping the technological benefits of cloud computing.

- Public Cloud:

Is the most widely adopted and commercially dominant deployment model in cloud computing today. It refers to a cloud infrastructure that is made available to the general public or a large industry group and is owned, managed, and operated by a third-party cloud service provider (Mell and Grance, 2011). In this model, computing resources including servers, storage, networking, applications, and services are hosted on the provider's premises and delivered over the internet to multiple independent users.

Public cloud platforms are built on the principle of multi-tenancy, where multiple customers (tenants) share the same infrastructure, but each operates within isolated virtual environments. This allows for high scalability, elasticity, and cost efficiency, as resources are dynamically allocated based on real-time demand (Armbrust *et al.*, 2010). Users pay only for what they consume, typically through pay-as-you-go or subscription-based pricing models, making the public cloud particularly appealing for startups, small businesses, and enterprises seeking to avoid large capital expenditures.

Well-known examples of public cloud providers include Amazon Web Services (AWS) offering services like EC2 (Elastic Compute Cloud) and S3 (Simple Storage Service) as well as Google App Engine, Microsoft Azure, and Salesforce.com. These providers offer a vast ecosystem of services ranging from Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) to Software as a Service (SaaS), catering to a wide array of use cases such as data storage, application hosting, artificial intelligence, analytics, and disaster recovery.

Public cloud environments operate on the foundational principles of:

- Scalable infrastructure on demand
- Elastic resource provisioning
- High availability and redundancy
- Reduced need for physical hardware or maintenance

These advantages are particularly beneficial for organizations experiencing unpredictable workloads, needing to launch products quickly, or supporting remote work environments. The ease of access, broad network availability, and automated management also reduce the burden on in-house IT teams (Buyya *et al.*, 2009).

In contrast, Private Cloud deployments although they also virtualize and abstract hardware are managed within a single organization and provide restricted access to internal users only. External data sharing is limited and subject to organizational policies and trust boundaries. The private cloud is typically implemented to address security, regulatory compliance, and data sovereignty concerns, and is fully monitored and managed by the organization or a designated third party (Vikas *et al.*, 2013).

While public clouds offer unmatched scalability and lower operational costs, they also introduce challenges in areas such as data privacy, vendor lock-in, and regulatory compliance. Users must place full trust in the cloud provider to uphold security standards, data governance policies, and service-level agreements. Concerns about multi-tenancy risks, lack of physical control over data, and cross-border data transfer regulations can be significant, especially in industries like healthcare, finance, and government (Subashini and Kavitha, 2011).

Nonetheless, academic and industry research strongly supports the viability of public cloud adoption across most sectors. As cloud service providers continue to enhance security frameworks, compliance certifications (e.g., ISO 27001, GDPR, HIPAA), and service reliability, the public cloud is increasingly being seen as a strategic asset that accelerates digital transformation, innovation, and global competitiveness (Zhang, Cheng and Boutaba, 2010).

- Hybrid Cloud:

Is a cloud deployment model that combines two or more distinct cloud infrastructures typically public, private, or community clouds that remain unique entities but are integrated through standardized or proprietary technologies that enable data and application portability (Mell and Grance, 2011). These technologies allow for seamless communication, workload migration, and resource sharing across different cloud environments. The goal of a hybrid cloud is to create a unified, automated, and scalable IT environment that leverages the benefits of multiple cloud architectures while minimizing their individual limitations.

In a hybrid cloud environment, core business operations or sensitive data are typically maintained on a private cloud or on-premise infrastructure, where organizations retain full control over security, compliance, and data governance. Meanwhile, less critical or more variable workloads such as web hosting, email services, or backup and disaster recovery are outsourced to the public cloud, taking advantage of its scalability, cost efficiency, and broad accessibility (Srinivasan, Quadir and Vijayakumar, 2015).

One of the key enablers of hybrid cloud systems is cloud bursting, where applications initially run in a private cloud and then “burst” into a public cloud when demand exceeds the capacity of the private infrastructure. This capability allows for dynamic load balancing and resource optimization, especially during traffic spikes or peak business periods (Zhang, Cheng and Boutaba, 2010). Such elasticity ensures that organizations can maintain performance standards without overprovisioning their in-house resources.

Hybrid cloud models are especially attractive to organizations operating in regulated industries such as healthcare, finance, defense, and government, where certain data must remain within strict legal or compliance boundaries. By segmenting workloads, organizations can retain sensitive data in a controlled environment while simultaneously benefiting from the innovation and scalability of public cloud platforms (Buyya *et al.*, 2009). This approach offers the best of both models flexibility from public cloud scalability, and security from private infrastructure control, making the hybrid cloud one of the most utility-driven models for modern enterprises.

According to (Srinivasan, Quadir and Vijayakumar, 2015), the hybrid cloud has become one of the most widely adopted models in the business sector due to its ability to adapt to variable computing needs. Organizations with fluctuating demand can dynamically scale their cloud usage, improving both cost-efficiency and resource utilization. Hybrid clouds are also ideal for supporting legacy systems, enabling gradual digital transformation without requiring a full migration to the cloud. This makes it particularly suitable for large enterprises or institutions undergoing modernization.

Despite its advantages, hybrid cloud environments also present challenges in interoperability, management complexity, and security integration. Effective implementation requires sophisticated orchestration tools, robust identity and access management (IAM), and consistent policy enforcement across the different cloud environments (Subashini and Kavitha, 2011). Additionally, ensuring low-latency communication and secure data transfer between public and private components is crucial to the reliability of hybrid operations.

Nevertheless, when strategically implemented, the hybrid cloud represents an optimal balance between agility, control, scalability, and compliance, allowing organizations to tailor their IT environment to both present and future needs.

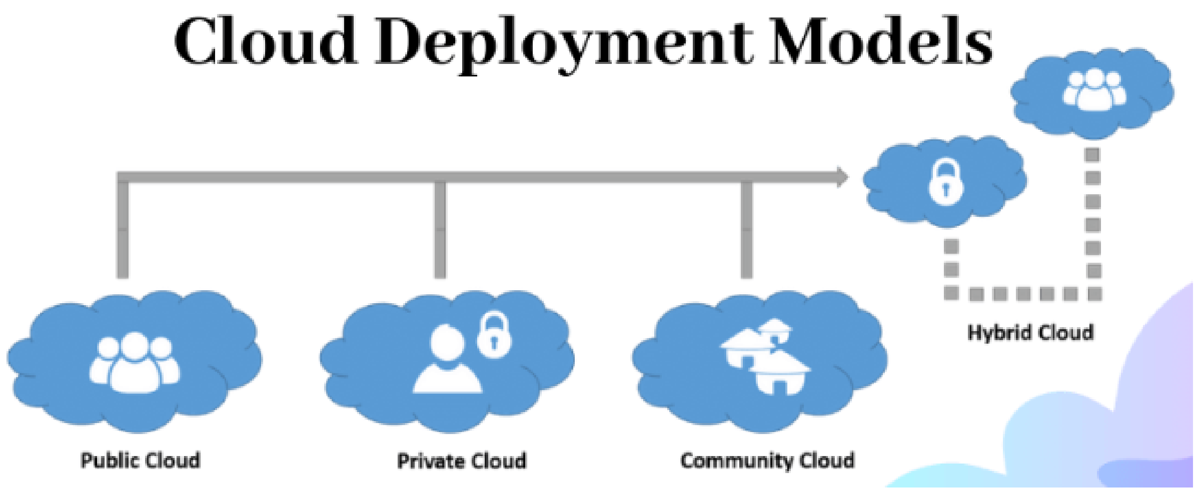

Figure 3: Cloud Deployment Model (Manrai, 2020)

Amazon Web Services (AWS) has recently introduced an additional deployment model:

- Virtual Private Cloud (VPC):

Is a specialized deployment model that provides a logically isolated environment within a public cloud infrastructure, offering organizations the security and control benefits of a private cloud while leveraging the scalability and flexibility of a public cloud. It is often described as a hybrid solution that bridges the gap between public and private cloud paradigms by enabling users to operate within a dedicated virtual space inside a public cloud provider's infrastructure (Amazon Web Services, Google Cloud Platform, Microsoft Azure, etc.).

Amazon Web Services (AWS), one of the first to popularize the VPC concept, defines a VPC as a "logically isolated section of the AWS cloud where you can launch AWS resources in a virtual network that you define." This virtual network can mimic a traditional on-premises data center, including features like IP address ranges, subnets, routing tables, and network gateways (AWS, 2023). Other cloud vendors offer similar services under the same or different branding (e.g., Google Virtual Private Cloud, Azure Virtual Network).

Although a VPC resides on a public cloud, it is "virtually private" due to two key attributes:

1. Secure Connectivity: The link between the customer’s on-premises IT infrastructure and the VPC is established via VPN (Virtual Private Network) or dedicated direct connections (e.g., AWS Direct Connect), ensuring encrypted and secure data transmission. This allows organizations to extend their internal networks to the cloud without compromising on security, effectively operating as though they are within a private infrastructure.
2. Isolated Resources: Cloud providers allocate dedicated or logically isolated resources to each VPC instance. While the underlying infrastructure is shared among multiple tenants (as in public cloud), each VPC has customized virtual networking, firewall rules, and access control policies, ensuring segregation and privacy between tenants. Importantly, organizations benefit from pay-as-you-go pricing models, eliminating the need for upfront capital investment in dedicated infrastructure while still achieving isolation and performance guarantees.

This model is especially advantageous for organizations that wish to retain control over their IT environment including routing, subnets, firewalls, and network ACLs while avoiding the overhead of managing physical infrastructure. It is also an ideal solution for running sensitive workloads or applications that require compliance with data governance, security, or performance standards.

VPCs are frequently used in hybrid architectures, where organizations host core applications or sensitive data on-premises or in a private cloud, while using a VPC for secondary workloads, such as development, testing, backups, or customer-facing applications. This setup supports both bursting capabilities and disaster recovery, aligning with hybrid cloud strategies (Zhang, Cheng and Boutaba, 2010).

It is also important to note that cloud service models (IaaS, PaaS, SaaS) are orthogonal to cloud deployment models (public, private, hybrid, community, VPC). This means, for example, that Software as a Service (SaaS) can be deployed over a public cloud, a private cloud, or a VPC depending on the organization’s needs and regulatory requirements (Mell and Grance, 2011). Thus, a VPC can serve as the infrastructure layer for hosting any of these service models with enhanced security and configurability.

2.5 Adoption Definition

Adoption refers to the process of initiating the use of a new or different practice, technology, or system (Merriam-Webster, 2015). Some researchers have conceptualized adoption through the lens of task-technology fit, evaluating how well technological solutions align with specific tasks (Yadegaridehkordi, Iahad and Ahmad, 2016). Adoption of cloud has been discussed in various industries, including education, healthcare (Boiron and Dussaux, 2015) (FMCG) and other business processes (Benmerzoug, 2015).

In this study, cloud computing adoption refers to the incorporation of cloud-based technologies by businesses, whether as a short-term operational solution or as a component of a long-range strategic IT initiative. As Ercan (Ercan, 2010) notes, the on-demand accessibility of cloud resources has transformative potential for various sectors. Prior studies have explored both technological and strategic dimensions of adoption, ranging from security concerns to business model realignment (Misra and Mondal, 2011) developed two types of business models designed for companies intending to adopt cloud computing services. These models differentiate between established firms with existing IT infrastructures and startups that may lack such resources. A recent survey found that the current pricing structures and adoption drivers associated with cloud computing are particularly suitable for small and medium-sized enterprises (SMEs) (Misra and Mondal, 2011). However, firm size has been found to influence the perceived strategic value of cloud computing in the context of technological innovation. (Pyke, 2009) has stated that firm applications typically would be in charge of their localized sets of processes, with the connection of applications to these processes.

Previous studies have introduced trade-off models to evaluate which technologies can yield greater financial returns. (Misra and Mondal, 2011) expanded this perspective by developing a model that not only incorporates key adoption factors but also estimates the productivity gains and cost-benefit outcomes associated with cloud computing. (Banerjee, 2010) provides an overview of technological research studies that were performed in H.P. labs and that adopted cloud-scale smart environments, for example, the smart data center and utility computing. (Buyya *et al.*, 2009) have additionally managed with market-oriented resource allocation of cloud computing by utilizing third-generation Aneka enterprise grid technology.

(Grossman *et al.*, 2009) formed a cloud-based infrastructure that had remained optimized for the performance of the networks and maintained important data mining applications. In summary, earlier research on cloud computing adoption presents two key insights:

(1) Although various factors affect cloud computing adoption among prior researchers' findings, all these factors can be classified in technological, organizational, or environmental contexts. Therefore, applying the Technology–Organization–Environment (TOE) framework is valuable for examining the multifaceted nature of cloud computing adoption.

(2) Most of the studies have examined the importance of the technological factors impacting cloud computing adoption in any matter; the influences of environmental and organizational factors on cloud computing selection vary over various industry contexts. As such, it is essential to analyze adoption factors across different industries to gain a more comprehensive understanding of cloud computing adoption.

Recent studies highlight that the COVID-19 pandemic has significantly accelerated the global adoption of cloud technologies, particularly among SMEs and public sectors (Mishrif and Khan, 2023). This shift was fueled by the urgent need for remote work solutions, digital service delivery, and scalable IT infrastructure. In regions like the Middle East, cloud computing adoption grew by an estimated 25% between 2020 and 2022, indicating that technological readiness and external pressures must be re-evaluated in current TOE-based frameworks (Gartner, 2022).

2.6 Cloud Adoption Challenges

Despite its rapid technological progress, cloud computing remains in the developmental phase of widespread adoption and continues to encounter several critical challenges. Based on a survey conducted by IDC in 2008, the significant challenges that prevent Cloud

Computing from being adopted are recognized by organizations, as shown in Figure 4

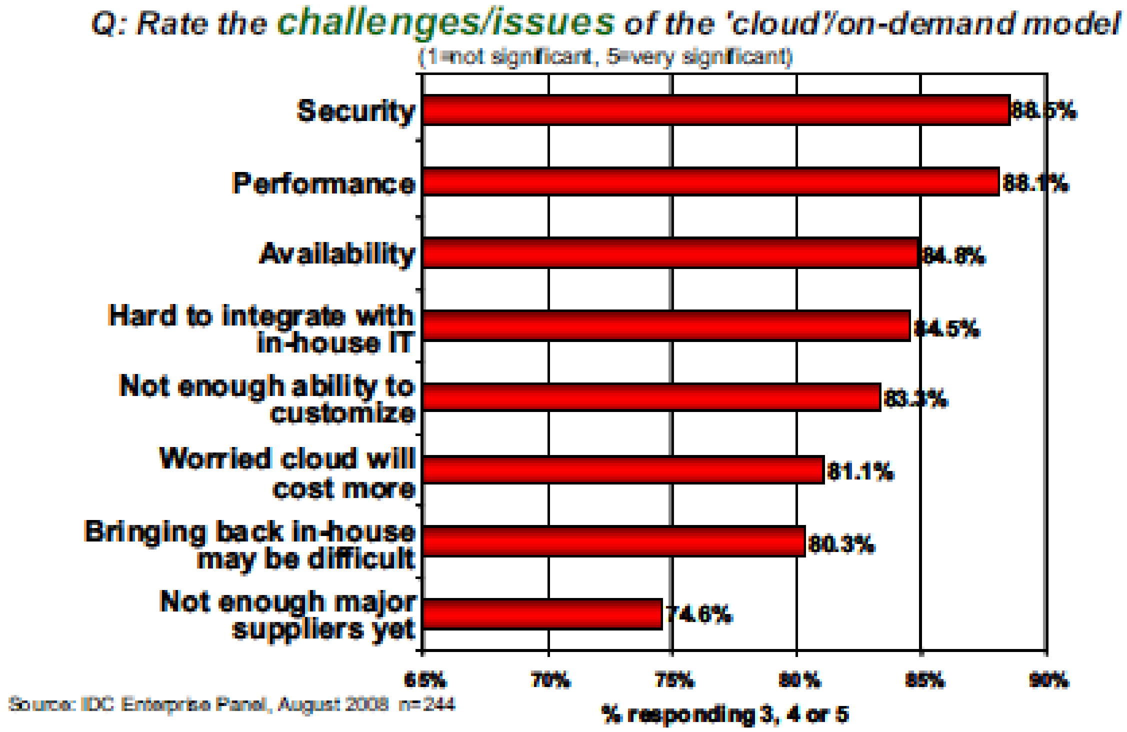

Figure 4: Challenge rates of the cloud on demand model (International Data Corporation (IDC), 2008)

1. Security

Security remains one of the most critical barriers to cloud adoption. Entrusting data and applications to third-party infrastructure raises substantial concerns. Key risks include data breaches, phishing attacks, and loss of control over sensitive information. Besides, these challenges require innovative security strategies(Chen, Paxson and Katz, 2010). Its scalable nature and low cost make it a target for cybercriminals. For instance, the cloud frequently gives progressively reliable infrastructure services, so hackers want to utilize it because it is generally lower cost for them to start an attack (Chen, Paxson and Katz, 2010).

Two new security problems are related to the multi-tenancy model. First, shared resources (hard disk, data, V.M.) on the same physical machine invite unexpected side channels between a malicious resource and a natural resource. This issue, known as "reputation fate-sharing," can negatively impact legitimate users who share infrastructure with malicious tenants. Misbehavior by one tenant may result in service disruptions or reputational damage for others using the same shared resources. Since they might be sharing the same network address, any lousy conduct will be referred to all the users without differentiating real subverters from regular users.

2. Costing Model

Cloud users must consider trade-offs between infrastructure savings and increased communication costs. While cloud services often reduce upfront capital expenses, they can introduce new operational costs, such as data transfer fees (Leinwand, 2009), and the expense per unit (e.g., a V.M.) of computing resources used is likely to be higher. This problem is particularly prominent if the customers use the hybrid cloud deployment model where the association's data is distributed amongst several public/private (in-house I.T. infrastructure) /community clouds. As (Gray, 2008) emphasized, the principle of "moving computation closer to data" remains relevant. On-demand computing is most beneficial for compute-intensive tasks. However, transactional applications such as ERP or CRM may not benefit economically if data transfer costs outweigh infrastructure savings.

Conceptually, on-demand computing makes sense only for CPU-intensive jobs. Transactional applications such as ERP/CRM may not be suitable for cloud computing from a purely economic perspective if cost savings do not offset the extra data transfer cost.

In addition, the cost of data integration can be substantial as different clouds often use proprietary protocols and interfaces. This needs the cloud consumer to react with different clouds using cloud provider-specific APIs and to develop ad-hoc adaptors so as to spread and integrate heterogeneous resources and data assets to and from different clouds (even within a single organization).

3. Charging Model

The virtual machine (VM) has become the primary unit for cost analysis, replacing the traditional focus on physical servers. A comprehensive pricing model must consider associated elements, including bandwidth usage, licensing fees, and administrative overhead.

For SaaS providers, supporting multi-tenancy introduces significant development and maintenance costs. These include reengineering applications originally designed for single users, enhancing customization capabilities, and addressing performance and security concerns.

As a result, SaaS providers need to weigh up the trade-off between the arrangement of multi-tenancy and the cost savings yielded by multi-tenancy, for example, decreased overhead through amortization, decreased number of on-site software licenses, etc.

Thus, an applicable and strategic charging model for SaaS providers is critical for SaaS cloud providers' profitability and sustainability.

4. Service Level Agreement

Although cloud customers lack direct control over the underlying infrastructure, they require assurances regarding service reliability, availability, and performance. These assurances are typically provided through Service Level Agreements (SLAs) negotiated with cloud providers. The absolute first problem is the definition of SLA particulars so that has an suitable level of granularity, namely the trade-offs between expressiveness and complicatedness, so that they can cover up most of the customer expectations and is generally easy to be weighted, confirmed, assessed, and authorized by the resource allocation mechanism on the cloud.
Besides, different cloud offerings (IaaS, PaaS, SaaS, and DaaS) will need to define different SLA meta-specifications.
This also raises several implementation problems for cloud providers. For example, resource managers need to possess precise and updated information on resource usage at any particular time within the cloud. By updating information, we mean any changes in the cloud environment would fire an event subscribed to by the resource manager to make real-time evaluation and adjustment for SLA fulfillment. Resource managers need to utilize fast and effective decision models and optimization algorithms to do this. It may need to reject specific resource requests when SLAs cannot be met. All these should be done in a nearly automatic fashion due to the promise of "self-service" in cloud computing. Besides, advanced SLA mechanisms need to persistently incorporate customization features and user feedback into the SLA evaluation framework.

5. What to migrate

According to an IDC survey conducted in 2008, many organizations remain hesitant to migrate their data to the cloud due to ongoing security and privacy concerns. At present, peripheral functions such as IT support and personal applications are the most likely candidates for migration. Organizations are generally more conservative in adopting Infrastructure as a Service (IaaS) compared to Software as a Service (SaaS), primarily because core operations are retained in-house. The survey projected that within three years, approximately 31.5% of organizations would move their storage functions to the cloud. However, this adoption rate remains lower than that of collaborative applications, which stood at 46.3%.

In summary, Security, trust, and data governance continue to represent significant barriers to the adoption of cloud computing, particularly in fragile or transitioning economies where institutional frameworks and regulatory mechanisms are often underdeveloped. In addition to traditional concerns such as data breaches and diminished control over sensitive information, the shared nature of cloud infrastructure particularly in multi-tenant environments gives rise to what is known as reputation fate-sharing. In such settings, the actions or security failures of one tenant can negatively impact the overall trustworthiness and perceived integrity of the entire shared environment (Kablan *et al.*, 2015). Trust in cloud service providers continues to pose a major barrier to adoption, particularly in regions where digital governance frameworks and institutional trust mechanisms are still evolving (Kuada, 2014). Moreover, developing countries face unique regulatory and legal complexities that hinder adoption progress (Senyo, Effah and Addae, 2017). Cost-related barriers, particularly in hybrid or multi-cloud setups, exacerbate adoption hesitancy as organizations face compliance expenses and unpredictable operational charges (Polinati, 2025). In fragile contexts like Syria, perceived cyber-risks are intensified due to underdeveloped infrastructure and weak cybersecurity enforcement mechanisms(United Nations Economic and Social Commission for Western Asia (UN ESCWA), 2024).

2.7 Technology-Organization-Environment (TOE) framework

This study adopts the Technology–Organization–Environment (TOE) framework to analyze how organizations adopt cloud computing. The TOE framework is well-regarded for its ability to capture the multidimensional factors influencing the adoption of technological innovations
The technological dimension considers the characteristics and availability of technologies, both internal and external to the organization. Existing systems shape the scope of feasible change, while emerging technologies offer opportunities for innovation and competitive differentiation (Mehran Amini and Bakri, 2015). (Lawan, Oduoza and Buckley, 2021) identified 37 highly relevant studies to determine the most salient factors influencing cloud computing adoption. Their analysis revealed that technology readiness, top management support, relative advantage, competitive pressure, compatibility, complexity, and data security are among the most significant determinants shaping organizational adoption decisions.

(Low, Chen and Wu, 2011) noted that the TOE model includes constructs that can be context-dependent, making it necessary to tailor its variables to specific organizational settings. To enhance the framework's applicability, additional factors should be incorporated, including cognitive and sociological variables, the ability to regulate IT investments through various channels (e.g., organizational learning), and technological readiness (e.g., knowledge management capabilities). Other critical elements that should be considered are security concerns, the expertise and experience of IT professionals, managerial ability to drive organizational change, government regulations and policies, cultural influences, and technological infrastructure.

To address its limitations, (Lian, Yen and Wang, 2014) extended the TOE model by integrating concepts from the Human–Organization–Technology (HOT-fit) theory. This integration aimed to address the human factor, which is absent in the original TOE framework but plays a crucial role in influencing an organization's decision to adopt new innovations.

Tornatzky and Fleischer developed TOE in 1990, which emphasizes the adoption of technological innovation (Tornatzky, Fleischer and Chakrabarti, 1990). The theoretical framework characterizes three dimensions of an organization's context that affect technological innovation adoption and implementation:

- Technological context

The technological context refers to both the internal and external technologies related to the organization. Studies show that organizational factors like top management support strongly moderate technology adoption success, particularly in developing economies (Aldahwan and Ramzan, 2022).

(Tornatzky, Fleischer and Chakrabarti, 1990) identified ten innovation factors that have been widely used to study technology adoption in organizations. They are relative advantage, complexity, communicability, divisibility, cost, profitability, compatibility, social approval, trial-ability, and observability. Prior studies have proposed that proportional compatibility, advantage, and complexity are consistently related to innovation adoption (Premkumar and Ramamurthy, 1995; Agarwal and Prasad, 1998; Cooper and Molla, 2014).

The TOE framework aligns with Rogers' (1995) Diffusion of Innovations theory. For example, relative advantage is defined as the degree to which an innovation is perceived as better than the idea it replaces (Rogers, 1995). Compatibility is the degree to which an innovation is perceived as consistent with existing values, experiences, and needs (Rogers, 1995). Complexity describes the extent to which an innovation is perceived as difficult to understand and implement (Rogers, 1995).

"Technological adoptions share core traits with traditional innovation processes. Eventually, technological factors such as relative advantage, compatibility, and complexity have significant relationships with organizational Cloud adoption. Organizations are more likely to implement technological innovations if these technologies can bring about perceived organizational benefits such as better organizational performance and higher economic gains. Studies (Nedbal and Stieninger, 2014; Oliveira, Thomas and Espadanal, 2014) show that economic advantages are an essential technical characteristic that influences the adoption of cloud computing. Furthermore, the Implementation of cloud initiatives can be driven by cloud technologies that are more compatible with an organization's technologies, processes, and work application systems (Weng and Lin, 2011; Ho and Lin, 2012).

- Organizational context

The organizational context refers to the characteristics, structures, processes, and resources that constrain or facilitate technological innovation adoption. Tornatzky and Fleischer highlight several organizational factors that influence innovation, including informal communication, leadership behavior, employee expertise, and organizational size (Tornatzky, Fleischer and Chakrabarti, 1990). Among all these factors, the quality of human resources, top management's leadership, slack resources, and size are the most frequently discussed factors within the organizational context that affect innovation adoption.

The hypothesis in this study will focus only on the most commonly studied factors in the organizational context of innovation literature. The quality of human resources refers to the extent to which technical know-how is available within an organization. The study of (Cooper and Molla, 2014) provides empirical evidence that the higher the employees' absorptive capacity to generate Green I.T. knowledge, the more likely the organization is adopt green initiatives successfully. Top management's leadership describes the role of executive leadership in encouraging and facilitating innovation within the organization's overall strategy. In particular, top management commitment plays an essential role in driving various initiatives for Green I.T. during the implementation stage. (Cooper and Molla, 2014) their findings identified top management commitment as an essential factor in steering the organization towards the strategic importance of cloud computing and realizing business value from cloud computing adoption. Similarly, the empirical study of (Weng and Lin, 2011) found that top management support has a positive effect on the adoption of cloud computing

- Environmental context.

The environmental context relates to an organization's industry, competitors, and government policy on intention.

(Tornatzky, Fleischer and Chakrabarti, 1990) identify three categories of environmental factors: industry characteristics, government regulation, and technical support infrastructure. The industry characteristics are comprised of competitive pressure and pressure from trading partners; it defines competitive pressure as the pressure that arises from a threat to losing or maintaining competitive advantage, forcing organizations to search for new technology adoption as alternatives to their current strategies (Lin and Lin, 2008). As more and more organizations adopt green initiatives, this pervasive phenomenon has been pushing firms to adopt green technologies to stay competitive in the industry or outperform their competitors. The empirical study of (Oliveira, Thomas and Espadanal, 2014) contends that organizations are increasingly adopting cloud computing as they face competitive pressure from their competitors and consequently follow their competitors' adoption of green technologies. Furthermore, the adoption of Green I.T. can also be driven by the organizations' trading partners. For instance, when Walmart adopted radio frequency identification, the organization made it mandatory for its top 100 suppliers to adopt the new technology for the shipping container and case identification (Wang *et al.*, 2006).

Figure 5 presents the Technology–Organization–Environment (TOE) framework, which outlines the key contextual factors influencing technological innovation decision-making within organizations

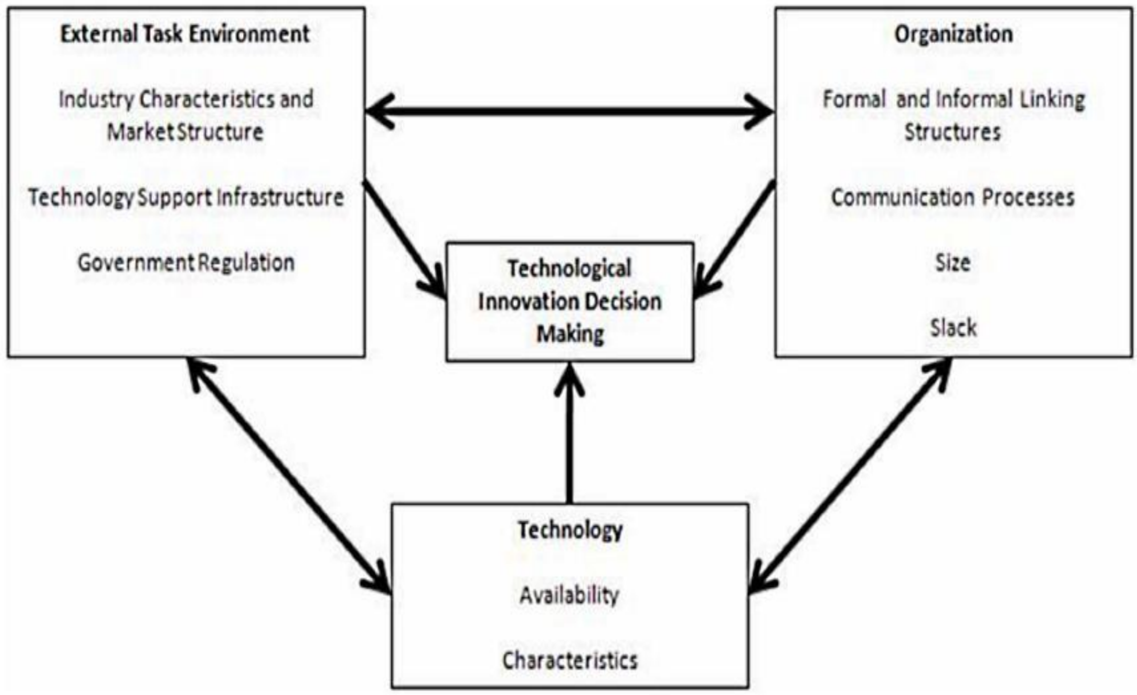

Figure 5: TOE framework (Tornatzky, Fleischer and Chakrabarti, 1990)

2.8 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), originally proposed by Davis (1989), asserts that perceived usefulness (PU) and perceived ease of use (PEOU) are the primary determinants of users' behavioral intention to use an information system, which in turn predicts actual usage. Davis' study demonstrated that PU and PEOU are both significant and distinct predictors, with PEOU sometimes exerting its effect indirectly by influencing PU (Davis, 1989). TAM emerged from the Theory of Reasoned Action (TRA) and has been widely validated across organizational and technological contexts, consistently showing robustness in explaining acceptance behavior (Davis, 1989; Venkatesh and Davis, 2000). Subsequent developments such as TAM2 and the Unified Theory of Acceptance and Use of Technology (UTAUT) extended TAM by integrating social influence, cognitive instrumental processes, and facilitating conditions, thereby increasing explanatory power, particularly in both voluntary and mandatory usage environments (Venkatesh and Davis, 2000). Meta-analyses further confirm TAM's generalizability while highlighting the value of contextual extensions in predicting technology adoption outcomes.

2.9 Global Perspectives on Cloud Computing Adoption: A Comparative Overview

Over the past two decades, cloud computing has transformed information technology by offering organizations significant advantages such as cost efficiency**,** operational scalability, and rapid deployment compared to traditional in-house IT systems. As organizations aim to reduce capital expenditures (CAPEX), minimize total cost of ownership (TCO), and increase return on investment (ROI), cloud computing presents a strategic shift by enabling businesses to provision software, storage, and processing power from cloud service providers with minimal lead time (Qian *et al.*, 2009). McKinsey estimates cloud adoption could generate $3 trillion in global economic value by 2030, highlighting the technology's transformative potential (McKinsey & Company, 2022).This paradigm shift is driven by the growing demand for computational capacity and storage**,** which accelerated notably after the internet boom in the early 1990s. Major technology firms such as Google**,** Amazon, and Microsoft responded by developing scalable cloud platforms. Amazon Web Services (AWS), for instance, introduced Infrastructure as a Service (IaaS) in 2006–2007, followed by Google App Engine (Platform as a Service – PaaS) in 2008, and Microsoft Azure, based on the Windows Azure Hypervisor (WAH), to offer end-to-end cloud infrastructure services. Cloud computing has since evolved into a globally adopted framework supported by SaaS, PaaS, and IaaS models, with leading providers like Salesforce offering specialized application services such as Customer Relationship Management (CRM). StackOverflow (2021) survey results show that COVID-19 accelerated digital transformation, with 90% of firms increasing cloud usage (Spencer, Wood and Goldstein, 2021). Comparative studies indicate notable regional differences in cloud adoption. In the Gulf region, readiness has been greatly influenced by substantial government IT investments and comprehensive national digital transformation strategies (SMEX, 2025). In Japan, SMEs benefit from centralized cloud advisory programs that mitigate vendor risk and enhance adoption rates (Organisation for Economic Co-operation and Development (OECD), 2024). Meanwhile, China's centralized data governance framework has facilitated robust cloud adoption within the public sector; however, concerns over data privacy and regulatory oversight continue to hinder broader acceptance in the private sector (Zhang, 2024). In Egypt, public cloud frameworks have been deployed across ministries and health systems, demonstrating the government's commitment to digital reform (Alorbany *et al.*, 2025). In post-conflict MENA countries such as Iraq, Libya, and Syria, the pace of cloud technology adoption remains limited due to persistent infrastructure degradation and institutional fragility; however, the emergence of localized innovation efforts suggests early signs of digital recovery (United Nations Economic and Social Commission for Western Asia (UN ESCWA), 2024).

2.10 Country-Level Adoption Trends

- Australia

The Australian government has actively promoted cloud computing as a means to meet governmental IT needs in a cost-effective, secure, flexible, and reliable manner. Research emphasizes a strategic focus on balancing the advantages of cloud adoption with potential risks (Bisley, 2013). Government agencies are encouraged to adopt cloud solutions to improve operational capacity and public service delivery, reduce costs, and enhance overall IT performance.

- China

China's national cloud initiative has prioritized IaaS infrastructure such as centralized data centers through state-owned telecom giants, while PaaS development continues via commercial providers like Alibaba and Tencent (Tan, 2024). Public sector adoption is strong, particularly in telecommunications and government online services, although private sector adoption lags due to security and privacy concerns (*China Daily*, 2013).

- Japan

In 2009, Japan launched the Digital Japan Creation Project, which included the development of Kasumigaseki Cloud, a national cloud platform aimed at facilitating inter-ministerial collaboration and reducing redundancy in IT infrastructure. The project seeks to consolidate government systems and deliver services through a shared, high-efficiency platform (Ministry of Internal Affairs and Communications (Japan), 2009). Japan's approach reflects a centralized strategy designed to reduce costs and increase public sector efficiency through cloud integration.

- United Arab Emirates (UAE)

The United Arab Emirates (UAE) has positioned itself as a regional leader in cloud computing adoption, reflecting its broader national vision of becoming a digitally enabled, knowledge-based economy. The country's proactive stance is evident in strategic government initiatives such as UAE Vision 2021 and the Smart Dubai initiative, both of which prioritize digital transformation, e-governance, innovation, and robust ICT infrastructure development. These initiatives emphasize the role of emerging technologies, including cloud computing, artificial intelligence, and blockchain, in enhancing public services and creating a globally competitive economy (SmartDubai, 2021).

The UAE's commitment to fostering a vibrant cloud ecosystem is supported by the establishment of local data centers by major international cloud providers, including Microsoft Azure, Amazon Web Services (AWS), and Oracle Cloud. These in-country hosting services address a critical challenge in cloud adoption across the region data sovereignty. By ensuring that sensitive data remains within national borders, these providers help comply with local regulatory requirements and alleviate concerns related to data privacy, cross-border data transfer, and compliance with laws such as UAE's Federal Law No. 2 of 2019 (Government of the United Arab Emirates, 2019) on the Use of Information and Communication Technology (ICT) in Health Fields.

The UAE's "Cloud First Policy", introduced by the Telecommunications and Digital Government Regulatory Authority (TDRA), encourages federal entities to prioritize cloud services in new IT investments. The policy outlines clear frameworks for security, procurement, and performance monitoring, aiming to reduce duplication in IT resources, improve service delivery, and achieve cost-efficiency across government institutions ((TDRA), 2020).

Despite the presence of such a robust ecosystem, adoption of cloud computing in the UAE is not without challenges. As noted by (Srivastava and Nanath, 2017), many organizations particularly in the private sector continue to express concerns related to data security, regulatory clarity, and return on investment (ROI). Although data localization laws and cloud governance policies have improved in recent years, businesses remain cautious about the complexity of migration, vendor lock-in risks, and the uncertain cost implications of long-term cloud integration.

Additionally, some enterprises face difficulties in aligning legacy systems with new cloud platforms, as well as ensuring compliance with sector-specific regulations, especially in banking, healthcare, and government services. The relative shortage of cloud-specific technical skills and cybersecurity professionals within the domestic labor market can also hinder seamless adoption, despite significant investment in digital training and upskilling programs.

Recent academic research and market reports suggest that overcoming these barriers will require:

- Greater emphasis on interoperability and hybrid cloud solutions to support transitional architectures;
- Public-private collaboration to establish clearer service-level agreements (SLAs), accountability standards, and cost models;
- Continuous capacity-building for cloud-related skills to bridge the human capital gap in cloud security, DevOps, and data governance.

Nevertheless, the UAE remains at the forefront of cloud innovation in the Arab region, leveraging public policy, private investment, and international partnerships to create a conducive environment for cloud computing. With continued regulatory evolution and strategic digital initiatives, the country is well-positioned to accelerate its cloud maturity model, ensuring that both public and private sectors benefit from scalable, secure, and future-ready cloud infrastructure.

- Egypt

Cloud computing adoption in Egypt is steadily gaining traction, particularly as organizations seek cost-effective, scalable, and efficient IT solutions in response to growing digital demands. Empirical research has shown that cloud technologies are widely perceived as easy to learn, time-saving, and capable of enhancing employee performance and job satisfaction (Kandil *et al.*, 2018). These characteristics make cloud computing especially attractive to small and medium-sized enterprises (SMEs) and government agencies aiming to optimize their operations and reduce dependence on traditional in-house infrastructure.

The Egyptian government has recognized the strategic importance of digital transformation, including cloud adoption, as part of its broader "Digital Egypt" initiative. This national program emphasizes the modernization of public services, digital inclusion, and private sector innovation through ICT adoption. Moreover, several public-sector digitization projects such as the automation of civil registry services and online tax portals have demonstrated the practical utility of cloud computing in public administration ((MCIT), 2025).

Egypt has made important strides in cloud adoption. However, legal and regulatory gaps still pose major challenges to its broader implementation. The absence of a comprehensive legal framework addressing data protection, intellectual property rights, and cloud-specific cybersecurity standards raises substantial concerns among organizations about the safety, confidentiality, and legal ownership of data stored in the cloud. As (Kandil *et al.*, 2018) emphasize, without formal legal instruments to enforce copyright laws, regulate cross-border data flows, or ensure cloud provider accountability, both public and private sector organizations remain cautious in adopting cloud solutions for mission-critical or sensitive operations.

Furthermore, while Egypt has enacted legislation such as the Cybercrime Law No. 175 of 2018 and the Data Protection Law No. 151 of 2020, enforcement remains inconsistent, and cloud-specific applications of these laws are still under development. These gaps create a regulatory grey area, especially for foreign cloud service providers seeking to operate in the Egyptian market under clear and enforceable guidelines (Baker McKenzie, 2024).

Infrastructure constraints also pose challenges. Although Egypt has made notable progress in improving broadband access and expanding fiber-optic networks, cloud infrastructure remains underdeveloped. The lack of local data centers and reliance on foreign-hosted cloud platforms complicates compliance with data sovereignty and localization requirements, which are becoming increasingly important in sectors such as healthcare, finance, and education.

Additionally, Organizational readiness for cloud adoption differs notably across industries. Multinational corporations and large enterprises often possess the technical expertise and financial resources necessary to implement cloud technologies. In contrast, many smaller organizations face constraints such as limited cloud-literate personnel, underdeveloped change management processes, and insufficient internal IT infrastructure, which hinder effective cloud integration (Hidayah and Suryahadi, 2023).

Egypt's case reflects a dual reality in the realm of cloud computing: one of growing awareness and positive perception, and another of regulatory and infrastructural shortcomings. For Egypt to unlock the full potential of cloud computing, government intervention is essential not only to update and enforce relevant laws but also to build an ecosystem that supports innovation, data protection, and public trust. This includes establishing local data centers, strengthening regulatory oversight, and investing in cloud-related education and capacity building.

- Jordan

Cloud computing has become a transformative force in modern information technology strategies across the globe, enabling organizations to streamline operations, enhance scalability, and reduce IT costs. In the Middle East, Jordan has emerged as a country steadily progressing toward cloud adoption, supported by a combination of government initiatives, growing private sector interest, and increasing digital transformation efforts. Despite these positive developments, several structural and regulatory challenges remain that must be addressed to enable a more secure and sustainable cloud ecosystem.

The Jordanian government has played a central role in promoting cloud computing as a tool for enhancing public service delivery, optimizing resource use, and stimulating economic innovation. Spearheaded by the Ministry of Digital Economy and Entrepreneurship ((MODEE), 2020), several key policies have been introduced to create a conducive environment for digital transformation. Notably, the Jordan National Cloud Policy (2020) and the ICTP Sector Policy (2018) articulate a national vision to leverage cloud technologies for smarter governance, improved public services, and better digital infrastructure management. These policies emphasize the importance of cloud computing for enhancing flexibility, cost-efficiency, and innovation within public institutions and small to medium enterprises (SMEs) ((MODEE), 2020).

Cloud adoption in Jordan's private sector has also gained momentum in recent years. Companies are increasingly aware of cloud computing's potential to improve service quality, reduce capital expenditure, and support remote operations. According to academic research e.g.,(Hammouri and Abu-Shanab, 2020), several key factors influence cloud adoption in Jordan, including perceived service quality, cost savings, IT readiness, and ease of integration. However, many firms still exhibit caution due to concerns about data control, security risks, and lack of trust in external providers.

The public cloud market in Jordan is witnessing gradual growth, driven by broader digital transformation trends and a post-pandemic shift toward remote work and cloud-based collaboration. The increasing reliance on cloud services by both public institutions and private firms reflects a growing recognition of cloud computing as a scalable and adaptive tool for meeting modern business and governance needs. Collaborations with international cloud providers, such as Microsoft's partnership with the Jordanian government to develop a national cloud platform, have further strengthened the country's cloud infrastructure (MME, 2023).

Despite these developments, Jordan still faces several challenges that hinder widespread adoption. Chief among these is the absence of a comprehensive data protection and cybersecurity legal framework. Without robust regulations that ensure the privacy and security of data in the cloud, organizations remain hesitant to fully migrate their critical workloads to cloud platforms. Additionally, technical integration challenges and limited in-country data center availability pose further obstacles to secure and seamless adoption (M. Amini and Bakri, 2015).

Moreover, a skills gap persists within the local workforce, especially in cloud architecture, cybersecurity, and DevOps. While some efforts have been made to train IT professionals, further investment in cloud education and certification programs is necessary to build a sustainable ecosystem capable of managing and innovating cloud-based solutions.

In summary, Jordan's approach to cloud computing adoption is a promising but evolving journey. The government's active role, especially through policy development and partnerships, has laid a solid foundation for broader cloud integration. The private sector is increasingly leveraging cloud solutions for operational efficiency and competitiveness. Nevertheless, the country must continue to address regulatory, infrastructural, and educational challenges to fully realize the benefits of cloud computing. With sustained efforts in these areas, Jordan is well-positioned to emerge as a regional leader in digital transformation through the adoption of cloud technology.

- Syria

Although academic research on cloud computing in Syria remains scarce, there is a growing recognition of its potential among businesses, policymakers, and IT professionals. Cloud computing is increasingly viewed as a cost-effective and scalable alternative to traditional IT infrastructure, especially in the wake of prolonged economic challenges and post-conflict reconstruction efforts. For many Syrian organizations, particularly small and medium-sized enterprises (SMEs), these platforms enable a practical means of reducing capital expenditures (CAPEX) and lowering operational costs (OPEX) expenses that would otherwise be invested in purchasing and maintaining hardware, software licenses, and in-house IT personnel.

The emergence of more secure and reliable internet services in major Syrian urban centers has further supported this shift, creating new opportunities for organizations to adopt cloud-based storage, software, and computing platforms. These services offer greater flexibility, enable remote work, and facilitate digital collaboration factors increasingly vital to organizational resilience and competitiveness in the modern digital economy.

Despite these encouraging trends, Syria's cloud computing landscape remains in its early stages and faces critical structural challenges. One of the most pressing issues is the lack of comprehensive academic research exploring the national cloud ecosystem, including the availability and performance of cloud service providers, the maturity of telecommunications infrastructure, and the regulatory and legal frameworks governing data privacy, cybersecurity, and service-level agreements (SLAs). As a result, organizations lack the necessary guidance, benchmarks, and localized case studies that could inform their cloud adoption strategies.

Additionally, Syria does not currently host major global cloud providers, which means that most cloud services are accessed through international platforms, raising concerns about data sovereignty, latency, and service reliability. The absence of localized data centers and national cloud infrastructure also increases dependence on cross-border data flows, which can complicate compliance with privacy standards and increase vulnerability to geopolitical risks.

Moreover, regulatory uncertainty remains a significant barrier to cloud adoption. There is currently no cohesive national strategy or legal framework specifically addressing cloud computing in Syria. This includes gaps in data protection laws, electronic transactions legislation, and cybersecurity policies, all of which are essential to building trust in cloud solutions, particularly for sectors that handle sensitive information such as finance, healthcare, and public administration.

Furthermore, there is a notable shortage of cloud-specific technical expertise within the Syrian labor market. Without targeted training programs and capacity-building initiatives in areas such as cloud architecture, DevOps, and data governance, the transition to cloud-based systems may be slow and uneven, especially outside major cities.

In summary, cloud computing in Syria presents both significant opportunities and persistent challenges. While the growing interest among Syrian businesses and institutions signals a readiness to embrace digital transformation, the country must address key issues related to infrastructure, regulation, academic research, and human capital. Strategic investments in these areas, coupled with partnerships between government, academia, and industry, are essential for enabling a secure, sustainable, and inclusive cloud ecosystem in Syria.

2.11 Emerging Trends in Cloud Computing for Developing and Fragile Economies

As the global cloud computing ecosystem continues to evolve, developing and fragile economies such as Syria are increasingly engaging with emerging trends that redefine both the technological landscape and policy considerations. These trends not only influence how cloud services are adopted but also shape the opportunities and challenges facing organizations seeking to modernize their operations. This section explores five key emerging trends relevant to the Syrian context: edge computing, green cloud infrastructure, artificial intelligence (AI)-driven cloud services, zero-trust security, and government-led digital transformation frameworks.

2.11.1 Edge Computing and Localized Cloud Services

Edge computing is an architecture that brings computation and data storage closer to data sources, such as end-users or edge devices, to improve response times and save bandwidth. For countries like Syria, where central cloud data centers may be geographically distant and connectivity remains unstable, edge computing provides a viable alternative to centralized cloud systems (Shin, 2013) .Research shows that Edge computing facilitates real-time data processing and ensures continuous service delivery, even in settings where internet connectivity is unreliable (Wang *et al.*, 2020). It is increasingly seen as a critical enabler for sectors particularly healthcare, logistics, and education within fragile and resource constrained environments (Ajayi, Bagula and Ma, 2019).

2.11.2 Green Cloud Infrastructure and Sustainability

Sustainability is a growing concern globally, and cloud computing has a vital role in reducing the carbon footprint of IT operations. According to the International Energy Agency (International Energy Agency, 2023), cloud data centers consume significantly less energy than traditional on-premise infrastructure due to optimized hardware usage and renewable energy integration. In fragile economies, adopting green cloud solutions can reduce energy costs and promote sustainable development (ESCWA, 2023). Initiatives such as carbon-aware cloud services and energy-efficient virtual machines are increasingly adopted to align IT goals with environmental targets (Radovanovic *et al.*, 2021).

2.11.3 Artificial Intelligence in Cloud Services

(World Bank, 2023)Cloud computing is now deeply intertwined with artificial intelligence, as many AI tools are deployed via cloud platforms. AI-enhanced cloud services can support advanced analytics, natural language processing, and automation, which are vital for organizations operating in resource-constrained settings (McKinsey & Company, 2023). For Syrian businesses, AI-powered cloud tools can significantly boost operational efficiency by automating customer service, enhancing supply chain transparency, and predicting market trends (Bahna and Szalay, 2025). Moreover, AI's role in e-government and public service delivery is becoming increasingly recognized in the Middle East (World Bank, 2023)

2.11.4 Zero-Trust Security and Compliance Models

As cybersecurity remains a major barrier to cloud adoption in developing countries, the zero-trust model is emerging as a strategic framework to address trust and access control issues (National Institute of Standards and Technology (NIST), 2020). Zero-trust security is based on the principle that no user or device should be inherently trusted, regardless of their location within the network perimeter. Implementing this model in the Syrian context could significantly reduce risks related to insider threats and unauthorized access to cloud-based systems. Recent studies underscore the increasing emphasis on security practices such as micro-segmentation, identity verification, and continuous authentication particularly in volatile or high-risk environments (Prasad *et al.*, 2022).

2.11.5 National Digital Strategies and Cloud Policy Frameworks

National cloud strategies are gaining traction as governments recognize the transformative potential of digital infrastructure. In Syria, recent policy discussions have emphasized the need for regulatory clarity, public-private partnerships, and cloud-first governance models (United Nations Economic and Social Commission for Western Asia (UN ESCWA), 2024). Examples from neighboring countries provide valuable blueprints: the UAE's "Cloud First Policy" and Saudi Arabia’s Vision 2030 both prioritize scalable cloud adoption in public services and national data protection laws (OECD, 2021). International organizations such as UNDP and ESCWA have advocated for cloud-centric digital transformation roadmaps in conflict-affected settings (United Nations Development Programme (UNDP), 2022; ESCWA, 2023).

2.12 Recent Developments and Scholarly Perspectives on Cloud Computing Adoption

Cloud computing adoption has experienced an unprecedented acceleration over the past five years, largely driven by technological evolution, global crises like the COVID-19 pandemic, and shifting strategic priorities in both public and private sectors. This section presents a comprehensive review of recent scholarly literature focusing on three central themes: artificial intelligence integration, cybersecurity with an emphasis on zero-trust frameworks, and public sector digital transformation. The discussion is grounded in regional analyses from the Middle East and North Africa (MENA) and Asia-Pacific.

2.12.1 Artificial Intelligence and Cloud Synergy

The integration of AI with cloud services has significantly redefined computing paradigms, enabling predictive analytics, intelligent automation, and scalable decision support systems. AI-driven cloud solutions are increasingly being adopted by businesses seeking real-time insights and automation capabilities (Parsaeefard, Tabrizian and Leon-Garcia, 2019). In the Asia-Pacific region, countries such as China have witnessed rapid deployment of AI-as-a-Service platforms within finance and e-commerce, with applications like generative AI tools increasingly used to boost operational efficiency and brand engagement in cross-border markets (Cui, 2024). In the MENA region, Saudi Arabia and the United Arab Emirates have made substantial investments in AI-integrated cloud infrastructure, positioning themselves as leading regional hubs for technological innovation and digital transformation (Albous, Al-

Jayyousi and Stephens, 2025). Studies also point to AI enhancing cloud security through behavior-based threat detection optimizing resource allocation and enabling adaptive compliance frameworks (Olaoye, 2025).

2.12.2 Zero-Trust Security and Cloud Adoption

The increasing adoption of cloud technologies, cybersecurity concerns have become more prominent. Zero-trust architectures (ZTAs) have gained traction as a leading security model, operating on the principle that no user or device whether internal or external to the network should be inherently trusted. (Ahmadi, 2024). This model aligns with the dynamic, multi-tenant nature of cloud environments and is increasingly adopted in Asia-Pacific enterprises (Seng, Wei and Ming, 2023). In the MENA region, ZTAs are particularly relevant for government and financial institutions where regulatory compliance is paramount (Hasan, 2024). Scholars argue that zero-trust principles not only reduce attack surfaces but also foster cultural shifts toward proactive risk management (Pigola and Meirelles, 2025) .Recent works explore how ZTAs support hybrid and multi-cloud architectures, integrate with AI for real-time authentication , and affect user experience and trust (Rodigari *et al.*, 2021).

2.12.3 Public Sector Cloud Transformation

Governments throughout the MENA and Asia-Pacific regions are progressively embracing cloud technologies to improve public service delivery, enhance transparency, and reduce operational costs. In the wake of the COVID-19 pandemic, national recovery agendas have increasingly prioritized digital governance initiatives and the expansion of e-government services (Abell, Husar and Lim, 2021). Case studies from Egypt and Jordan show how cloud platforms are used for digital identity systems, health informatics, and educational services (Saleh *et al.*, 2020). In countries like South Korea and Singapore, public cloud adoption has significantly improved the agility and responsiveness of citizen service platforms (Raghavan, Demircioglu and Taeihagh, 2021). However, challenges persist, especially around data sovereignty, procurement models, and skills shortages (Alaraj, 2025). Research also underscores the importance of legal and institutional frameworks that align with national strategies and cultural contexts (Gupta and Kumar, 2025).

3 MATERIALS AND METHODS

3.1 Research Model and Hypothesis

3.1.1 Research Model

This conceptual model as shown in Figure 6 illustrates the proposed relationships among technological, organizational, and environmental determinants and their influence on the behavioral intention to adopt cloud computing services within the Syrian context. Grounded in the Technology–Organization–Environment (TOE) framework, the model integrates seventeen hypotheses to systematically examine the multidimensional factors that affect cloud adoption decisions.

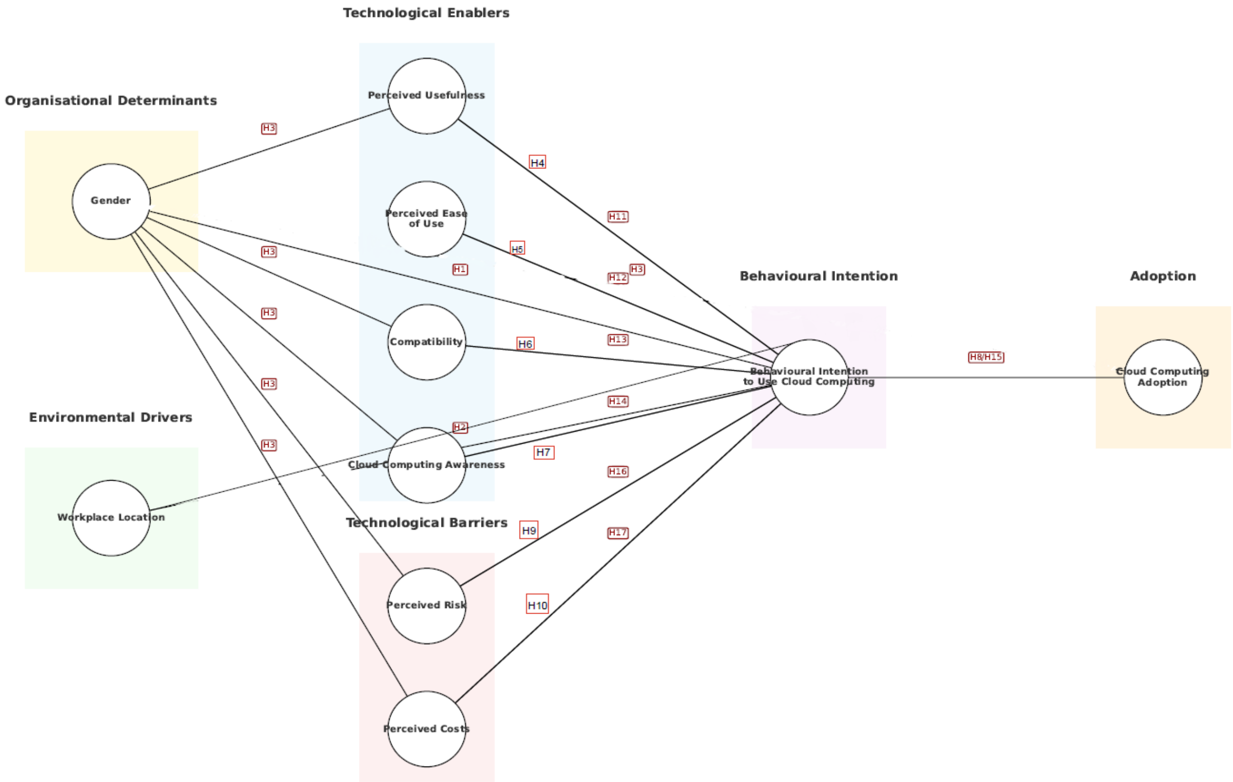

Figure 6: Research Model

Source: Author's own development

3.1.2 Research Hypotheses

Building on an integrated TAM–TOE framework, (Gangwar, Date and Ramaswamy, 2015) underscore that security perceptions are a key determinant in the adoption of cloud computing. Furthermore, (Xue, Ray and Gu, 2011) experimentally demonstrate that environmental uncertainty encompassing regulatory instability and infrastructural unpredictability significantly influences how organizations govern their IT infrastructure, highlighting the importance of context in shaping cloud adoption decisions. Usability and perceived benefit must be complemented by contextual feasibility (N. Phaphoom *et al.*, 2017). Institutional dynamics, such as national ICT agendas and governance capacity play a critical role in shaping how hypotheses are formulated in cloud computing research (Ali and Osmanaj, 2020). Additionally, emerging literature suggests digital literacy should be introduced as a control variable, particularly in countries undergoing digital transformation (Cetindamar, Abedin and Shirahada, 2024) .

Based on the proposed research model and an extensive review of relevant literature, seventeen statistical hypotheses (H1–H17) have been developed to examine the key factors that influence the adoption of cloud computing. These hypotheses are grounded in well-established theoretical frameworks and empirical evidence, aiming to investigate the relationships between technological, organisational, and environmental factors, as well as adoption pathways and the influence of behavioural intention on adoption perceptions.

The seventeen statistical hypotheses are grouped into six main categories that align with the core themes of the research model:

- Technological enablers of intention

H4: There is a significant relationship between behavioural intention to use cloud computing and perceived usefulness.

H5: There is a significant relationship between behavioural intention to use cloud computing and perceived ease of use.

H6: There is a significant relationship between behavioural intention to use cloud computing and compatibility.

H7: There is a significant relationship between behavioural intention to use cloud computing and cloud computing awareness.

- Technological barriers to intention

H9: There is a significant relationship between behavioural intention to use cloud computing and perceived risk.

H10: There is a significant relationship between behavioural intention to use cloud computing and perceived costs.

- Organisational determinants

H1: Gender significantly determines behavioural intention to use cloud computing.

H3: Gender significantly determines behavioural intention to use cloud computing, perceived usefulness, compatibility, cloud computing awareness, cloud computing adoption, perceived risk, and perceived costs.

- Environmental/contextual drivers

H2: The location of the workplace significantly determines behavioural intention to use cloud computing.

- Adoption pathway (intention → adoption)

H8: There is a significant relationship between behavioural intention to use cloud computing and cloud computing adoption.

H15: Behavioural intention to use cloud computing significantly determines cloud computing adoption.

- Impact of behavioural intention on adoption perceptions

H11: Behavioural intention to use cloud computing significantly determines perceived usefulness.

H12: Behavioural intention to use cloud computing significantly determines perceived ease of use.

H13: Behavioural intention to use cloud computing significantly determines compatibility.

H14: Behavioural intention to use cloud computing significantly determines cloud computing awareness.

H16: Behavioural intention to use cloud computing significantly determines perceived risk.

H17: Behavioural intention to use cloud computing significantly determines perceived costs.

3.2 Methodology of the Research

3.2.1 Overview

This study employs a two-phase design, beginning with an exploratory investigation followed by a comprehensive empirical analysis. By integrating both qualitative and quantitative methods, the research aims to deliver robust statistical analysis while capturing in-depth contextual insights into cloud computing adoption in Syria. This mixed-methods approach ensures a holistic understanding of the research problem. (Creswell and Creswell, 2018) argue that pragmatism provides the necessary flexibility for mixed-methods research, allowing researchers to prioritize research questions over methodological purity.

3.2.2 Preliminary (Exploratory) Research

Prior to launching the main survey, an exploratory phase was undertaken to investigate the local landscape of cloud computing adoption in Syria. Due to the limited academic research in this context, this phase aimed to:

- Gauge awareness and perceptions of cloud computing among Syrian IT professionals
- Identify perceived enablers and barriers to adoption
- Assess the clarity and relevance of the initial survey instrument
- Adapt and validate the TOE and TAM frameworks for the Syrian environment

Interviews were conducted with IT managers, professionals, and decision-makers across various sectors. Interviewees expressed concerns over vendor trust, infrastructural limitations, cultural resistance to change, and misconceptions around costs. These insights were instrumental in refining the research model and hypotheses.

3.2.3 Empirical Research Design

The empirical phase followed the exploratory research and was designed to test the developed hypotheses and validate the proposed conceptual model. This phase utilized a mixed-methods strategy, integrating structured survey data with qualitative insights to ensure both breadth and depth in data interpretation.

3.2.4 Qualitative Research

The qualitative component consisted of in-depth interviews conducted during the exploratory phase. These interviews yielded nuanced, context-specific insights that complemented the quantitative analysis. Key themes that emerged included:

- Widespread awareness of cloud benefits such as scalability and cost efficiency
- Misconceptions among leadership viewing the cloud as a non-essential luxury
- Concerns about data sovereignty, vendor reliability, and security
- Infrastructure limitations, including unreliable internet and a lack of local data centers
- Cultural inertia and leadership's reluctance to adopt new technologies
- Apprehension around vendor lock-in and long-term financial commitment

These qualitative findings were pivotal in understanding local adoption dynamics and refining the survey instrument.

3.2.5 Quantitative Research

The quantitative analysis served as the primary method for hypothesis testing. A structured questionnaire, aligned with the TOE and TAM frameworks, was distributed to 400 IT professionals and organizational decision-makers across different sectors in Syria.

The survey captured data across the following domains:

- Technological factors (e.g., perceived usefulness, compatibility, cost)
- Organizational factors (e.g., IT infrastructure readiness, organizational culture, employee training)
- Environmental factors (e.g., competitive pressure, regulatory support, vendor trust)
- Behavioral intention to adopt cloud computing

Responses were collected using a 5-point Likert scale and analyzed using SPSS. Both descriptive and quantitive statistical methods were employed, including Pearson correlation and ANOVA, to determine the strength and significance of relationships.

Key findings revealed that:

- Organizational readiness (infrastructure, support, and training) had the strongest influence on adoption intentions
- Technological factors, such as perceived usefulness and cost, showed no significant statistical impact
- Environmental factors yielded inconsistent or minimal influence

3.2.6 Data Sources

3.2.6.1 Primary Data

The primary data for this study consists of original information collected specifically to address the research objectives. This includes:

- Quantitative data obtained from a structured survey distributed to 400 participants. The primary data were collected via an online survey using Google Forms over the period from October 2024 to December 2024
- Qualitative data derived from in-depth interviews with IT professionals and decision-makers
  Both forms of data are context-specific and directly aligned with the research scope, offering firsthand insights into cloud adoption in Syria.

3.2.6.2 Secondary Data

Secondary data were primarily used to support the literature review and establish the broader contextual background of the study. This included:

- Peer-reviewed academic literature (e.g., (Srivastava and Nanath, 2017;Atobishi et al., 2021))
- Governmental and industry reports (e.g., MCIT Egypt, IDC, Arabian Computer News)
- Case studies from neighboring countries such as Egypt, Jordan, and the UAE these materials helped refine the theoretical model and offered comparative insights into regional adoption patterns. Nonetheless, the empirical findings and analysis in this thesis are based entirely on the primary data collected by the researcher.

3.2.7 Target Population

Identifying a clear and relevant target population is essential for ensuring the validity and applicability of research findings. For this study, the target population comprises individuals employed in Syrian-based organizations whose professional roles are directly related to IT services. These shared characteristics help ensure consistency in the data collected and align the sample with the research objectives.

The total sample size selected for the study is 400 respondents.

3.2.8 Sample Frame

Once the target population has been identified, the researcher constructs a sample frame comprising all individuals who meet the inclusion criteria. In this study, the sample frame includes employees working in Syrian organizations whose job functions are directly related to IT services. This frame ensures that the selected sample is representative of the population relevant to the research objectives.

- behavioural intention to use

This refers to an organization's willingness and preparedness to adopt cloud computing technologies, often shaped by perceived benefits, system compatibility, and environmental factors (Alshamaila, Papagiannidis and Li, 2013). (Oliveira, Thomas and Espadanal, 2014) further define this construct as the degree to which firms intend to implement cloud computing solutions, influenced by technological, organizational, and environmental dynamics.

- perceived usefulness

(Gangwar, Date and Ramaswamy, 2015) suggest that the greater the alignment between cloud computing platforms and the internet, the more organizations can maximize the benefits of cloud adoption while simultaneously reducing user uncertainty regarding new technology. Consequently, when implementing a cloud computing model, it is essential to assess whether the new technology is compatible with the organization's existing technological infrastructure.

(Davis, 1989) defines perceived usefulness as the extent to which a user believes that a particular technology will enhance their job performance. This perception is strongly influenced by the relative advantages within the technological context. The mobility offered by cloud computing enables users to access data and perform tasks from any location, provided they have an internet connection and a compatible device. Additionally, users are not required to own a personal computer to utilize cloud services, making technology more accessible and cost-effective. As a result, perceived usefulness positively influences behavioral intention and user attitude, as it contributes to time and cost savings. Furthermore, compatibility with existing systems plays a crucial role in shaping perceived usefulness, further encouraging adoption.

(Shin, 2013) highlights that cloud computing enables users to access content, information, and services anytime and anywhere. This seamless accessibility enhances perceived availability, which users often associate with the usefulness and benefits of cloud technology. Additionally, perceived availability fosters a sense of psychological readiness, as users feel assured that computing resources are readily accessible whenever needed. Consequently, the ubiquitous nature of cloud computing strengthens its perceived usefulness, making it a more valuable and convenient solution for users.

- perceived ease of use

(Gangwar, Date and Ramaswamy, 2015) By implementing a cloud computing system, companies can eliminate the need for annual maintenance and administration of their IT infrastructure, significantly reducing operational costs. Additionally, cloud computing provides pay-as-you-go services, allowing organizations to scale usage based on their current needs, ensuring cost efficiency and flexibility.

Perceived ease of use refers to the degree to which an individual believes that using a particular technology or system will require minimal mental and physical effort. It is closely linked to self-efficacy, which represents an individual's confidence in their ability to successfully execute the necessary actions to navigate and manage potential situations effectively (Davis, 1989).

- compatibility

Rogers' Diffusion of Innovation (DOI) theory emphasizes that compatibility is a key factor in technology adoption, as organizations are more inclined to adopt innovations that integrate smoothly with their existing operations and workflows (Rogers, Singhal and Quinlan, 2014).

According to (Lin and Chen, 2012) when adopting new technologies, early adopters have primarily focused on the anticipated benefits of the innovation and its compatibility with the organization's existing environment and infrastructure

- cloud computing awareness

(Gangwar, Date and Ramaswamy, 2015) emphasize that cloud computing awareness is a critical factor in technology adoption. A higher level of awareness enhances perceived usefulness and ease of use, both of which significantly influence adoption intention. These factors are central to widely recognized models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT).

Similarly, (Alshamaila, Papagiannidis and Li, 2013) , in their study on cloud adoption in SMEs, found that a lack of awareness is a significant barrier to adoption, as organizations with low cloud literacy struggle to evaluate security, cost, and performance implications.

From the perspective of the Technology-Organization-Environment (TOE) framework, (Oliveira, Thomas and Espadanal, 2014) emphasize that organizational readiness, which encompasses awareness of cloud computing benefits and risks, plays a crucial role in adoption decisions.

Therefore, cloud computing awareness extends beyond simply understanding cloud services; it also involves recognizing its strategic significance, potential risks, and impact on business efficiency, security, and scalability.

- cloud computing adoption

Cloud computing adoption refers to the process by which individuals, businesses, or organizations accept, integrate, and utilize cloud-based technologies for their operations. It involves the decision-making process regarding the selection, implementation, and sustained use of cloud computing solutions, influenced by various technological, organizational, and environmental factors.

According to (Oliveira, Thomas and Espadanal, 2014), cloud computing adoption is shaped by factors such as technological readiness, security concerns, cost benefits, and organizational capability. Organizations that perceive cloud computing as compatible with their existing IT infrastructure and business strategies are more likely to adopt and integrate it into their operations.

- perceived risk

Perceived risk in cloud computing refers to an individual's or organization's subjective assessment of potential threats and uncertainties associated with adopting cloud-based technologies. These risks include concerns about data security, privacy, service reliability, financial loss, and compliance with regulatory standards.

According to (Featherman and Pavlou, 2003), perceived risk is a critical factor influencing technology adoption decisions, as users weigh the potential benefits against possible threats. In the context of cloud computing, security risks, loss of control over data, and service downtime are among the most common concerns affecting adoption behavior (Gupta, Seetharaman and Raj, 2013).

- Costs

From the perspective of the Technology-Organization-Environment (TOE) framework, (Oliveira et al., 2014) emphasize that cost considerations are a key determinant in cloud adoption particularly for small and medium-sized enterprises (SMEs), where financial limitations often influence IT investment strategies.

Likewise, (Low, Chen and Wu, 2011) highlight that cost savings from cloud computing are contingent on multiple factors, including usage patterns, service level agreements (SLAs), and the level of customization required. While cloud adoption can lead to lower IT operational costs, organizations must carefully assess the total cost of ownership (TCO) to prevent unexpected financial burdens.

Investigating the above-mentioned variables, it is observed that there is one dependent variable, which is behavioural intention to use, and the other variables are independent variables. Through these variables, the researcher investigates whether behavioural intention to use is affected by perceived usefulness, perceived ease of use, cloud computing awareness, cloud computing adoption, perceived risk and costs.

Table 1 below consists of the variables that are used for the research:

Table 1: The summary of variables used in the primary research

Source: Author's own development

Variable name	Dependent/Independent	Short explanation	Variable type
behavioural intention to use	dependent	The extent it which the user intends to use cloud computing.	scale variable, 1: totally disagree, 5: totally agree
perceived usefulness	independent	The extent of usefulness of cloud computing	scale variable, 1: totally disagree, 5: totally agree

		perceived by the user.	
perceived ease of use	independent	The degree to which the cloud computing user thinks it is easy.	scale variable, 1: totally disagree, 5: totally agree
compatibility	independent	The extent to which cloud computing is perceived as being consistent with the existing needs values and past experiences	scale variable, 1: totally disagree, 5: totally agree
cloud computing awareness	independent	The level of awareness in relation to cloud computing among users.	scale variable, 1: totally disagree, 5: totally agree
cloud computing adoption	independent	The future plans of the users in relation to cloud computing.	scale variable, 1: totally disagree, 5: totally agree
perceived risk	independent	The extent of privacy and security assured by cloud computing as perceived by the user.	scale variable, 1: totally disagree, 5: totally agree
cost	independent	The cost is related to the adoption of cloud computing.	scale variable, 1: totally disagree, 5: totally agree

The presented variables are the most relevant factors that might have an influence on the cloud computing adoption in the case of Syrian companies. Each variable is investigated through different statements where the participants of the research are asked to provide their answers on a five-point scale where 1 means totally disagree and 5 means totally agree. Due to the use of five-point scales to investigate the variables, the potential relationship between the presented variables can be examined through different techniques. As many studies have investigated the above-mentioned factors, the models used in these studies can also be examined, and the results can be compared.

3.2.9 Sampling Strategies for Primary Data Collection

Once the sample frame is selected, the researcher has to decide which sampling method to apply. Viral data can be achieved through inappropriate sampling techniques and this is the reason why the applied technique or techniques have to be selected carefully. As the topic of the current research is complex, the following techniques are applied:

- Cluster sampling: the population is divided into different clusters by the researcher, and then, one or more clusters will be selected randomly. This is a probability sampling method.

  According to (Jackson, 2011). Cluster sampling includes identifying a cluster of participants showing the population and their composition in the sample group**.**

- Convenience sampling: the researcher selects those members of the sample who are the easiest to reach, for example due to the willingness of the potential participants, the available time, or the geographical proximity. This is a non-probability sampling method.

  According to (Etikan, Musa and Alkassim, 2016), this method is often used when quick, cost-effective data collection is needed, especially in early exploratory research. More recently, convenience sampling has been highlighted as particularly pertinent in digital and conflict-affected contexts where logistical, infrastructural, or security challenges limit access to randomized samples. However, despite its practicality, convenience sampling may introduce sampling bias and limit the generalizability of findings due to the lack of random selection. Researchers are therefore encouraged to apply triangulation and cross-validation strategies to enhance the robustness of studies employing this method (Hair Jr, Howard and Nitzl, 2020).

- Systematic sampling: it is easy to use, in addition, it covers a wide range of the population as the researcher selects the sample members based on a regular interval which was defined in advance. This is a probability sampling method.
  As described by (Acharya *et al.*, 2013), this method is both efficient and easy to implement, especially when dealing with large populations. However, it may introduce bias if there is a hidden pattern in the population list that coincides with the sampling interval.

3.2.10 The Questionnaire

The questionnaire is divided into three major parts: demographic information, organization information and cloud information. In total, it consists of 36 questions, all are closed questions. In relation to question types, the following are applied: one-choice questions, multiple-choice questions, five-point Likert-scale questions.

In relation to demographic information, the gender, the age, the location, the years of cloud experience, the job position, and the primary involvement with cloud computing are examined.

Regarding organization information, the participants are asked about the size of their company, the age of their company, the location of the headquarters, the market scope and the primary business type.

The cloud information part of the questionnaire is divided into two additional parts. The first part of the questions investigates the implementation process and the experiences of the company in relation to cloud computing services, moreover, the future plans and the related objectives are covered too. The second part of the questionnaire includes the variables of the research. The participants of the research are required to mark on a five-point scale the extent to which they agree with the given statements in relation to the following topics: behavioural intention to use, perceived usefulness, perceived ease of use, cloud computing awareness, cloud computing adoption, perceived risk and costs.

3.2.11 Suitability of Statistical Methods and Assumption Testing

Before applying inferential statistical methods, it was necessary to examine whether the dataset met the assumptions required for parametric analyses such as ANOVA. While Likert-type data are technically ordinal, they are commonly treated as interval-level when based on large samples. The present study is based on 400 valid responses, which, under the Central Limit Theorem, provides sufficient robustness for parametric procedures. Nevertheless, assumption testing was formally conducted to ensure methodological correctness.

The distribution of each dependent variable was assessed using a combination of statistical and graphical methods. Specifically, the Shapiro–Wilk test was conducted within each group, while visual inspections through histograms and Q–Q plots were complemented by a review of skewness and kurtosis statistics, with values within ±2 considered acceptable for approximate normality (George and Mallery, 2010). Equality of variances across groups was then tested using Levene's test; when Levene's test was non-significant ($p \geq .05$), the standard one-way ANOVA was applied, and when significant ($p < .05$), the Welch ANOVA was used as a robust alternative. To further strengthen the analysis, non-parametric methods were also employed as robustness checks, with the Mann–Whitney U test used for two-group comparisons and the Kruskal–Wallis H test applied for comparisons involving more than two groups. When overall group differences were statistically significant, Tukey's HSD test was applied in cases of equal variances, while Games–Howell tests were used when variances were unequal.

By systematically applying these diagnostic procedures combining Shapiro–Wilk tests, skewness and kurtosis measures, histograms, Q–Q plots, and Levene's test, and supplementing ANOVA with Welch or non-parametric alternatives where required the analysis maintains both methodological rigor and interpretive clarity. The complete diagnostic results and supporting visualizations are presented in Appendix A2 titled "Analysis3" and "Visual Diagnostics". Although Tukey's HSD and Games–Howell procedures were specified as part of the analytic strategy, in practice they were only applicable where more than two groups existed; for hypotheses involving only two groups (e.g., gender and workplace), post hoc testing was not required. These methodological decisions were consistently applied across hypothesis testing (see Chapter 4, Sections 4.3 and 4.4), where both parametric and non-parametric results are reported to demonstrate robustness. Nonetheless, it is acknowledged that the use of parametric tests on Likert-type data remains debated in methodological literature; this study mitigates such concerns by systematically applying assumption checks and confirming results with non-parametric alternatives.

3.3 Syrian Background

3.3.1 Demographics

According to the most recent World Bank estimates(World Bank, 2025), Syria's population stands at approximately 22.1 million people. Gender distribution remains relatively balanced, with 49.8% males and 50.2% females, maintaining the parity observed in earlier reports (United Nations High Commissioner for Refugees (UNHCR), 2023). However, updated demographic data disaggregated at the governorate level remains scarce due to ongoing conflict and challenges in comprehensive nationwide data collection (United Nations Development Programme (UNDP), 2024).

The latest detailed distribution across Syrian governorates is still based on the Syrian Central Bureau of Statistics (Syrian Central Bureau of Statistics, 2017), records, reflecting the population as of 2016. Although temporal discrepancies exist, reliance on this dataset remains justifiable for research purposes, particularly given the relative stability of internal distribution patterns among non-displaced populations (Etikan, Musa and Alkassim, 2016) .Sampling strategies thus utilize proportional governorate representations to approximate societal structure in the study. Minor shifts due to displacement or migration are acknowledged but deemed non-significant for the analytical goals of this research (United Nations High Commissioner for Refugees (UNHCR), 2023). This approach aligns with methodological recommendations for conflict-affected contexts where real-time census data is unavailable (Creswell and Creswell, 2018; Hair Jr, Howard and Nitzl, 2020).Furthermore, demographic trends indicate that approximately 32% of Syria's population is under 15 years of age, 61% falls between 15 and 64 years, and 7% is over 65 years (UNICEF, 2024). The implications of these figures for technology adoption patterns, including cloud computing, warrant particular attention as they suggest a predominantly youthful workforce with potential for digital skill acquisition, yet facing infrastructural and economic barriers(World Bank, 2025).

3.3.2 Estimated Population of Syria by Governorate (2025)

This Table 2 presents the estimated population distribution across Syria’s governorates in 2025. Figures are derived from international organizations’ projections and national statistical data, considering the impact of conflict-related displacement and migration patterns.

Table 2: Estimated Population of Syria by Governorate (2025)

Source: Author’s own development based on data from (Worldometer, 2025), and Syrian Central Bureau of Statistics (latest available estimates).

Governorate	Estimated Population (Thousands)	Percent
Aleppo	4,513	17.6
Rural Damascus	3,576	14.0
Damascus	2,111	8.2
Homs	1,903	7.4
Hama	2,021	7.9
Latakia	1,486	5.8
Idlib	1,476	5.8
Al-Hasakeh	1,656	6.5
Deir ez-Zor	1,148	4.5
Tartous	1,137	4.4
Raqqa	871	3.4
Daraa	863	3.4
As-Suwayda	520	2.0
Quneitra	83	0.3
Total	25,368	100

3.3.3 Gender and Age Distribution in Syria (2025)

Recent demographic data as descried in Figure 7 indicates that Syria's population in 2025 is estimated at approximately 22.5 million individuals, reflecting a slight growth compared to previous years despite ongoing conflict and migration challenges (World Bank, 2025). The gender distribution remains almost balanced, with 50.1% females and 49.9% males (United Nations Children’s Fund (United Nations Children’s Fund (UNICEF), 2025) The age structure highlights the country's youthful demographic profile, with around 30% of the population under the age of 15, approximately 62% between the productive ages of 15 and 64, and about 8% aged 65 and above (United Nations Development Programme (UNDP), 2025). These figures underscore the significant potential of the working-age population while also emphasizing the developmental needs of the youth segment, particularly in areas related to education, employment, and digital literacy (World Bank, 2025). The demographic trends are also influenced by internal displacement and refugee movements, which have affected the natural age and gender distribution, particularly in urban centers and conflict-affected regions (United Nations High Commissioner for Refugees (UNHCR), 2023). Consequently, any policy planning, cloud computing adoption strategies, or digital transformation initiatives must carefully consider these sociodemographic realities to ensure inclusivity and sustainability.

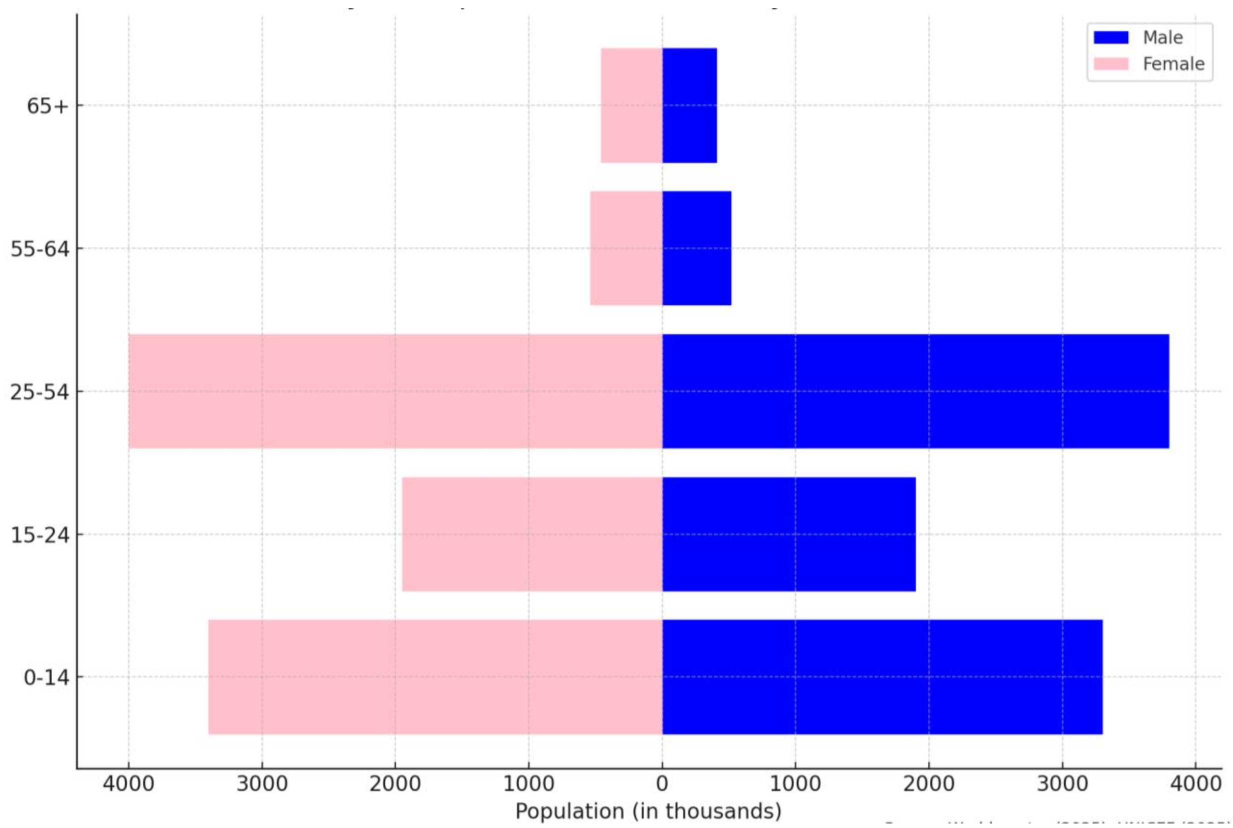

Figure 7: Syrian population distribution (2025)(Worldometer, 2025)

Given the predominantly youthful demographic structure in Syria, there exists substantial potential for technology-driven societal advancement. The concentration of the population within the 15–64 age range indicates a workforce that is not only digitally adaptable but also increasingly exposed to mobile technologies and internet services (United Nations Children's Fund (UNICEF), 2025) . However, the country's post-conflict realities including infrastructure fragility, economic constraints, and educational disruptions pose significant challenges to the adoption of advanced digital innovations such as cloud computing (World Bank, 2025). Understanding these sociodemographic dynamics is therefore crucial in formulating strategies that facilitate technology diffusion while addressing digital inequalities. Future cloud computing initiatives in Syria must prioritize digital skill development among youth populations, gender-sensitive ICT policies, and equitable access frameworks to ensure broader societal engagement and sustainable adoption (United Nations Development Programme (UNDP), 2025).

3.3.4 Education Based on Gender Distribution in Syria (2025)

Education remains a cornerstone for Syria's post-conflict recovery, and gender-based educational indicators reveal both resilience and challenges. According to UNICEF (United Nations Children's Fund (UNICEF), 2025) and the UNDP (United Nations Development Programme (UNDP), 2025), the literacy rate among Syrian youth aged 15–24 has remained relatively high despite a decade of conflict, standing at approximately 94% for males and 91% for females. Primary and lower secondary school enrollment rates show marginal gender gaps, with female enrollment rates reaching nearly 89% compared to 91% for males (World, 2025). However, gender disparities become more pronounced at higher levels of education. In tertiary education, male enrollment exceeds female enrollment by roughly 8%, with 58% of male youth pursuing university studies compared to 50% of females (United Nations Children's Fund (UNICEF), 2025). Socioeconomic factors, early marriage, and localized instability contribute significantly to the dropout rates among female students, particularly in rural and conflict-affected areas (United Nations Development Programme (UNDP), 2025).

Nevertheless, international and national initiatives aimed at promoting female education, including scholarship programs and ICT-based distance learning solutions, are gradually narrowing the gap (World Bank, 2025). The observed gender distribution suggests that any technology-driven development plans, such as cloud computing expansion in Syria, must be sensitive to educational gender dynamics to achieve equitable digital inclusion.

3.4 Bibliometric Analysis

Bibliometric analysis represents a rigorous quantitative approach to systematically evaluating scholarly literature (Zupic and Čater, 2015; Donthu *et al.*, 2021). It facilitates the mapping of intellectual structures, the identification of influential works, the detection of emerging research trends (Chen, 2017), and the recognition of critical gaps within a field. This chapter employs bibliometric methods to investigate the global development of cloud computing adoption research, with a particular focus on the Syrian context. Data were extracted from Google Scholar and the Web of Science Core Collection.

3.4.1 Data Collection

The literature search involved two principal databases. Google Scholar was queried using targeted keywords, including 'cloud computing adoption,' 'TOE framework cloud computing,' 'technology adoption model cloud computing,' 'SaaS adoption,' and 'cloud computing Syria,' yielding approximately 250 articles published between 2010 and 2024. A parallel search was conducted in the Web of Science Core Collection, applying specific queries to retrieve 820 articles related to cloud computing adoption within the Technology-Organization-Environment (TOE) framework (Mongeon and Paul-Hus, 2016). Records were exported with full bibliographic metadata and cited references.

3.4.2 Data Preprocessing

Prior to analysis, extensive data cleaning procedures were undertaken to enhance the integrity and reliability of the bibliometric mappings. Author name variations were unified to ensure accurate attribution, and similar keywords were standardized to consolidate related research themes. Generic and trivial stopwords were systematically removed, and a thesaurus file was developed to group synonymous terms. These preprocessing steps were critical to eliminating redundancy and ensuring that the resulting analyses accurately represented the field's intellectual structure.

3.4.3 Bibliometric Analysis Tool

VOSviewer was employed as the primary bibliometric analysis tool in this study (Van Eck and Waltman, 2010). It was utilized to construct and visualize keyword co-occurrence networks, author collaboration patterns, and citation networks within the cloud computing adoption research landscape. The software enabled the identification of major thematic clusters, the mapping of intellectual structures, and the visualization of scholarly collaborations across institutions and regions (Cobo *et al.*, 2011). By leveraging VOSviewer's capabilities in network visualization, density visualization, and overlay visualization, this study systematically uncovered the evolving research trends, prominent contributors, and interconnected areas of inquiry critical to understanding the development of cloud computing adoption globally and within the Syrian context.

4 RESULTS AND DISCUSSIONS

At first, the results will be presented through descriptive statistics, and then, the hypotheses of the research will be tested.

4.1 Descriptive Statistics

The first questions in Table 3 investigate the demographic characteristics of the respondents. Regarding gender, the 52.8% of the sample are female, the 47.3% are male

Table 3: The gender of the respondents

Source: Author's own development

1- What is your gender?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	189	47,3	47,3	47,3
	female	211	52,8	52,8	100,0
	Total	400	100,0	100,0	

The most respondents as shown Table 4 belong to the 31-45 years group, their share is 86.5% while the 13.5% of the sample are between 19 and 30 years. There are no participants who are younger than 19 years old or who are older than 45 years old.

Table 4: The age group of the respondents

Source: Author's own development

2- How old are you?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	19-30 years	54	13,5	13,5	13,5
	31-45 years	346	86,5	86,5	100,0
	Total	400	100,0	100,0	

Based on workplace location as presented in Table 5, the respondents can be divided into two groups: in case of the 83.8% of the sample members, the workplace is located in the capital, and for the 16.3% of the respondents, it is located in a city.

Table 5: The workplace location of the respondents

Source: Author's own development

3- What is the location of your workplace?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	capital	335	83,8	83,8	83,8
	city	65	16,3	16,3	100,0
	Total	400	100,0	100,0	

The next question as shown in Table 6 investigates how many years of Cloud experience the respondents have. The 21.8% of the sample have less than 1 year Cloud experience, the 17.5% of them have 1-3 years experiences, the 26.0% of them have 4-6 years experiences, the 14.0% of them have 7-10 years experiences, and the 20.8% of them have more than 10 years experiences.

Table 6: How many years of Cloud experience do you have?

Source: Author's own development

4- How many years of Cloud experience do you have?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 year	87	21,8	21,8	21,8
	1-3 years	70	17,5	17,5	39,3
	4-6 years	104	26,0	26,0	65,3
	7-10 years	56	14,0	14,0	79,3
	more than 10 years	83	20,8	20,8	100,0
	Total	400	100,0	100,0	

The questionnaire also investigates the job positions of the respondents as per Table 7: the 7.8% of them is an owner/CEO, the 12% of them as a manager/team leader, the 13.5% of them as a Software Developer/QA Analyist, the 34.3% of them as a DevOps/System Administrator, and the 32.5% of them are in other type of position.

Table 7: The job position of the respondents

Source: Author's own development

5- What is your job position?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Owner/CEO	31	7,8	7,8	7,8
	Manager/Team leader	48	12,0	12,0	19,8
	Software Developer/QA Analyst	54	13,5	13,5	33,3
	DevOps/System Administrator	137	34,3	34,3	67,5
	Other	130	32,5	32,5	100,0
	Total	400	100,0	100,0	

The involvement level of the respondents with Cloud computing is various: Table 8 shows that the 24.8% of them are Cloud provider end user, the 20.8% of them are Cloud provider administrator, the 46.3% of them are IT/Developer, and the 8.3% of them are Partner.

Table 8: Which describes your primary involvement with Cloud computing the best?

Source: Author's own development

6- Which describes your primary involvement with Cloud computing the best?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cloud provider end user	99	24,8	24,8	24,8
	Cloud provider administrator	83	20,8	20,8	45,5
	IT/Developer	185	46,3	46,3	91,8
	Partner	33	8,3	8,3	100,0
	Total	400	100,0	100,0	

The participants of the research work for companies with different size: Table 9 shows that the 20.3% of them work for a company with less than 10 employees, the 9.5% of them for a company with 11-50 employees, the 30.0% of them for a company with 51-250 employees, and the most of them (40.3%) for a company with more than 250 employees.

Table 9: What is the size of the company?

Source: Author's own development

7- What is the size of the company?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 10 employees	81	20,3	20,3	20,3
	11-50 employees;	38	9,5	9,5	29,8
	51-250 employees;	120	30,0	30,0	59,8
	More than 250 employees	161	40,3	40,3	100,0
	Total	400	100,0	100,0	

Regarding the age of the company, Table 10 shows that the 36.3% of the respondents work for a company which is older than 20 years old, the 30.0% of them for a 11-20 years old company, the 20.5% of them for a 5-10 years old company, and the 13.3% of them for a company which is less than 5 years old.

Table 10: How old is the company?

Source: Author's own development

8- How old is the company?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	53	13,3	13,3	13,3
	5-10 years	82	20,5	20,5	33,8
	11-20 years	120	30,0	30,0	63,7
	More than 20 years	145	36,3	36,3	100,0
	Total	400	100,0	100,0	

The next question investigates the location of the company's headquarters. Table 11 shows that most of them (94.0%) are located in Damascus Governorate, 2.5% os Latakia Governorate, and 3.5% in Rif Dimashq Governorate.

Table 11: Where is the headquarters of the company?

Source: Author's own development

9- Where is the headquarters of the company?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Damascus Governorate	376	94,0	94,0	94,0
	Latakia Governorate	10	2,5	2,5	96,5
	Rif Dimashq Governorate	14	3,5	3,5	100,0
	Total	400	100,0	100,0	

Table 12 shows that the share of the companies whose market scope is the local market is 33%. In case of the 34.0% of the companies, the scope is the international market while the 17.3% of them focuses on the national market.

Table 12: What is the market scope of the organization?

Source: Author's own development

10- What is the market scope of the organization?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	local	132	33,0	33,0	33,0
	national	69	17,3	17,3	50,2
	international	136	34,0	34,0	84,3
	both national and international	63	15,8	15,8	100,0
	Total	400	100,0	100,0	

The next question as presented in Table 13 investigates the primary business type of the companies. Based on the answers, the 5.3% of the companies operate in the food industry, the 9.0% of them in the construction industry, the 2.5% of them in the education industry, the 11.5% of the in the financial sector, the 3.3% of them in the governmental sector, the 10.0% of them in the non-profit sector, the 3.8% in the healthcare sector, the 2.5% of them in the manufacturing industry, the 2.5% of them in professional and business services, the 3.5% of the them in sales and marketing, the 16.3% of them in the telecommunications industry, the 8.3% of them in transportation, the 16.0% of them in the banking sector, and the 2.5% of them in other sector.

Table 13: What is the primarily business type at the company?

Source: Author's own development

11- What is the primarily business type at the company?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	food	21	5,3	5,3	5,3
	construction	36	9,0	9,0	14,2
	education	10	2,5	2,5	16,8
	financials	46	11,5	11,5	28,2
	government	13	3,3	3,3	31,5
	non-profit	40	10,0	10,0	41,5
	healthcare	15	3,8	3,8	45,3
	information technology	13	3,3	3,3	48,5
	manufacturing	10	2,5	2,5	51,0
	other	10	2,5	2,5	53,5
	professional and business services	10	2,5	2,5	56,0
	sales and marketing	14	3,5	3,5	59,5
	telecommunication	65	16,3	16,3	75,8
	transportation	33	8,3	8,3	84,0
	banking	64	16,0	16,0	100,0
	Total	400	100,0	100,0	

Table 14 shows that all companies where the respondents work use cloud-based solutions, which means that the answers are valuable from the perspective of investigating the opinions and experiences in relation to these services.

Table 14: Does your company use cloud-based solutions?

Source: Author’s own development

12- Does your company use cloud-based solutions?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	400	100,0	100,0	100,0

The next question as per Table 15 investigates since when the companies use cloud-based solutions: the 12.5% of them for less than 1 year, the 14.2% of them for 1-3 years, the 20.3% of them for 4-5 years, the 25.5% of them for 6-10 years, and the 27.5% of them for more than 10 years.

Table 15: Since when has your company used cloud-based solutions?

Source: Author’s own development

13 - Since when does your company use cloud-based solutions?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 year	50	12,5	12,5	12,5
	1-3 years	57	14,2	14,2	26,8
	4-5 years	81	20,3	20,3	47,0
	6-10 years	102	25,5	25,5	72,5
	10+ years	110	27,5	27,5	100,0
	Total	400	100,0	100,0	

The questionnaire also examines which cloud computing services are used at the companies where the respondents work as shown in Figure 8 . Based on the answers, 57.75% of the companies use Storage as a Service (SaaS), 57.5% of them use Software as a Service (SaaS), 55.75% of them use Infrastructure as a Service (IaaS). 47.25% of them Network as a Service (NaaS), 41.0% of them Platform as a Service (PaaS), 25.0% of them Database as a Service (DaaS), 13.50% of them Disaster Recovery as a Service (DRaaS), and 12.0% of them Business Process as a Service (BPaaS).

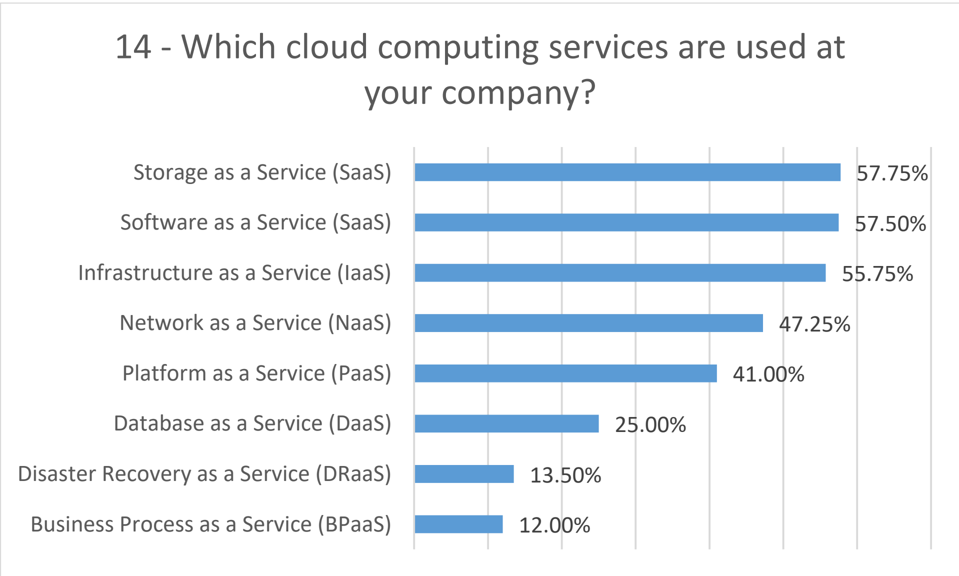

Figure 8: Which cloud computing services are used at your company?

Source: Author's own development

The next question as shown in Figure 9 investigates which applications have been moved to the Cloud at the companies the respondents work for. Based on the answers, in case of the 57.0% of the companies, Desktop Applications have been moved to the Cloud, in case of the 52,5-52,5% of them E-mail and E-mail Archiving, in case of the 49.50% of them Storage, in case of the 38.25% of them the ERP, in case of the 28.25% of them Security, in case of the

22.25% of them Sales Management, in case of the 21.75% of them Scheduling/Calendars, in case of the 15.75% of them the CRM, and in case of the 15.50% of them Continuity.

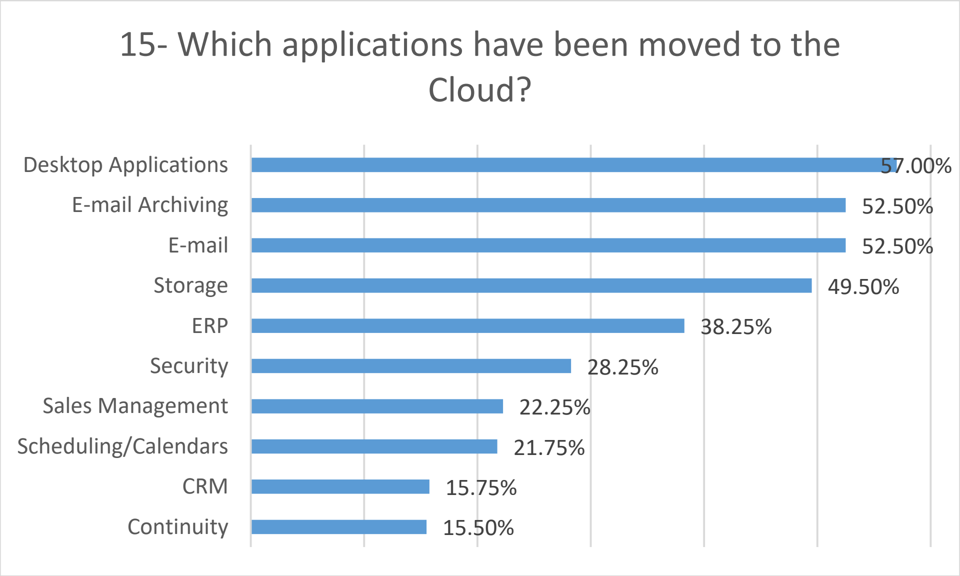

Figure 9: Which applications have been moved to the Cloud?

Source: Author's own development

Table 16 presents that based on the 25.0% of the respondents, Storage is the most valuable Cloud-based application, for the 21.8% of them Desktop Applications is the most valuable, and for the 18.0% of them Security. The other investigated Cloud based applications have been mentioned as follows: CRM by the 4.3% of the research participants, the ERP by the 5.3% of them, the Sales Management by the 6.5% of them, the Continuity by the 5.5% of them, and Scheduling/Calendars by the 13.8% of them.

Table 16: Which ones do you think are the most valuable Cloud-based applications?

Source: Author's own development

16- Which ones do you think are the most valuable Cloud-based applications?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	CRM	17	4,3	4,3	4,3
	ERP	21	5,3	5,3	9,5
	Sales Management	26	6,5	6,5	16,0
	Security	72	18,0	18,0	34,0
	Storage	100	25,0	25,0	59,0
	Continuity	22	5,5	5,5	64,5
	Scheduling/Calendars	55	13,8	13,8	78,3
	Desktop Applications	87	21,8	21,8	100,0
	Total	400	100,0	100,0	

The next question according to Table 17 examines whether the Cloud provider implementation is a standalone application to support a specific need or part of a strategic effort at the investigated companies. Most respondents, 42.5% of them, do not have any information about it. In the case of 36.8% of the research participants, it is a standalone application, and in the case of 20.8% of them it is part of a strategic effort.

Table 17: Is the Cloud provider implementation a standalone application to support a specific need or part of a strategic effort at the company?

Source: Author's own development

17- Is the Cloud provider implementation a standalone application to support a specific need or part of a strategic effort at the company?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	standalone application	147	36,8	36,8	36,8
	part of a strategic effort	83	20,8	20,8	57,5
	I don't know	170	42,5	42,5	100,0
	Total	400	100,0	100,0	

Table 18 shows 60.3% of the respondents say that their companies definitely will continue to use Cloud provider in the future, the 37.3% say that they probably will, and only the 2.5% of them say that they probably will not continue to use it in the future.

Table 18: How likely is your company to continue to use Cloud provider in the future?

Source: Author's own development

18- How likely is your company to continue to use Cloud provider in the future?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	definitely will	241	60,3	60,3	60,3
	probably will	149	37,3	37,3	97,5
	probably will not	10	2,5	2,5	100,0
	Total	400	100,0	100,0	

In the next question, different motivations have been listed which could motivate companies to apply Cloud-based solutions as shown in Figure 10 . The respondents could choose maximum 3 motivations from the list which motivations were present at their companies in relation to Cloud-based solutions. The most respondents chose security (66.0%), lower costs (61.50%) and efficiency (51%). The other investigated motivations were mentioned by them as follows: sustainability by the 43.25% of them, reliability by the 40.75% of them, agility/scalability by the 39.75% of them, better performance by the 29.75% of them, and streamline administration by the 18.75% of them.

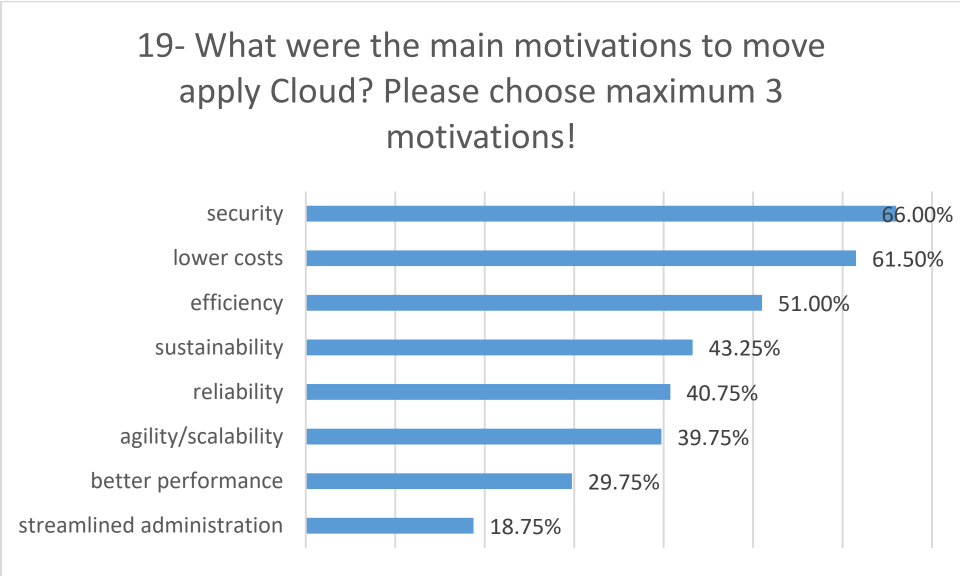

Figure 10: What were the main motivations to move apply Cloud? Please choose maximum 3 motivations!

Source: Author's own development

The next question as per Figure 11 examines the business objectives which led the companies to apply Cloud services. This is a multiple-choice question. Thus the research participants marked all business objectives which led their companies to apply these services. The majority of respondents (53.25%) chose reducing operational costs, 49.25% aimed to improve data quality, and 46.25% of them aimed to improve customer service. The other investigated business objectives were mentioned by the respondents as follows: increasing customer satisfaction by the 39.75% of them, increasing marketing effectiveness by the 30.50% of them, increasing sales revenue by the 27.50% of them, winning new customers by the 24.25% of them, improving customer retention by the 21.50% of them, increasing customer loyalty by the 17.25% of them, and increasing up-sell opportunities by the 10.50% of them.

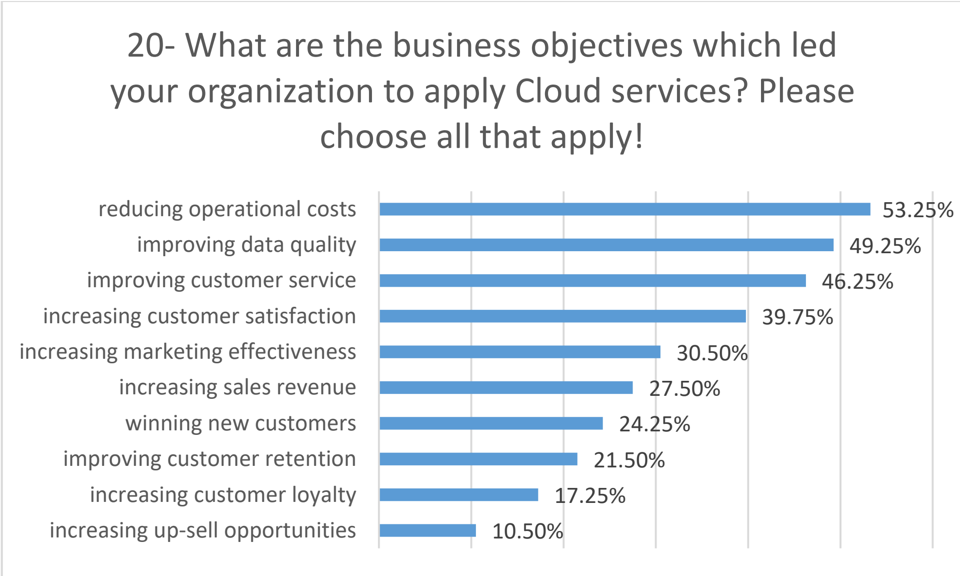

Figure 11: What are the business objectives which led your organization to apply Cloud services?

Source: Author's own development

The next question as per Figure 12 lists the same answer options as the previous one, and the respondents have been asked to choose all of them that were experienced at the organisation they work for. Almost two-thirds of the research participants (63.75%) have experienced reducing operational costs, 45.0% of them improving data quality, 31.25% of them winning new customers, 28.0% of them improving customer service and 27.25% of them increasing customer satisfaction. The other investigated experiences were mentioned by less than the one-quarter of the research participants: increasing sales revenue by 20.25% of them, improving customer retention by 14.25% of them, increasing customer loyalty by 14.25% of them, increasing marketing effectiveness by 11.75% of them, and increasing up-sell opportunities by 7.0% of them.

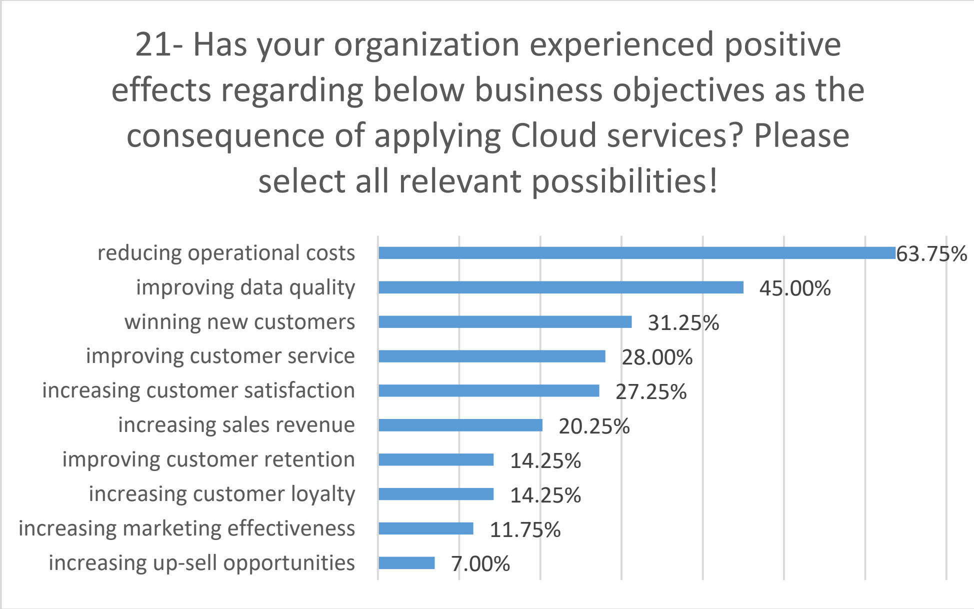

Figure 12: Has your organization experienced positive effects regarding below business objectives as a consequence of applying Cloud services?

Source: Author's own development

The questionnaire as presented in Table 19 also investigates which the current plans are at the organization in relation to Cloud provider deployment in the next 12 months. This question is not applicable in case of the 47.5% of the research participants. The 19.8% of the respondents say that the current plan is to increase users over 50% at the company they work for. In case of the 13.0% of them, the plan is to increase users by 1-50%, in case of the 6.5% of them no changes are planned, in case of the 8.0% of them the plan is to decrease users by 1-50%, and in case of the 5.3% of them the plan is to decrease users by over 50%.

Table 19: What are the current plans at the organization in relation to Cloud provider deployment at the next 12 months?

Source: Author's own development

22- What are the current plans at the organization in relation to Cloud provider deployment in the next 12 months?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	decrease users by over 50%	21	5,3	5,3	5,3
	decrease users by 1-50%	32	8,0	8,0	13,3
	about the same	26	6,5	6,5	19,8
	increase users by 1-50%	52	13,0	13,0	32,8
	increase users over 50%	79	19,8	19,8	52,5
	not applicable	190	47,5	47,5	100,0
	Total	400	100,0	100,0	

The first five-point Likert scale type question investigates how likely the research participants recommend the Cloud provider to others. The average for this question is 4.3775, which means that overall, the research participants will probably recommend the Cloud provider to others. The standard deviation is 0.85839, which is a low value in this case, and it expresses how much the sample members differ from the mean value of the sample. Table 20 also presents the minimum and the maximum value, based on these, there is nobody among the respondents who would not recommend the Cloud provider to others. The median is 5.0, and this value divides the sample into two equal parts based on their answers. The mode is 5.0, which means that the most respondents will definitely recommend it to others. 62.7% of the respondents say that they definitely will recommend the Cloud provider to others, 12.3% of them say that they probably will recommend it, while 25.0% of them are neutral from this perspective.

Table 20: How likely are you to recommend the Cloud provider to others?

Source: Author's own development

Statistics

23- How likely are you to recommend Cloud provider to others?

N	Valid	400
	Missing	0
Mean		4,3775
Median		5,0000
Mode		5,00
Std. Deviation		,85839
Minimum		3,00
Maximum		5,00

The research participants as shown in Table 21 rated the Cloud provider's user interface on a five-point Likert scale. The mean is 3.7250, which means that overall, they rate it rather positively. The standard deviation is low, which is also supported by the minimum and the maximum value, as there is nobody among the respondents who rates it rather negatively or absolutely negatively. The mode is 4, thus most research participants rate it rather positively. 13.0% of the respondents rate it as excellent, 46.5% of them rather positively, and 40.50% of them say that they have a neutral opinion.

Table 21: Please rate the Cloud provider user interface!

Source: Author's own development

Statistics

24- Please rate the Cloud provider user interface!

N	Valid	400
	Missing	0
Mean		3,7250
Median		4,0000
Mode		4,00
Std. Deviation		,67862
Minimum		3,00
Maximum		5,00

The overall satisfaction of the respondents with the Cloud provider was also given on a five-point Likert scale as presented in Table 22. The mean is 3.94, which means that in general, the respondents are rather satisfied with the Cloud provider. However, the standard deviation is higher than in the case of the previous questions, which means that the sample members differ more from the mean value of the sample. The minimum and the maximum values show that there is nobody among the respondents who is rather dissatisfied or who is absolutely dissatisfied with the Cloud provider. 41.3% of the respondents are totally satisfied, 11.5% of them are rather satisfied, while 47.3% are neutral from the perspective of overall satisfaction.

Table 22: Please rate your overall satisfaction with the Cloud provider!

Source: Author's own development

Statistics

25- Please rate your overall satisfaction with Cloud provider!

N	Valid	400
	Missing	0
Mean		3,9400
Median		4,0000
Mode		3,00
Std. Deviation		,94000
Minimum		3,00
Maximum		5,00

The next question as presented in Table 23 investigates the estimated time required for the organization to achieve a return on investment from the Cloud provider investment. The one-third of the respondents say the estimated time is between 6 and 12 months, in case of the 25.3% of the companies it is more than 2 years, in case of the 18.0% of the companies, it is between 19 and 24 months, in case of the 17.0% of the companies it is between 13 and 18 months, and only the 6.5% of the research participants say that the organization is estimated to achieve return on investment from the Cloud provider investment within 6 months.

Table 23: What is the estimated time it took for the organization to achieve a return on investment from the Cloud provider investment?

Source: Author's own development

26- What is the estimated time it took for the organization to achieve return on investment from the Cloud provider investment?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	maximum 6 months	26	6,5	6,5	6,5
	6-12 months	133	33,3	33,3	39,8
	13-18 months	68	17,0	17,0	56,8
	19-24 months	72	18,0	18,0	74,8
	24+ months	101	25,3	25,3	100,0
	Total	400	100,0	100,0	

The next question of the questionnaire as presented in Table 24 investigates organisation and technology readiness-related factors which could affect Cloud computing adoption. The answers of the respondents are summarized below:

- Service quality: The mean is 3.4925, which means that overall, the respondents think that service quality is neutral from the perspective of affecting Cloud computing adoption, however, the standard deviation is quite high, which means that the sample members differ more from the mean value of the respondents. The mode is 4, thus according to most research participants, service quality rather affects Cloud computing adoption. The minimum value is 2 and the maximum value is 5 in this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.
- Usefulness: The mean is 3.2475, which means that overall, the respondents think that usefulness is neutral from the perspective of affecting Cloud computing adoption, while the standard deviation is standard at a five-point Likert scale. The mode is 4, thus according to most research participants, usefulness rather affects Cloud computing adoption. The minimum value is 1 and the maximum value is 5 for this question.
- Security concern: The mean is 3.1800, which means that overall, the respondents think that security concern is neutral from the perspective of affecting Cloud computing adoption, however, the standard deviation is average. The mode is 4, thus according to

most research participants, security concern rather affects Cloud computing adoption. The minimum value is 1 and the maximum value is 5 for this question.

- Complexity: The mean is 3.5225, which means that overall, the respondents think that complexity rather affects Cloud computing adoption. However, the standard deviation is quite high, which means that the sample members differ more from the mean value of the respondents. The mode is 4, thus according to most research participants, complexity rather affects Cloud computing adoption. The minimum value is 2 and the maximum value is 5 at this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.
- cost: The mean is 3.7025 which means that overall, the respondents think that cost rather affects Cloud computing adoption, however, the standard deviation is quite low which means that the sample members differ less from the mean value of the respondents. The mode is 4, thus according to the most research participants, cost rather affects Cloud computing adoption. The minimum value is 2 and the maximum value is 5 at this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.

Table 24: According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? 1.

Source: Author's own development

		27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Service quality]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Usefulness]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Security concern]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Complexity]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Cost]
N	Valid	400	400	400	400	400
	Missing	0	0	0	0	0
Mean		3,4925	3,2475	3,1800	3,5225	3,7025
Median		4,0000	3,0000	3,0000	4,0000	4,0000
Mode		4,00	4,00	4,00	4,00	4,00
Std. Deviation		1,12165	,99182	,96433	1,14795	,80350
Minimum		2,00	1,00	1,00	2,00	2,00
Maximum		5,00	5,00	5,00	5,00	5,00

- organization size: The mean is 3.5150 as presented in Table 25 which means that overall, the respondents think that organization size rather affects Cloud computing adoption, however, the standard deviation is quite high which means that the sample members differ more from the mean value of the respondents. The mode is 3, thus according to the most research participants, organization size is neutral from this perspective. The minimum value is 2 and the maximum value is 5 in this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.
- IT infrastructure readiness: The mean is 3.4650, which means that overall, the respondents think that IT infrastructure readiness is neutral from the perspective of affecting Cloud computing adoption, however, the standard deviation is quite high, which means that the sample members differ more from the mean value of the respondents. The mode is 2, thus according to most research participants, IT infrastructure readiness does not affect Cloud computing adoption. The minimum value is 2 and the maximum value is 5 in this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.
- Feasibility: The mean is 3.48, which means that overall, the respondents think that feasibility is neutral from the perspective of affecting Cloud computing adoption, however, the standard deviation is quite high, which means that the sample members differ more from the mean value of the respondents. The mode is 3, thus according to most research participants, feasibility is neutral from this perspective. The minimum value is 2 and the maximum value is 5 in this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.
- Trust: The mean is 3.15, which means that overall, the respondents think that trust is neutral from the perspective of affecting Cloud computing adoption, however, the standard deviation is quite high, which means that the sample members differ more from the mean value of the respondents. The mode is 1, thus according to most research participants, trust does not affect Cloud computing adoption at all. The minimum value is 1 and the maximum value is 5 for this question.
- Organization culture: The mean is 3.53, which means that overall, the respondents think that organization culture rather affects Cloud computing adoption, however, the standard deviation is quite high, which means that the sample members differ more from the mean value of the respondents. The lowest mode is 2, thus according to most

research participants, organizational culture does not affect Cloud computing adoption. The minimum value is 2 and the maximum value is 5 in this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.

Table 25: According to your opinion, how do the following organizational and technology readiness-related factors affect Cloud computing adoption? 2.

Source: Author's own development

		27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Organization size]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [IT infrastructure readiness]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Feasibility]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Trust]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Organization culture]
N	Valid	400	400	400	400	400
	Missing	0	0	0	0	0
Mean		3,5150	3,4650	3,4800	3,1500	3,5300
Median		3,0000	4,0000	3,0000	3,0000	4,0000
Mode		3,00	2,00	3,00	4,00	2,00[a]
Std. Deviation		1,11260	1,15634	1,11252	1,18364	1,14559
Minimum		2,00	2,00	2,00	1,00	2,00
Maximum		5,00	5,00	5,00	5,00	5,00

- Organization structure: The mean is 3.4350 as presented in Table 26, which means that overall, the respondents think that organization structure is neutral from the perspective of affecting Cloud computing adoption, however, the standard deviation is quite high, which means that the sample members differ more from the mean value of the respondents. The mode is 4, thus according to most research participants, organization structure rather affects Cloud computing adoption. The minimum value is 2 and the maximum value is 5 at this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.

- privacy risks: The mean is 3.4300 which means that overall, the respondents think that privacy risks are neutral from the perspective of affecting Cloud computing adoption, however, the standard deviation is quite high which means that the sample members differ more from the mean value of the respondents. The mode is 2, thus according to the most research participants, privacy risks rather do not affect Cloud computing adoption. The minimum value is 2 and the maximum value is 5 at this question, so there is nobody in the sample who thinks that this factor does not affect Cloud computing adoption at all.

Table 26: According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? 3.

Source: Author's own development

		27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Organization structure]	27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally) [Privacy risks]
N	Valid	400	400
	Missing	0	0
Mean		3,4350	3,4300
Median		3,0000	3,0000
Mode		4,00	2,00
Std. Deviation		1,08800	1,13062
Minimum		2,00	2,00
Maximum		5,00	5,00

At the next question as presented in Table 27, different statements have been listed, and the respondents marked on a five-point Likert scale whether they agree on these statements:

- Organisation must ensure that they have adequate technical support before adopting Cloud computing: The mean is 3.5825, which means that overall the respondents rather agree this statement. However, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Organisation must ensure that they have adequate technical support after adopting Cloud computing: The mean is 3.29 which means that overall the respondents are neutral regarding this statement. However, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Organisations have to provide staff training from Cloud providers or other training institutions. The mean is 2.9125, indicating that overall the respondents are neutral regarding this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

- Organisations should have enough resources to provide high speed and reliable internet for Cloud computing: The mean is 3.4550, which means that overall the respondents are neutral regarding this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Organisations should have an adequate budget for Cloud computing adoption: The mean is 3.1675, which means that overall the respondents are neutral regarding this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

Table 27: Do you agree on the following statements? 1.

Source: Author's own development

		28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Organisation must ensure that they have adequate technical support before adopting Cloud computing.]	28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Organisation must ensure that they have adequate technical support after adopting Cloud computing.]	28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Organisations have to provide staff training from Cloud providers or other training institutions.]	28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Organisations should have enough resources to provide high speed and reliable internet for Cloud computing.]	28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Organisations should have an adequate budget for Cloud computing adoption.]
N	Valid	400	400	400	400	400
	Missing	0	0	0	0	0
Mean		3,5825	3,2900	2,9125	3,4550	3,1675
Median		4,0000	4,0000	4,0000	4,0000	3,0000
Mode		4,00	4,00	4,00	4,00	4,00
Std. Deviation		1,28152	1,53028	1,43701	1,05867	1,04026
Minimum		1,00	1,00	1,00	1,00	1,00
Maximum		5,00	5,00	5,00	5,00	5,00

Table 28 shows that:

- Organisations encounter pressure from competitors to adopt Cloud computing technology: The mean is 2.6975, which means that overall, the respondents are neutral regarding this statement. However, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

- Cloud computing technology supports organisations to gain a competitive advantage: The mean is 2.9775, which means that overall, the respondents are neutral regarding this statement. However, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- The employees need to be trained in order to use the Cloud computing technology: The mean is 3.1225, which indicates that overall the respondents are neutral regarding this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Organisations should create employee awareness of using Cloud computing technology: The mean is 3.2575, which means that overall the respondents are neutral regarding this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

Table 28: Do you agree on the following statements? 2.

Source: Author's own development

		28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Organisations encounter pressure from competitors to adopt Cloud computing technology.]	28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Cloud computing technology supports organisation gain competitive advantage.]	28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [The employees need to be trained in order to use the Cloud computing technology]	28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Organisations should create employee awareness of using Cloud computing technology.]
N	Valid	400	400	400	400
	Missing	0	0	0	0
Mean		2,6975	2,9775	3,1225	3,2575
Median		3,0000	3,0000	4,0000	4,0000
Mode		4,00	4,00	4,00	4,00
Std. Deviation		1,30585	1,09544	1,34611	1,11773
Minimum		1,00	1,00	1,00	1,00
Maximum		5,00	5,00	5,00	5,00

The next question as presented in Table 29 lists statements in relation to perceived usefulness:

- Using Cloud computing services would improve my skills to manage business operation efficiently: The mean is 3.8575 which means that overall the respondents rather agree this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5, thus there is nobody in the sample who does not agree on this statement at all.

- Using Cloud computing services increases business productivity: The mean is 3.74 which means that overall the respondents rather agree this statement, the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5, thus there is nobody in the sample who does not agree this statement at all.
- Using Cloud computing services would make it easier to manage my tasks efficiently: The mean is 3.5400 which means that overall the respondents rather agree this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Using Cloud computing services would increase my performance: The mean is 3.2675 which means that overall the respondents are neutral in relation to this this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Using Cloud computing services would enable me to accomplish tasks more quickly: The mean is 3.2050 which means that overall the respondents are neutral from the perspective of this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

Table 29: Do you agree the following statements? 3.

Source: Author's own development

		29- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing services would improve my skills to manage business operation efficiently.]	29- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing services would increase business productivity.]	29- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing services would make it easier to manage my tasks efficiently.]	29- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing services would increase my performance.]	29- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing services would enable me to accomplish tasks more quickly.]
N	Valid	400	400	400	400	400
	Missing	0	0	0	0	0
Mean		3,8575	3,7400	3,5400	3,2675	3,2050
Median		4,0000	4,0000	4,0000	4,0000	4,0000
Mode		4,00	4,00	4,00	4,00	4,00
Std. Deviation		1,11369	,93787	1,36310	1,13099	1,17107
Minimum		2,00	2,00	1,00	1,00	1,00
Maximum		5,00	5,00	5,00	5,00	5,00

The next question as per Table 30 lists statements in relation to perceived ease of use:

- Learning to use Cloud computing services would be easy for me: The mean is 3.1725 which means that overall the respondents are neutral in relation to this statement, however, the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- My interaction with Cloud computing services would be clear and understandable: The mean is 3.5050 which means that overall the respondents rather agree this statement, however, the standard deviation is quite low. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5, so no one in the sample does not agree this statement at all.
- It would be easy for me to become skilled by using Cloud computing services: The mean is 3.5200 which means that overall the respondents rather agree this statement, however, the standard deviation is really high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

Table 30: Do you agree the following statements? 4.

Source: Author's own development

		30- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Learning to use Cloud computing services would be easy for me.]	30- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [My interaction with Cloud computing services would be clear and understandable.]	30- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [It would be easy for me to become skilful by using Cloud computing services.]
N	Valid	400	400	400
	Missing	0	0	0
Mean		3,1725	3,5050	3,5200
Median		3,0000	4,0000	4,0000
Mode		4,00	4,00	4,00
Std. Deviation		1,07500	,85546	1,50175
Minimum		1,00	2,00	1,00
Maximum		5,00	5,00	5,00

The next question as per Table 31 lists statements in relation to compatibility:

- Using Cloud computing is compatible with most aspects of my tasks: The mean is 3.37 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is average. The mode is 3 which means that the most research participants are also neutral. The minimum value is 2 and the maximum value is 5, thus there is nobody in the sample who does not agree this statement at all.
- Using Cloud computing fits my work: The mean is 3.33 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5, thus there is nobody in the sample who does not agree this statement at all.
- Using Cloud computing fits well with the way I do my work: The mean is 2.9575 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is really high. The mode is 3 which means that the most research participants are also neutral. The minimum value is 1 and the maximum value is 5.

Table 31: Do you agree the following statements? 5.

Source: Author’s own development

		31- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing is compatible with most aspects of my tasks.]	31- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing fits my work.]	31- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Using Cloud computing fits well with the way I do my work.]
N	Valid	400	400	400
	Missing	0	0	0
Mean		3,3700	3,3300	2,9575
Median		3,0000	3,0000	3,0000
Mode		3,00	4,00	3,00
Std. Deviation		,96718	1,01916	1,35102
Minimum		2,00	2,00	1,00
Maximum		5,00	5,00	5,00

The next question as per Table 32 lists statements in relation to Cloud computing awareness:

- I have received enough information about Cloud computing services in general: The mean is 3.365 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is quite high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- I have received enough information about benefits of using Cloud computing services: The mean is 3.5675 which means that overall the respondents rather agree this statement, and the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5, thus there is nobody in the sample who does not agree this statement at all.
- I have enough information about services which are applied at my organisation: The mean is 3.3625 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

Table 32: Do you agree the following statements? 6.

Source: Author's own development

		32- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I have received enough information about Cloud computing services in general.]	32- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I have received enough information about benefits of using Cloud computing services.]	32- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I have enough information about services which are applied at my organisation.]
N	Valid	400	400	400
	Missing	0	0	0
Mean		3,3650	3,5675	3,3625
Median		3,0000	4,0000	3,0000
Mode		4,00	4,00	4,00
Std. Deviation		1,12914	,97356	1,05064
Minimum		1,00	2,00	1,00
Maximum		5,00	5,00	5,00

The next question as per Table 33 lists statements in relation to Cloud computing adoption:

- I predict that I would continue to use Cloud computing services for my professional development: The mean is 3.5425 which means that overall the respondents rather agree this statement, and the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- I plan to use Cloud computing services to manage my personal development: The mean is 2.5600 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is really high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- I intended to use Cloud computing services to access business data in the future: The mean is 3.3060 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is average. The mode is 3 which means that the most research participants are also neutral. The minimum value is 1 and the maximum value is 5.
- I intend to adopt Cloud services for development purposes in the future: The mean is 3.3475 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum

value is 5, so there is no one among the research participants who does not agree this statement at all.

Table 33: Do you agree the following statements? 7.

Source: Author's own development

		33- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I predict that I would continue to use Cloud computing services for my professional development.]	33- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I plan to use Cloud computing services to manage my personal development.]	33- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I intended to use Cloud computing services to access business data in the future.]	33- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I intend to adopt Cloud computing services for development purposes in the future.]
N	Valid	400	400	400	400
	Missing	0	0	0	0
Mean		3,5425	2,5600	3,0600	3,3475
Median		4,0000	2,0000	3,0000	3,0000
Mode		4,00	4,00	3,00	4,00
Std. Deviation		1,05165	1,30217	,97147	,89091
Minimum		1,00	1,00	1,00	2,00
Maximum		5,00	5,00	5,00	5,00

The next question as per Table 34 lists statements in relation to perceived risk:

- I think using Cloud computing services in monetary transactions has potential risks: The mean is 3.7925 which means that overall the respondents rather agree this statement, and the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- I think using Cloud computing services in merchandise services has potential risks: The mean is 2.7575 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- I think using Cloud computing services in product purchase has potential risks: The mean is 2.9650 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- I think using Cloud computing services puts my privacy at risk: The mean is 3.5325, which means that overall the respondents rather agree with the statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree on this statement. The minimum value is 1 and the maximum value is 5.
- I think using Cloud computing services puts the sensitive information of my organisation at risk: The mean is 2.8425 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

Table 34: Do you agree the following statements? 8.

Source: Author's own development

		34- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I think using Cloud computing services in monetary transactions has potential risks.]	34- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I think using Cloud computing services in merchandise services has potential risks.]	34- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I think using Cloud computing services in product purchases has potential risks.]	34- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I think using Cloud computing services puts my privacy at risks.]	34- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [I think using Cloud computing services puts the sensitive information of my organisation at risks.]
N	Valid	400	400	400	400	400
	Missing	0	0	0	0	0
Mean		3,7925	2,7575	2,9650	3,5325	2,8425
Median		4,0000	3,0000	3,0000	4,0000	3,0000
Mode		4,00	4,00	4,00	4,00	4,00
Std. Deviation		1,09656	1,18203	1,30116	1,26806	1,35362
Minimum		1,00	1,00	1,00	1,00	1,00
Maximum		5,00	5,00	5,00	5,00	5,00

The next question as per Table 35 lists statements in relation to behavioural intention to use:

- Generally, using Cloud computing services is advantageous: The mean is 3.2475 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is average. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Generally, I am in favour of using Cloud computing services: The mean is 3.1500 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.
- Assuming I had access to Cloud computing, I intend to use it: The mean is 3.4300 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is low. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5, so there is nobody in the sample who does not agree this statement at all.

- Given that I had access to Cloud computing, I predict that I would use it: The mean is 3.1075 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 1 and the maximum value is 5.

Table 35: Do you agree the following statements? 9.

Source: Author's own development

		35- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Generally, using Cloud computing services is advantageous.]	35- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Generally, I am in favour of using Cloud computing services.]	35- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Assuming I had access to Cloud computing, I intend to use it.]	35- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [Given that I had access to Cloud computing, I predict that I would use it.]
N	Valid	400	400	400	400
	Missing	0	0	0	0
Mean		3,2475	3,1500	3,4300	3,1075
Median		3,0000	3,0000	4,0000	4,0000
Mode		4,00	4,00	4,00	4,00
Std. Deviation		,99182	1,18364	,85553	1,20606
Minimum		1,00	1,00	2,00	1,00
Maximum		5,00	5,00	5,00	5,00

The last question as per Table 36 lists statements in relation to costs:

- The equipment cost is expensive for using the Cloud computing to offer integrated services: The mean is 3.7700 which means that overall the respondents rather agree this statement, and the standard deviation is high. The mode is 5 which means that the most research participants absolutely agree this statement. The minimum value is 1 and the maximum value is 5.
- The access cost is expensive for using the Cloud computing architecture of my organization: The mean is 3.7575 which means that overall the respondents rather agree this statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5 which means that there is nobody in the sample who does not agree this statement at all.

- The transaction fee is expensive, but using Cloud computing would be easy: The mean is 3.4850 which means that overall the respondents are neutral in relation to this statement, and the standard deviation is high. The mode is 4 which means that the most research participants rather agree this statement. The minimum value is 2 and the maximum value is 5, so there is nobody in the sample who does not agree this statement at all.

Table 36: Do you agree the following statements? 10.

Source: Author's own development

		36- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [The equipment cost is expensive of using cloud computing to offer integrated services.]	36- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [The access cost is expensive of using Cloud computing architecture of my organization.]	36- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree) [The transaction fee is expensive of using Cloud computing would be easy.]
N	Valid	400	400	400
	Missing	0	0	0
Mean		3,7700	3,7575	3,4850
Median		4,0000	4,0000	4,0000
Mode		5,00	4,00	4,00
Std. Deviation		1,27718	1,15196	1,07128
Minimum		1,00	2,00	2,00
Maximum		5,00	5,00	5,00

4.2 Testing of the Hypotheses

As it has been presented in the methodology chapter, behavioural intention to use is in the focus of the research. The hypotheses have been determined in order to understand behavioural intention to use better and even identify the factors which influence it. Another hypothesis refers to behavioural intention to use as an independent variable and the research investigates its effect on perceived usefulness, perceived ease of use, compatibility, cloud computing awareness, cloud computing adoption, perceived risk and costs. All hypotheses have been tested in SPSS, According to (Pallant, 2020), SPSS is particularly valued in the social sciences for its accessibility to non-technical users and its ability to handle large datasets efficiently. It supports both exploratory and confirmatory data analysis and is often used in academic and applied research for decision-making and hypothesis testing.

The complete outputs supporting this analysis are provided in a separate annex titled 'Analysis1', and 'Analysis2' attached to this thesis (see Appendix A2)

H1: Gender determines behavioural intention to use significantly.

In this hypothesis, there is a nominal variable (gender) while behavioural intention to use is a scale variable, thus H1 hypothesis is tested through analysis of variance (ANOVA).

(ANOVA): Analysis of Variance is a statistical technique used to determine whether there are significant differences between the means of three or more independent groups. It assesses the variability within each group compared to the variability between groups to identify whether any observed differences are likely due to chance. According to (Field, 2024), ANOVA helps researchers test hypotheses about group differences while controlling for Type I errors that may arise from multiple comparisons. It is widely used in social sciences, business, and experimental research to compare treatment effects or group responses.

During the testing, all four statements have been investigated which describe behavioural intention to use in the questionnaire:

- Generally, using Cloud computing services is advantageous: The higher mean belongs to female participants, it is 3.2891 with an average standard deviation. For male respondents, these values are similar: the mean is a bit lower (3.2011) while the standard deviation is a bit higher. Overall, both genders are neutral in relation to this statement.
- Generally, I am in favour of using Cloud computing services: The higher mean value belongs to female participants, it is 3.1706 with a quite high standard deviation. For male respondents, these values are similar: the mean is a bit lower (3.1270) while the standard deviation is a bit higher. Overall, both genders are neutral in relation to this statement.
- Assuming I had access to Cloud computing, I intend to use it: The higher mean belongs to male participants, it is 3.4921 with a low standard deviation. In case of female respondents, the mean is lower (3.3744) while the standard deviation is a bit higher. Overall, both genders are neutral in relation to this statement.

- Given that I had access to Cloud computing, I predict that I would use it: The higher mean belongs to male participants, it is 3.1323 with a quite high standard deviation. In case of female respondents, the mean is lower (3.0853) while the standard deviation is a bit higher. Overall, both genders are neutral in relation to this statement.

An F-test has also been performed to analyse the relationship of the investigated variables. During the tests, the following null hypotheses have been tested:

- The gender does not determine significantly whether the respondents agree the statement which says "generally, using Cloud computing services is advantageous": The value of F is 0.785 while the related significance level is 0.376. It means that the null hypothesis has been fulfilled at a 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly whether the respondents agree the statement which says "generally, I am in favour of using Cloud computing services": The value of F is 0.135 while the related significance level is 0.713. It means that the null hypothesis has been fulfilled at a 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly whether the respondents agree the statement which says "assuming I had access to Cloud computing, I intend to use it": The value of F is 1.890 while the related significance level is 0.170. It means that the null hypothesis has been fulfilled at a 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly whether the respondents agree the statement which says "Given that I had access to Cloud computing, I predict that I would use it": The value of F is 0.151 while the related significance level is 0.698. It means that the null hypothesis has been fulfilled at a 95% significance level, thus there is no significant relationship between the two investigated variables.

Overall, all four null hypotheses have been fulfilled which also means that H1 hypothesis has not been fulfilled as gender does not determine behavioural intention to use significantly.

H2: The location of the workplace determines behavioural intention to use significantly.

In this hypothesis, there is a nominal variable (location of the workplace) while behavioural intention to use is a scale variable, thus H2 hypothesis is tested through analysis of variance

(ANOVA). During the testing, all four statements have been investigated which describe behavioural intention to use in the questionnaire:

- Generally, using Cloud computing services is advantageous: The higher mean belongs to the participants whose workplace location is city, it is 3.40 with an average standard deviation. In case of the respondents whose workplace location is capital, these values are similar: the mean is a bit lower (3.2179) while the standard deviation is a bit higher. Overall both groups are neutral in relation to this statement.
- Generally, I am in favour of using Cloud computing services: The higher mean belongs to the participants whose workplace location is city, it is 3.2923 with a high standard deviation. In case of the respondents whose workplace location is capital, the mean is a bit lower (3.1224) and the standard deviation is also a bit lower. Overall both groups are neutral in relation to this statement.
- Assuming I had access to Cloud computing, I intend to use it: The higher mean belongs to the participants whose workplace location is capital, it is 3.4836 with a low standard deviation. In case of the respondents whose workplace location is city, the mean is lower (3.1538) and the standard deviation is also a bit lower. Overall, both groups are neutral in relation to this statement.
- Given that I had access to Cloud computing, I predict that I would use it: The higher mean belongs to the participants whose workplace location is the capital, it is 3.1403 with a high standard deviation. In case of the respondents whose workplace location is a city, these values are the following: the mean is a bit lower (2.9385) while the standard deviation is a bit higher. Overall, both groups are neutral in relation to this statement.

An F-test has also been performed to analyse the relationship of the investigated variables. During the tests, the following null hypotheses have been tested:

- The location of the workplace does not determine significantly whether the respondents agree the statement which says “generally, using Cloud computing services is advantageous”: The value of F is 1.839 while the related significance level is 1.176. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.
- The location of the workplace does not determine significantly whether the respondents agree the statement which says “generally, I am in favour of using Cloud computing services”: The value of F is 1.122 while the related significance level is 0.290. It means

that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.

- The location of the workplace does not determine significantly whether the respondents agree the statement which says "assuming I had access to Cloud computing, I intend to use it": The value of F is 8.233 while the related significance level is 0.004. It means that the null hypothesis has not been fulfilled at 95% significance level, thus there is a significant relationship between the two investigated variables.
- The location of the workplace does not determine significantly whether the respondents agree the statement which says "Given that I had access to Cloud computing, I predict that I would use it": The value of F is 1.527 while the related significance level is 0.217. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.

Overall, three null hypotheses out of four have been fulfilled and only one has not been fulfilled. It also means that H2 hypothesis has been fulfilled only in relation to the following statement: "assuming I had access to Cloud computing, I intend to use it". The strength of the relationship has been examined by the eta square test as well. Its value is 0.020 which means that there is a weak relationship between the investigated variables.

H3: Gender determines behavioural intention to use, perceived usefulness, compatibility, cloud computing awareness, cloud computing adoption, perceived risk and costs significantly.

In this hypothesis, there is a nominal variable (gender) while behavioural intention to use perceived usefulness, compatibility, cloud computing awareness, cloud computing adoption, perceived risk and costs are scale variables, thus H3 hypothesis is tested through analysis of variance (ANOVA) too. During the testing, all statements have been investigated which refer to behavioural intention to use perceived usefulness, compatibility, cloud computing awareness, cloud computing adoption, perceived risk and costs in the questionnaire. Mean has been calculated to all expressions as follows:

- behavioural intention to use: the mean of the four related statements
    - Generally, using Cloud computing services is advantageous.
    - Generally, I am in favour of using Cloud computing services.
    - Assuming I had access to Cloud computing, I intend to use it.
    - Given that I had access to Cloud computing, I predict that I would use it.

- perceived usefulness: the mean of the five related statements
    - Using Cloud computing services would improve my skills to manage business operation efficiently.
    - Using Cloud computing services would increase business productivity.
    - Using Cloud computing services would make it easier to manage my tasks efficiently.
    - Using Cloud computing services would increase my performance.
    - Using Cloud computing services would enable me to accomplish tasks more quickly.
- perceived ease of use: the mean of the three related statements
    - Learning to use Cloud computing services would be easy for me.
    - My interaction with Cloud computing services would be clear and understandable.
    - It would be easy for me to become skilful by using Cloud computing services.
- compatibility: the mean of the three related statements
    - Using Cloud computing is compatible with most aspects of my tasks.
    - Using Cloud computing fits my work.
    - Using Cloud computing fits well with the way I do my work.
- cloud computing awareness: the mean of the three related statements
    - I have received enough information about Cloud computing services in general.
    - I have received enough information about the benefits of using Cloud computing services.
    - I have enough information about the services which are applied at my organisation.
- cloud computing adoption: the mean of the four related statements
    - I predict that I would continue to use Cloud computing services for my professional development.
    - I plan to use Cloud computing services to manage my personal development.
    - I intend to use Cloud computing services to access business data in the future.
    - I intend to adopt Cloud computing services for development purposes in the future.
- perceived risk: the mean of the five related statements

    - I think using Cloud computing services in monetary transactions has potential risks.
    - I think using Cloud computing services in merchandise services has potential risks.
    - I think using Cloud computing services in product purchases has potential risks.
    - I think using Cloud computing services puts my privacy at risk.
    - I think using Cloud computing services puts the sensitive information of my organisation at risk.
- costs: the mean of the three related statements: the mean of the three related statements
    - The equipment cost is expensive for using cloud computing to offer integrated services.
    - The access cost is expensive for using the Cloud computing architecture of my organization.
    - The transaction fee is expensive, but using Cloud computing would be easy.

The report summary contains the results by gender:

- Perceived usefulness: The mean is higher in the case of the male respondents, and the standard deviation is really small. In case of the female respondents, the mean is a bit lower while the standard deviation is a bit higher. Overall, perceived usefulness is rather high in the case of both genders.
- Perceived ease of use: The mean is higher in the case of the female respondents, and the standard deviation is really small. In case of the male respondents, the mean is a bit lower while the standard deviation is a bit lower. Overall, perceived ease of use has an average value for both genders.
- Compatibility: The mean is higher in the case of the female respondents, and the standard deviation is really low. In case of the male respondents, the mean is a bit lower while the standard deviation is also a bit lower. Overall, compatibility has an average value for both genders.
- Cloud computing awareness: The mean is higher in case of the female respondents, and the standard deviation is really low. In case of the male respondents, the mean is a bit lower while the standard deviation is a bit higher. Overall, cloud computing awareness has a neutral value in case of both genders.
- Cloud computing adoption: The mean is higher in case of the female respondents, and the standard deviation is really low. In case of the male respondents, the mean is a bit

lower while the standard deviation is also a bit lower. Overall, cloud computing adoption has a neutral value in case of both genders.

- Perceived risk: The mean is higher in case of the male respondents, and the standard deviation is really low. In case of the female respondents, the mean is a bit lower while the standard deviation is also a bit lower. Overall, perceived risk has a neutral value in case of both genders.
- Behavioural intention to use: The mean is higher in case of the male respondents, and the standard deviation is really low. In case of the female respondents, the mean is a bit lower while the standard deviation is also a bit lower. Overall, behavioural intention to use has a neutral value in case of both genders.
- Costs: The mean is higher in case of the male respondents, and the standard deviation is really low. In case of the female respondents, the mean is a bit lower while the standard deviation is a bit higher. Overall, costs have a neutral value in case of both genders

F-test has been also performed to analyse the relationship of the investigated variables. During the tests, the following null hypotheses have been tested:

- The gender does not determine significantly the level of perceived usefulness: The value of F is 0.522 while the related significance level is 0.471. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly the level of perceived ease of use: The value of F is 0.068 while the related significance level is 0.795. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly the level of compatibility: The value of F is 0.009 while the related significance level is 0.925. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly the level of Cloud computing awareness: The value of F is 0.614 while the related significance level is 0.434. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.

- The gender does not determine significantly the level of Cloud computing adoption: The value of F is 1.591 while the related significance level is 0.208. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly the level of perceived risk: The value of F is 0.044 while the related significance level is 0.834. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly the level of behavioural intention to use: The value of F is 0.025 while the related significance level is 0.875. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.
- The gender does not determine significantly the level of costs: The value of F is 0.862 while the related significance level is 0.354. It means that the null hypothesis has been fulfilled at 95% significance level, thus there is no significant relationship between the two investigated variables.

Overall, all null hypotheses have been fulfilled, which also means that the H3 hypothesis has not been fulfilled as gender does not determine behavioural intention, perceived usefulness, compatibility, cloud computing awareness, cloud computing adoption, perceived risk and costs.

H4: There is a significant relationship between behavioural intention to use and perceived usefulness.

Both variables are scale variables and this is the reason why this hypothesis has been tested through Pearson's correlation.

In case of behavioural intention to use, the mean is 3.2338 with a standard deviation of 0.52212. For perceived usefulness, the mean is higher (3.5220) and the standard deviation is lower (0.49083).

The value of Pearson correlation is 0.026 and the significance level is 0.599. It means that there is no significant relationship between behavioural intention to use and perceived usefulness at 95% significance level. The H4 hypothesis has not been fulfilled.

H5: There is a significant relationship between behavioural intention to use and perceived ease of use.

Both variables are scale variables and this is the reason why this hypothesis has been tested through Pearson's correlation.

In case of behavioural intention to use, the mean is 3.2338 with a standard deviation of 0.52212. For perceived ease of use, the mean is higher (3.3992) and the standard deviation is also higher (0.66744).

The value of Pearson correlation is 0.072 and the significance level is 0.152. It means that there is no significant relationship between behavioural intention to use and perceived ease of use at 95% significance level. The H5 hypothesis has not been fulfilled.

H6: There is a significant relationship between behavioural intention to use and compatibility.

Both variables are scale variables and this is the reason why this hypothesis has been tested through Pearson's correlation.

In case of behavioural intention to use, the mean is 3.2338 with a standard deviation of 0.52212. For compatibility, the mean is lower (3.2192) and the standard deviation is higher (0.66079).

The value of Pearson correlation is 0.006 and the significance level is 0.908. It means that there is no significant relationship between compatibility and perceived usefulness at 95% significance level. The H6 hypothesis has not been fulfilled.

H7: There is a significant relationship between behavioural intention to use and Cloud computing awareness.

Both variables are scale variables and this is the reason why this hypothesis has been tested through Pearson's correlation.

In case of behavioural intention to use, the mean is 3.2338 with a standard deviation of 0.52212. For Cloud computing awareness, the mean is higher (3.4317) and the standard deviation is also higher (0.58390).

The value of Pearson correlation is -0.026 and the significance level is 0.964. It means that there is no significant relationship between behavioural intention to use and Cloud computing awareness at 95% significance level. The H7 hypothesis has not been fulfilled.

H8: There is a significant relationship between behavioural intention to use and Cloud computing adoption.

Both variables are scale variables and this is the reason why this hypothesis has been tested though Pearson's correlation.

For the behavioural intention to use, the mean is 3.2338 with a standard deviation of 0.52212. For Cloud computing adoption, the mean is lower (3.1275) and the standard deviation is slightly higher (0.54410).

The value of Pearson correlation is 0.119 and the significance level is 0.018. It means that there is a positive significant relationship between behavioural intention to use and Cloud computing adoption at 95% significance level. The H8 hypothesis has been fulfilled.

H9: There is a significant relationship between behavioural intention to use and perceived risk.

Both variables are scale variables and this is the reason why this hypothesis has been tested through Pearson's correlation.

In case of behavioural intention to use, the mean is 3.2338 with a standard deviation of 0.52212. For perceived risk, the mean is lower (3.1780) and the standard deviation is higher (0.55161).

The value of Pearson correlation is -0.037 and the significance level is 0.461. It means that there is no significant relationship between behavioural intention to use and perceived risk at 95% significance level. The H9 hypothesis has not been fulfilled.

H10: There is a significant relationship between behavioural intention to use and costs.

Both variables are scale variables and this is the reason why this hypothesis has been tested through Pearson's correlation.

In case of behavioural intention to use, the mean is 3.2338 with a standard deviation of 0.52212. For costs, the mean is higher (3.6709) and the standard deviation is also higher (0.66973).

The value of Pearson correlation is 0.067 and the significance level is 0.182. It means that there is no significant relationship between behavioural intention to use and costs at 95% significance level. The H10 hypothesis has not been fulfilled.

H11: Behavioural intention to use determines perceived usefulness significantly.

Based on the Model Summary, the R-squared value is 0.001 which means that behavioural intention explains the 0.1% of perceived usefulness.

The ANOVA table presents whether the R square value is significant or not. As the significance is 0.599, this value is not significant. The H11 hypothesis has not fulfilled.

H12: Behavioural intention to use determines perceived ease of use significantly.

Based on Model Summary, the R square value is 0.005 which means that behavioural intention explains the 0.5% of perceived ease of use.

The ANOVA table presents whether the R square value is significant or not. As the significance is 0.152, this value is not significant. The H12 hypothesis has not fulfilled.

H13: Behavioural intention to use determines compatibility significantly.

Based on Model Summary, the R square value is 0.000 which means that behavioural intention explains the 0.0% of compatibility.

As the significance is 0.908 in the ANOVA table, the R square value is not significant. The H13 hypothesis has not fulfilled.

H14: Behavioural intention to use determines Cloud computing awareness significantly.

Based on Model Summary, the R square value is 0.000 which means that behavioural intention explains the 0.0% of Cloud computing awareness.

As the significance is 0.964 in the ANOVA table, the R square value is not significant. The H14 hypothesis has not fulfilled.

H15: Behavioural intention to use determines Cloud computing adoption significantly.

Based on Model Summary, the R square value is 0.014 which means that behavioural intention explains the 1.4% of Cloud computing adoption.

As the significance is 0.018 in the ANOVA table, the R square value is significant. The H15 hypothesis has been fulfilled.

The Coefficients table presents the relationship between the investigated relationships. The significance level (0.018) also confirms the significant correlation between the investigated variables. The Beta value provides information regarding the strength of the correlation: it is

0.119 which means that the effect of behavioural intention on Cloud computing adoption is weak.

H16: Behavioural intention to use determines perceived risk significantly.

Based on Model Summary, the R square value is 0.001 which means that behavioural intention explains the 0.01% of perceived risk.

As the significance is 0.461 in the ANOVA table, the R square value is not significant. The H16 hypothesis has not been fulfilled.

H17: Behavioural intention to use determines costs significantly.

Based on the Model Summary, the R-squared value is 0.004, indicating that behavioural intention explains 0.4% of the costs.

As the significance is 0.182 in the ANOVA table, the R-squared value is not significant. The H17 hypothesis has not been fulfilled.

This study identifies the factors that influence the decision to adopt cloud computing technologies in Syria and examines the relationships between these factors and adoption behavior, which will be determined based on the Technology-Organization-Environment (TOE) framework. Additionally, this research presents the challenges and issues of cloud computing adoption.

4.3 Assumption Testing and Robustness Checks (H1–H3)

Prior to testing the hypotheses involving group comparisons (H1–H3), assumption diagnostics were carried out to ensure the validity of the analyses. The Shapiro–Wilk test was significant across most variables ($p < .05$), which is common with large samples (n=400). However, skewness and kurtosis values remained within ±2, and visual inspections of histograms and Q–Q plots indicated approximate normality, justifying the application of parametric methods. The assumption of homogeneity of variances was assessed using Levene's test; when non-significant ($p \geq .05$), the standard ANOVA was applied, while in cases of significant results ($p < .05$), the Welch ANOVA was used. Non-parametric robustness checks were also performed, namely the Mann–Whitney U test for two-group comparisons and the Kruskal–Wallis H test for multi-group comparisons. These robustness checks consistently confirmed the substantive conclusions of the parametric analyses. Post hoc comparisons were planned using Tukey's HSD under equal variances and Games–Howell when variances were unequal. However, because the realized dataset contained only two groups for gender (male, female) and workplace (capital, city), post hoc comparisons were not applicable

The detailed diagnostic outputs and visualizations are provided in Appendix A2.

H1: Gender and behavioural intention

Preliminary diagnostics indicated that Likert-scale data approximated normality, with skewness and kurtosis values within acceptable bounds (±2). Although the Shapiro–Wilk test was significant ($p < .05$), Q–Q plots and histograms supported the assumption of approximate normality. Levene's test was non-significant ($p = 0.83$), confirming homogeneity of variances. Accordingly, the standard ANOVA with Tukey post hoc comparisons was applied. Since only two gender groups existed, post hoc analysis was not applicable .Non-parametric checks (Mann–Whitney U) yielded consistent results.

H2: Workplace and behavioural intention

Normality checks again suggested approximate normality despite significant Shapiro–Wilk results. Skewness and kurtosis values were acceptable, and visual inspections supported parametric testing. Levene's test was non-significant ($p = 0.47$), indicating homogeneity of variances; therefore, the standard ANOVA was applied. As workplace comparisons involved only capital vs. city, post hoc analysis was not required. Robustness checks with the Kruskal–Wallis test confirmed the conclusions.

H3: Gender and multiple adoption constructs

For the constructs tested under H3 (perceived usefulness, compatibility, awareness, adoption, risk, and cost), skewness and kurtosis values were within the acceptable range, and visual inspections supported approximate normality despite significant Shapiro–Wilk results. Levene's tests were mostly non-significant, but in cases of heteroscedasticity, the Welch ANOVA was applied. Post hoc analyses used Tukey HSD under equal variances and Games–Howell where variances were unequal. Although post hoc procedures (Tukey HSD under equal variances and Games–Howell where variances were unequal) were specified, they were not required in practice because only two gender groups were present. Non-parametric checks (Mann–Whitney U) confirmed the robustness of the findings.

Table 37: Assumption Testing for H1–H3 (Gender & Workplace Groupings)

Construct	**Grouping**	**Skewness**	**Kurtosis**	**Normality ≈**	**Levene's p**	**Equal variances?**
Adoption	Gender	-0.03	-1.37	✓	0.961	✓ ($p \geq .05$)
Adoption	Workplace	-0.03	-1.37	✓	0.738	✓ ($p \geq .05$)
Awareness	Gender	-0.20	-1.18	✓	0.599	✓ ($p \geq .05$)
Awareness	Workplace	-0.20	-1.18	✓	0.521	✓ ($p \geq .05$)
Compatibility	Gender	0.02	-1.34	✓	0.981	✓ ($p \geq .05$)
Compatibility	Workplace	0.02	-1.34	✓	0.084	✓ ($p \geq .05$)
Ease of Use (reversed)	Gender	-0.09	-1.42	✓	0.832	✓ ($p \geq .05$)
Ease of Use (reversed)	Workplace	-0.09	-1.42	✓	0.649	✓ ($p \geq .05$)
Perceived Cost	Gender	-0.73	-0.40	✓	0.321	✓ ($p \geq .05$)
Perceived Cost	Workplace	-0.73	-0.40	✓	0.756	✓ ($p \geq .05$)
Perceived Risk	Gender	-0.42	-1.05	✓	0.588	✓ ($p \geq .05$)
Perceived Risk	Workplace	-0.42	-1.05	✓	0.498	✓ ($p \geq .05$)
Perceived Usefulness	Gender	-0.17	-0.63	✓	0.959	✓ ($p \geq .05$)
Perceived Usefulness	Workplace	-0.17	-0.63	✓	0.694	✓ ($p \geq .05$)

4.4 Assumption Testing and Robustness Checks for Correlation and Regression (H4–H17)

Before testing H4–H17, which examine correlations and regression relationships, the distributional properties of the constructs were assessed. Skewness and kurtosis values for behavioural intention, perceived usefulness, perceived ease of use, compatibility, awareness, adoption, perceived risk, and perceived cost were all within the acceptable ±2 range, indicating approximate normality. Although Shapiro–Wilk tests were significant ($p < .05$) across all constructs—likely due to the large sample size ($n = 400$)—visual inspections of histograms and Q–Q plots confirmed that the data distributions did not deviate substantially from normality.

On this basis, Pearson's correlation and regression analyses were used as the primary methods of hypothesis testing. To ensure robustness against potential deviations from normality, Spearman's rho correlations were also computed, which produced consistent outcomes with the parametric analyses and reinforced the validity of the conclusions.

Table 38: Normality Checks for Constructs (H4–H17)

Construct	**Skewness**	**Kurtosis**	**Shapiro–Wilk W**	**Shapiro–Wilk p**	**Normality Decision**
Behavioural Intention (BI)	-0.03	-1.37	0.85	0.00	Approx. normal
Perceived Usefulness (PU)	-0.17	-0.63	0.90	0.00	Approx. normal
Perceived Ease of Use (PEOU)	-0.42	-1.05	0.82	0.00	Approx. normal
Compatibility	-0.09	-1.42	0.84	0.00	Approx. normal
Awareness	-0.78	0.17	0.78	0.00	Approx. normal
Adoption (Service quality)	-0.03	-1.37	0.85	0.00	Approx. normal
Risk (Security concern)	-0.42	-1.05	0.82	0.00	Approx. normal
Cost	-0.78	0.17	0.78	0.00	Approx. normal

Full diagnostics and visual plots are available in Appendix A2 titled “Analysis3” and “Visual Diagnostics”

Given these results, Pearson’s correlation and regression analyses were used as the primary methods of hypothesis testing. To ensure robustness against potential deviations from normality, Spearman’s rho correlations were also computed, and both methods yielded consistent results.

Table 39 summarises the correlation results between behavioural intention and the technological constructs. None of the correlations reached statistical significance, indicating that technological enablers and barriers did not strongly influence behavioural intention in the Syrian context. Both Pearson’s r and Spearman’s ρ are reported to demonstrate robustness; as shown, results are consistent and non-significant

Table 39: Correlation Results between Behavioural Intention and Technological Constructs

Construct vs BI	**Pearson r**	**p**	**Spearman ρ**	**p**
PU	0.026	0.599	-0.011	0.822
PEOU	0.072	0.151	0.067	0.182
Compatibility	0.006	0.913	0.001	0.988
Awareness	-0.002	0.964	0.001	0.990
Risk	-0.037	0.461	-0.021	0.673
Cost	0.067	0.181	0.068	0.174
Adoption	0.097	0.052	0.091	0.070

4.5 Qualitative Insights from the Interviews

To support the survey results and better understand the real situation in Syrian businesses, several in-depth interviews were conducted with IT professionals and decision-makers from different sectors. These interviews aimed to explore deeper views and challenges related to cloud computing adoption.

The interview responses were analyzed by identifying key themes that appeared repeatedly. One major concern was data security. Many participants said they do not fully trust international or local cloud service providers. This lack of trust is mainly due to the absence of strong data protection laws in Syria, along with fears about surveillance, data misuse, and the influence of international sanctions.

Another common challenge was limited organizational capacity. Participants pointed out that many companies do not have enough skilled IT workers, reliable systems, or technical support. Even when managers are interested in adopting cloud services, the lack of trained staff and clear plans makes it difficult to move forward.

Government and economic issues were also mentioned as serious obstacles. These include weak internet infrastructure, unclear digital policies, and the high costs caused by inflation. These external problems often make it harder for organizations to deal with their own internal challenges, adding to the hesitation around cloud adoption.

Overall, the insights from these interviews support the findings from the survey and reflect the Technology–Organization–Environment (TOE) framework, especially the organizational and environmental factors. The interviews helped improve the final research model and survey tool, and they offer a more complete picture of the many barriers facing cloud computing adoption in Syria’s current economic and political situation.

4.6 Bibliometric Analysis Results and Visualization

The bibliometric analysis generated a series of visualizations to illustrate the evolution and structure of cloud computing adoption research.

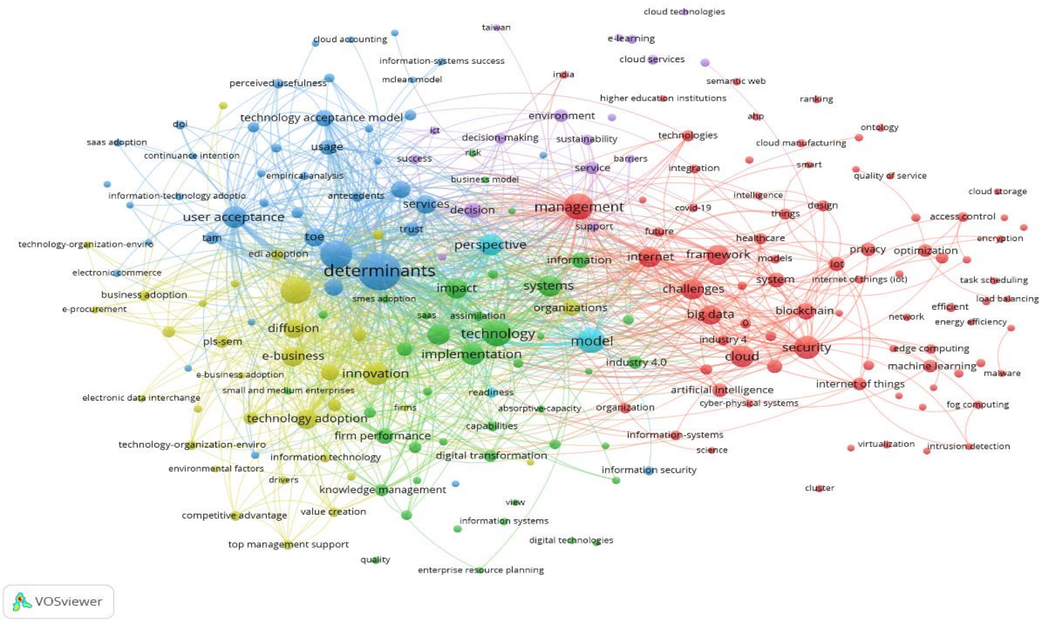

Figure 13: Visualization of the strength of keywords (Network Visualization)

Source: Author's own development (VOSviewer)

Figure 13 presents the keyword co-occurrence network map of cloud computing adoption research, constructed using VOSviewer. The visualization reveals distinct thematic clusters based on keyword co-occurrence patterns, with each cluster represented by a different color.

- Blue Cluster: This cluster is primarily centered around concepts such as "technology acceptance model," "user acceptance," "usage," "determinants," and "services." It indicates a strong focus in the literature on theoretical frameworks explaining individual and organizational acceptance of cloud technologies.
- Green Cluster: Keywords like "technology adoption," "innovation," "firm performance," "implementation," and "knowledge management" dominate this cluster. It suggests an emphasis on the organizational and strategic factors influencing cloud computing integration within businesses.
- Red Cluster: This cluster is heavily focused on technological challenges and future trends, featuring terms like "security," "privacy," "blockchain," "big data," "Internet of Things (IoT)," and "artificial intelligence." It highlights research dealing with technological risks, cybersecurity, and next-generation cloud applications.
- Yellow Cluster: Terms such as "e-business," "diffusion," and "electronic data interchange" are concentrated here, pointing to studies that explore the broader diffusion and business model impacts of cloud technology adoption.

- Purple Cluster (smaller): Emerging topics such as "e-learning," "higher education institutions," and "sustainability" suggest a growing interest in specific applications of cloud computing, particularly in education and environmental contexts.

The size of each node indicates the frequency of the keyword's appearance, while the thickness of the links between nodes represents the strength of the co-occurrence relationships. Overall, the network map highlights the multidimensional nature of cloud computing adoption research, connecting technological, organizational, strategic, and application-specific perspectives.

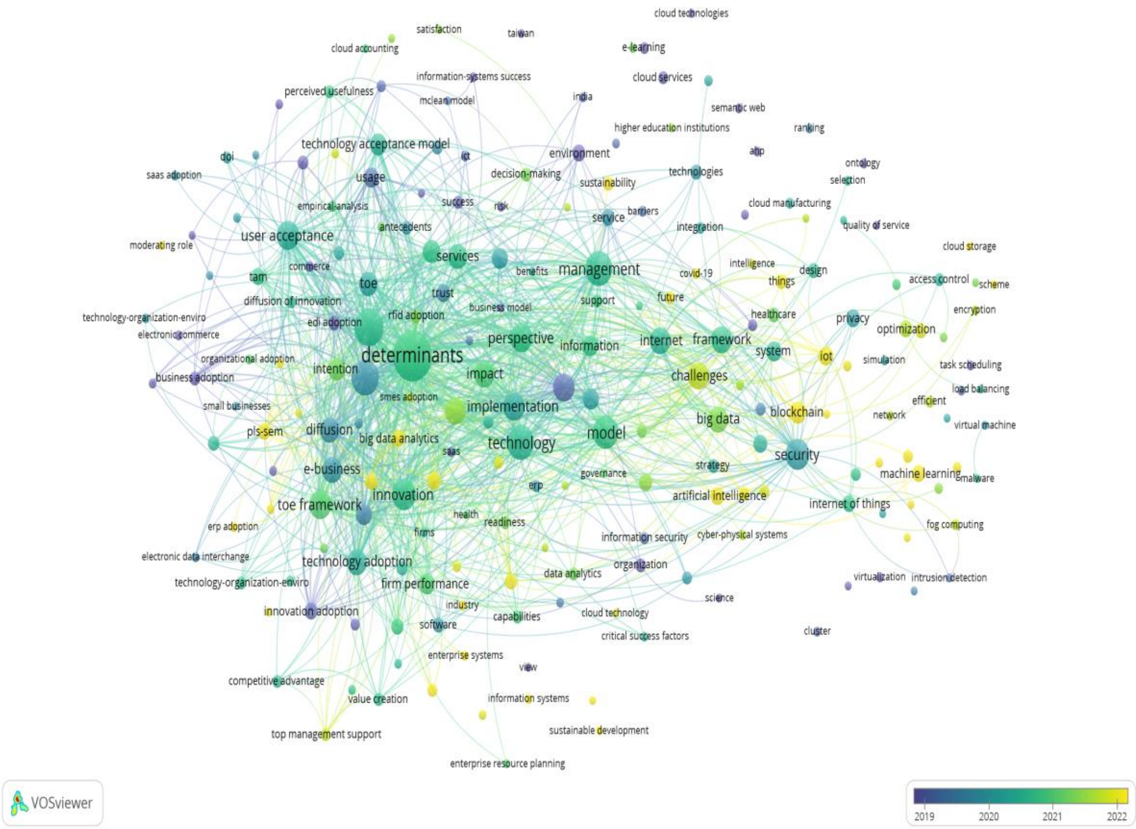

Figure 14: Visualisation of the keywords' yearly overlay strengths (Overlay Visualization)

Source: Author's own development (VOSviewer)

Figure 14 illustrates the overlay visualization of keywords related to cloud computing adoption research, highlighting the temporal evolution of thematic focuses between 2019 and 2022. In this map, the color gradient from dark blue (earlier years) to yellow (more recent years) indicates the average publication year associated with each keyword.

Analysis reveals that foundational concepts such as "technology acceptance model," "user acceptance," "determinants," "diffusion," and "e-business" are primarily located in the darker blue region. This suggests that earlier studies (around 2019–2020) concentrated heavily on theoretical frameworks and traditional models of technology adoption.

In contrast, emerging keywords located in the yellow regions, such as "blockchain," "Internet of Things (IoT)," "machine learning," "security," and "privacy," indicate a shift in research interest towards advanced technologies and contemporary challenges. These topics have gained prominence more recently (2021–2022), reflecting the growing complexity of cloud ecosystems and the rising importance of cybersecurity, AI integration, and edge computing.

Furthermore, newer topics such as "sustainability," "governance," and "healthcare" appearing in lighter colors suggest expanding applications of cloud computing beyond traditional corporate contexts into broader societal and environmental domains. This temporal mapping highlights the dynamic evolution of the field and underscores emerging areas that warrant further scholarly attention, particularly regarding strategic, ethical, and technological dimensions of cloud adoption.

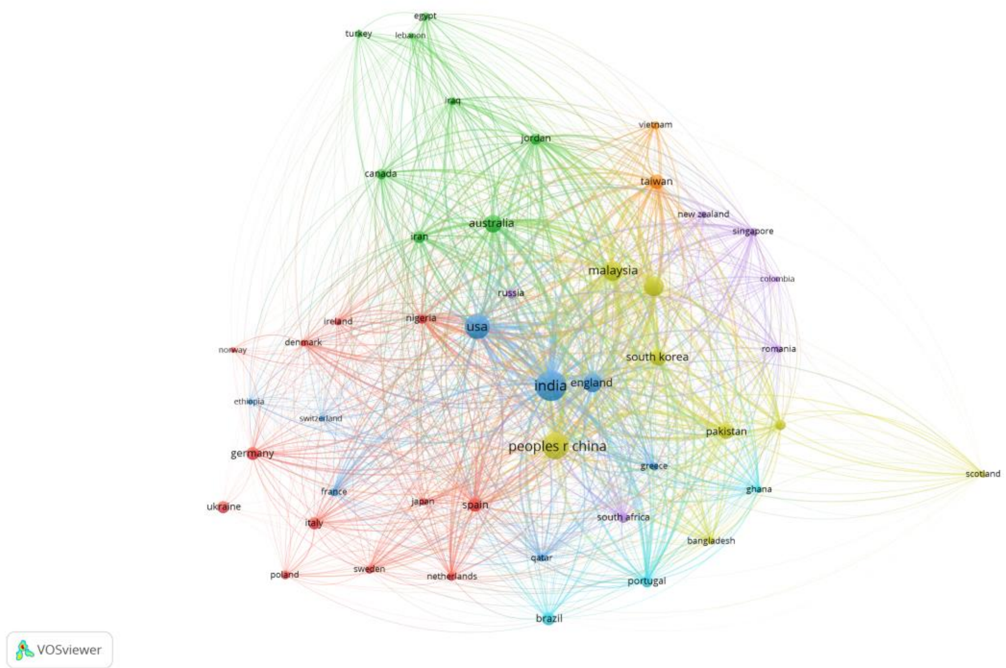

Figure 15: Country relations

Source: Author’s own development (VOSviewer)

Figure 15 depicts the country collaboration network in cloud computing adoption research, visualized through VOSviewer. Each node represents a country, and the size of the node corresponds to the volume of publications attributed to that country. The strength and thickness of the connecting lines between nodes reflect the intensity of international research collaborations.

The map reveals several dominant contributors: the United States, China, India, Malaysia, and England are central nodes, indicating their leading roles in the global production of research on cloud computing adoption. Notably, the United States and China exhibit dense collaborative ties with other countries, highlighting their influence and interconnectedness in the scholarly community (Glänzel, 2001).

Several regional clusters can be identified:

- Blue Cluster: Dominated by the USA, India, and China, forming the core of global collaboration.
- Green Cluster: Countries like Australia, Canada, Turkey, and Jordan, demonstrating strong intra-regional cooperation.
- Red Cluster: European countries such as Germany, France, the Netherlands, and Spain, with relatively strong internal collaboration but slightly less external reach compared to the USA and China.
- Yellow and Purple Clusters: Emerging research hubs including Malaysia, Pakistan, Singapore, and South Korea, reflecting the growing contributions from Southeast Asia and neighboring regions.

Interestingly, countries like Scotland and some African nations (e.g., Ghana, South Africa) appear more peripheral, suggesting less intensive participation in global research networks. The visualization underscores the geographical diversification of cloud computing adoption research, yet also reveals disparities in collaboration intensity across different regions.

Overall, this network highlights the central role of established economies in shaping research directions, while also pointing to the growing scholarly contributions from emerging markets

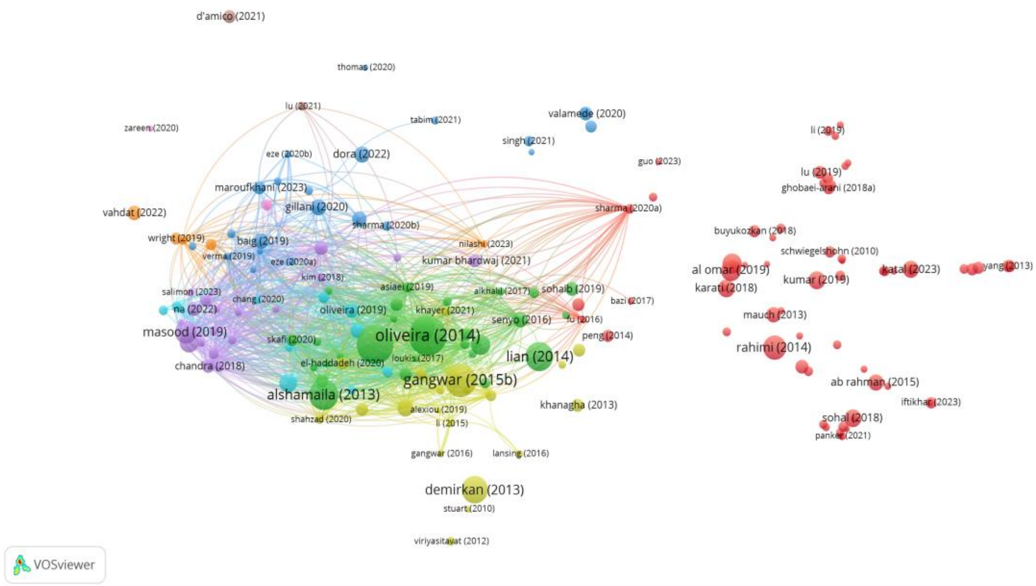

Figure 16: Reference web

Source: Author's own development (VOSviewer)

Figure 16 visualizes the reference network in cloud computing adoption research, highlighting the interconnections between highly cited documents. In this VOSviewer map, each node represents a specific academic publication, and the size of the node reflects its citation impact within the dataset. The thickness of the lines between nodes indicates the strength of bibliographic coupling that is, how frequently two documents cite common references (Kessler, 1963).

The visualization reveals several major clusters:

- Green Cluster: This central group, including prominent works such as (Alshamaila, Papagiannidis and Li, 2013; Oliveira, Thomas and Espadanal, 2014; Gangwar, Date and Ramaswamy, 2015), forms the intellectual core of the field. These studies primarily focus on the determinants and frameworks for cloud computing adoption in organizational settings, often employing the TOE (Technology-Organization-Environment) model.
- Red Cluster: Located to the right, this separate group includes works by (Rahimi *et al.*, 2014) and (Ab Rahman and Choo, 2015). These references often explore security, privacy, and risk management issues related to cloud adoption, suggesting a distinct thematic subfield.

- Yellow and Blue Clusters: Surrounding the core, these groups feature studies investigating user acceptance models (such as TAM and UTAUT), e-business adoption, and innovation diffusion, indicating methodological diversification within the field.

A key observation is that while the central core is highly interconnected, several peripheral documents (particularly on the right side of the map) exhibit fewer linkages. This suggests the presence of niche or emerging research topics that are somewhat isolated from mainstream theoretical frameworks.

Overall, this reference network map reveals the intellectual foundations and thematic divisions within cloud computing adoption research. It demonstrates how foundational theoretical studies are closely interconnected, while newer or specialized topics (e.g., cybersecurity, healthcare applications) are developing at the research frontier.

4.7 Conclusion of Bibliometric Findings

This bibliometric analysis has provided a systematic and comprehensive overview of the intellectual structure, thematic evolution, and global collaboration patterns within the field of cloud computing adoption research. Utilizing VOSviewer as the primary tool, the study visualized keyword co-occurrence networks, yearly thematic shifts, country-level collaborations, and citation-based intellectual linkages.

The keyword co-occurrence analysis (Figure 13) revealed the multidimensional nature of cloud computing adoption research, clustered into distinct thematic areas: foundational theoretical frameworks (e.g., TAM, TOE), organizational innovation and firm performance, technological risks such as security and privacy, diffusion and business model innovation, and emerging applications in education and sustainability. These findings underscore the integrative character of the field, where technological, organizational, and strategic factors intersect.

The overlay visualization (Figure 14) captured the temporal progression of research themes, illustrating a shift from early emphasis on classical adoption models and e-business to more contemporary concerns such as blockchain, Internet of Things (IoT), machine learning, and cybersecurity. This evolution reflects the dynamic and expanding scope of cloud computing technologies and their broader societal impacts, particularly in strategic, ethical, and governance dimensions.

The country collaboration network (Figure 15) highlighted the central role of major economies such as the United States, China, and India in driving scholarly output and fostering international research networks. Emerging contributions from Southeast Asia and parts of Europe further emphasized the geographical diversification of the research landscape, while the relatively peripheral position of some regions (e.g., parts of Africa) indicated areas for future collaborative development.

The reference network visualization (Figure 16) illuminated the intellectual foundations underpinning cloud computing adoption research. Core works focused on adoption frameworks and determinants, while newer and more specialized topics, particularly around cybersecurity and sector-specific applications, demonstrated the field’s ongoing expansion and diversification.

While the global bibliometric landscape demonstrates vibrant research activity in established and emerging markets, it also highlights critical geographical disparities. Notably, countries affected by conflict, such as Syria, are markedly underrepresented in the cloud computing research domain. This absence is not merely coincidental but reflects deeper structural barriers including limited research funding, damaged academic institutions, brain drain, and restricted digital infrastructure that have suppressed academic output in post-conflict settings (United Nations High Commissioner for Refugees (UNHCR), 2022).

Understanding this gap is essential because cloud computing can serve as a catalyst for recovery and innovation in fragile economies. Therefore, this study addresses a vital research void by exploring cloud adoption within the Syrian context, where little empirical evidence currently exists. Bridging this bibliometric gap contributes not only to academic discourse but also to the formulation of more inclusive global cloud strategies that consider conflict-affected regions.

In summary, the bibliometric findings map the historical development and current frontiers of cloud computing adoption research. They reveal both well-established domains and emerging thematic niches, providing valuable insights for guiding future studies. Furthermore, the relatively limited regional focus on developing economies, including the Syrian context, points to a significant research gap and an opportunity for future localized investigations that can enrich the global discourse on cloud technology adoption and innovation strategies.

4.8 Research Gap Identification and Relevance to Syria

The bibliometric analysis presented in this chapter highlights a strong global research focus on cloud computing adoption in developed and emerging economies such as the United States, China, and Europe. However, there remains a notable research gap in examining cloud computing adoption within fragile, conflict-affected, or post-crisis countries such as Syria.

While existing studies extensively explore technological, organizational, and environmental factors in stable contexts, little is known about how these frameworks apply in environments characterized by political instability, economic sanctions, infrastructure damage, and low digital maturity. These conditions create unique constraints that limit technology accessibility, financing, and skills development, making adoption dynamics fundamentally different from those in stable economies.

Therefore, this study contributes to the literature by extending cloud computing adoption research into the Syrian context. It addresses how traditional models like the TOE framework may require adaptation to reflect unique barriers and drivers present in fragile economies. The findings have the potential to inform targeted development strategies, such as creating resilient digital infrastructure, enabling alternative financing mechanisms, and designing tailored capacity-building programs that can operate effectively under ongoing instability. By offering an empirically grounded understanding of adoption barriers and enablers in such contexts, this research can guide policymakers, development agencies, and technology providers in aligning cloud-based solutions with the urgent needs of post-crisis recovery and long-term socio-economic growth. This highlights the relevance and necessity of this research for both academic inquiry and practical policymaking in post-conflict digital transformation efforts.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This research has comprehensively examined the factors influencing the adoption of cloud computing in Syrian organizations using a mixed-methods approach grounded in the Technology-Organization-Environment (TOE) framework and Technology Acceptance Model (TAM). The study was structured into two phases exploratory and empirical combining qualitative interviews and a large-scale quantitative survey to uncover both general and context-specific determinants of cloud computing adoption.

The qualitative findings from in-depth interviews revealed critical concerns such as infrastructural limitations, organizational resistance to change, lack of trust in cloud service providers, and cost misconceptions. These insights guided the refinement of the conceptual model and survey instrument. The quantitative phase involved the collection of responses from 400 IT professionals and decision-makers across Syria, providing a robust dataset for hypothesis testing. The findings indicated that organizational factors such as IT readiness, availability of technical support, and staff training were the most influential in shaping behavioral intention toward cloud computing adoption. Technological variables like perceived usefulness and ease of use, while significant in developed contexts, showed limited impact. Environmental factors such as regulatory support and vendor service quality showed mixed effects.

Statistical tests such as ANOVA and Pearson correlation revealed that gender and cloud awareness did not significantly affect behavioral intention, while workplace location showed only a weak but statistically significant relationship in one specific context ("assuming I had access to Cloud computing, I intend to use it"). Although perceived risk and perceived cost were frequently cited in literature as barriers, this study's quantitative results did not find them to be significant predictors of behavioral intention. The most notable finding was that behavioral intention significantly predicted cloud computing adoption, confirming H8 and H15. This research offers original empirical evidence from an under-researched context and highlights unique challenges for Syrian organizations, including limited local data centers, unstable internet connectivity, and the absence of clear legal frameworks for data security and privacy.

Overall, this research advances the understanding of cloud adoption in developing and conflict affected regions by offering a localized view supported by theoretical rigor and empirical validation. The findings underscore the importance of building internal capacities, increasing awareness, and implementing supportive policy frameworks to encourage wider cloud adoption. These insights can guide stakeholders including policymakers, IT leaders, and cloud providers in shaping strategies tailored to the specific needs and limitations of the Syrian digital ecosystem.

5.2 Recommendations

Based on both qualitative and quantitative findings, the study offers strategic recommendations to support the successful implementation of cloud computing in Syrian organizations. These recommendations are tailored for policymakers, senior management, IT teams, and cloud service providers, aiming to dismantle key adoption barriers and harness existing enablers. Specifically, policymakers are urged to prioritize the establishment of clear legal frameworks and inter-institutional coordination to address prevalent concerns related to data protection and cloud vendor accountability (Alkhater, 2022). Capacity-building efforts should include localized training tailored to organizational contexts and digital maturity (Haryanti, Rakhmawati and Subriadi, 2023). Enhancing SME participation in the cloud ecosystem necessitates streamlined procurement regulations and user-friendly onboarding frameworks to reduce entry barriers and promote broader engagement (OECD, 2019). Public-private partnerships could play a crucial role in building cloud governance structures that align with sector-specific needs (Li and Guo, 2024). Finally, targeted incentives such as cloud adoption tax credits or subsidized bandwidth can accelerate diffusion in nascent digital economies (Andres *et al.*, 2020).

Organizational factors emerged as some of the most influential predictors of cloud adoption. Therefore, Syrian organizations should prioritize enhancing their internal capacity and readiness. This can be achieved by developing comprehensive digital transformation plans that incorporate cloud computing into core business operations, equipping IT departments with modern cloud-compatible tools, and offering continuous training and professional development to build employee competence in cloud management. Furthermore, assigning specialized teams or roles to manage cloud transitions, from planning through implementation and monitoring, will support smoother integration and adoption.

A second key recommendation is the strengthening of national ICT infrastructure and the development of local cloud capabilities. Infrastructure limitations, such as unreliable internet and the lack of local data centers were identified as significant obstacles. To address this, Syria should invest in the expansion of high-speed broadband to enable secure, real-time access to cloud platforms. Establishing domestic data centers and edge computing facilities will also mitigate concerns related to latency, data security, and regulatory compliance. These efforts could be further enhanced through public-private partnerships (PPPs) aimed at co-developing scalable and resilient cloud ecosystems.

Additionally, widespread awareness and cultural change initiatives are necessary to overcome internal resistance and low cloud literacy among decision-makers. Awareness programs and workshops that highlight the strategic value of cloud technologies should be rolled out across government bodies and the private sector. Incorporating cloud-related topics into university curricula, offering industry certifications, and facilitating professional seminars can promote long-term cloud literacy. A culture of innovation and experimentation should be cultivated within organizations, encouraging the implementation of small-scale pilot projects that showcase the tangible benefits and return on investment of cloud solutions. Sharing successful case studies from comparable economies or regional contexts can further reinforce the value of cloud adoption.

Developing a robust regulatory and legal framework is equally critical. Many organizations remain cautious due to concerns over data security, privacy, and the lack of legal protection. Therefore, it is essential to enact and enforce comprehensive data protection laws that regulate data storage, cross-border transfers, and user consent. Additionally, compliance standards for cloud providers should be established to govern cybersecurity, service-level agreements (SLAs), and risk management practices. Regulatory bodies or digital transformation authorities could be created to oversee and guide cloud service use, particularly in sensitive sectors such as healthcare, education, and finance. These frameworks should be aligned with international best practices while remaining sensitive to Syria's unique legal, social, and economic context.

Financial incentives are also necessary to make cloud adoption more accessible, especially for small and medium-sized enterprises (SMEs). To alleviate cost-related barriers, the government could introduce cloud adoption grants, tax reliefs, or subsidized financing programs. Cloud vendors should be encouraged to offer flexible and scalable pricing models that accommodate varying organizational sizes and needs. Moreover, consulting services should be made available to assist organizations in evaluating the cost-benefit of adoption, selecting appropriate deployment models (such as hybrid or community clouds), and navigating the transition process effectively.

Finally, fostering a vibrant local cloud services ecosystem will be key to ensuring long-term digital sovereignty and innovation. Currently, overreliance on foreign vendors limits local control and innovation potential. Syria should promote local entrepreneurship in the cloud sector by supporting tech startups and infrastructure firms. Creating national or community cloud platforms dedicated to public institutions and essential sectors can enhance centralized and secure data management. Collaboration networks between local technology providers, academic institutions, and government agencies should also be established to drive innovation in cloud-based applications tailored to sectors like e-government, education, and healthcare.

By implementing these strategic recommendations, Syria can create a more supportive environment for cloud computing adoption one that not only addresses current limitations but also empowers organizations to harness the transformative potential of cloud technologies in the years to come.

5.3 Limitation of the Study

While this research makes a significant contribution to the understanding of cloud computing adoption within the Syrian context, several limitations should be acknowledged. These limitations may have influenced the scope, generalizability, and depth of the findings, and they also provide opportunities for future research.

- Geographical and Contextual Constraints

The study was geographically confined to organizations operating in Syria, a country that presents a unique combination of economic, infrastructural, and political challenges. Although this focus was intentional and relevant to the research objectives, the findings may not be generalizable to other developing or conflict-affected countries without careful contextual adaptation.

- Sample Composition and Representativeness

The data collected in the quantitative phase came primarily from IT professionals and decision-makers across various organizations. While their insights are crucial, the sample may not fully represent the views of other important stakeholders such as general employees, administrative staff, or end-users of cloud-based systems. Moreover, the use of non-probability sampling techniques (e.g., purposive and convenience sampling) may have introduced sampling bias, limiting the representativeness of the population.

- Reliance on Self-Reported Data

Both the survey and the interview data relied on participants' self-reported perceptions and experiences, which may be influenced by social desirability bias or inaccuracies in self-assessment. Although anonymity and confidentiality were maintained to reduce these risks, the subjective nature of responses must be acknowledged as a limitation.

- Cross-Sectional Design

The research adopted a cross-sectional design, capturing data at a single point in time. As such, it does not reflect changes in organizational behavior, technology readiness, or policy developments over time. A longitudinal approach would have provided richer insights into how cloud adoption evolves under dynamic conditions, especially in a rapidly changing digital environment.

- Limited Scope of Variables

While the conceptual model integrated key constructs from the TOE and TAM frameworks, it could not incorporate every potential variable influencing cloud computing adoption. Factors such as vendor lock-in, political instability, international sanctions, and user experience design were not explicitly analyzed but may hold significant relevance in the Syrian context.

- Likert-Scale Measurement and Statistical Assumptions

A methodological limitation of this study lies in the treatment of Likert-scale responses as interval data for parametric analyses such as ANOVA and regression. While this approach is widely accepted in large-sample research, it remains debated in methodological literature. To mitigate this concern, the study systematically applied assumption testing (normality and variance checks) and confirmed results through non-parametric robustness checks.

Nevertheless, the inherent subjectivity in treating ordinal data as interval-level should be acknowledged as a potential limitation.

5.4 Future Suggestions

While this study has provided valuable insights into the factors influencing cloud computing adoption in Syrian organizations, several important areas merit further investigation. Building on the findings, limitations, and contextual challenges addressed in this research, the following suggestions are offered for future academic inquiry and practical investigation.

- Conduct Longitudinal Studies

This study utilized a cross-sectional design, capturing data at a single point in time. Future research should adopt longitudinal approaches to monitor how cloud computing adoption evolves over time, particularly as the regulatory environment, infrastructure, and organizational capabilities develop. Long-term studies would provide more accurate insights into the adoption lifecycle and post-adoption outcomes.

- Expand the Demographic and Sectoral Scope

Future studies should include a broader range of participants, including non-IT employees, general users, and top-level executives, to gather diverse perspectives. Additionally, sector-specific investigations (e.g., healthcare, education, and manufacturing) could provide more detailed insights into industry-specific adoption barriers and requirements. Comparative studies between public and private sectors would also enhance the understanding of institutional differences in adoption readiness.

- Include Additional Variables and Theoretical Models

Although the study was grounded in the TOE and TAM frameworks, future researchers may consider incorporating additional constructs such as trust in government, user experience design, vendor lock-in concerns, cloud service maturity, and digital leadership. Further, the application of alternative models such as the Unified Theory of Acceptance and Use of Technology (UTAUT) could offer complementary insights.

- Explore Post-Adoption and Impact Evaluation

This study focused on behavioral intention and readiness to adopt cloud computing. Future research could explore post-adoption behaviors, including satisfaction levels, impact on organizational performance, return on investment (ROI), and change in operational efficiency. Evaluating the outcomes of cloud adoption could guide strategic decisions and help refine implementation practices.

- Conduct Comparative Regional Studies

To place Syrian cloud adoption in a broader regional context, future studies could perform comparative analyses across other Arab or developing countries. This would help identify shared challenges and unique enablers, offering valuable policy insights and best practices that can be adapted across borders.

- Assess the Role of Policy and Governmental Support

Further research should examine the influence of national digital policies, legal frameworks, and government initiatives on cloud adoption. This includes assessing the effectiveness of cybersecurity laws, data localization requirements, and public-private partnerships. Policy-oriented studies could support governments in creating more enabling environments for digital transformation.

6 NEW SCIENTIFIC RESULTS

This chapter outlines the principal scientific contributions derived from the research findings. Each result is directly linked to the key hypotheses presented in the conceptual framework and emphasizes how the study expands the academic discourse on cloud computing adoption in fragile and underrepresented contexts, particularly Syria.

1. Technological Enablers of Intention: The results indicate that H4, H5, H6, and H7 were not fulfilled. This means that in the Syrian context, perceived usefulness, ease of use, compatibility, and awareness do not significantly predict behavioural intention to adopt cloud computing. This contrasts with the expectations of the Technology Acceptance Model (TAM) and the TOE framework, which typically place these variables as primary adoption drivers. The lack of significance suggests that in fragile environments with sanctions, infrastructure gaps, and vendor restrictions, technological perceptions are outweighed by systemic and environmental constraints, thereby limiting their impact on adoption intentions. These null findings were confirmed through ANOVA diagnostics and robustness checks (normality, variance homogeneity, Mann–Whitney/Kruskal–Wallis), strengthening the validity of the conclusions.
2. Technological Barriers to Intention: Both H9 and H10 were not fulfilled, indicating that perceived risk and perceived costs do not significantly affect behavioural intention in the studied context. This diverges from many studies in stable economies where these barriers often deter adoption. In Syria, where risk and cost concerns are part of the general business environment, they appear to have little marginal impact on the decision to adopt cloud services. Non-parametric robustness checks yielded consistent results, confirming that these barriers were not significant even under alternative statistical assumptions.
3. Organisational Determinants: The findings show that H1 and H3 were not fulfilled, meaning gender does not significantly determine behavioural intention, perceptions, or adoption outcomes. This contrasts with certain developing-country studies where demographic variables influence adoption. In Syria's case, structural and environmental barriers appear to dominate decision-making, minimising demographic effects. ANOVA diagnostics (normality, variance homogeneity) and Mann–Whitney U tests confirmed the robustness of these null effects.
4. Environmental/Contextual Drivers: H2 was partially fulfilled. Workplace location had a significant effect only on the statement "Assuming I had access to cloud computing, I

intend to use it." The eta squared value ($\eta^2 = 0.020$) indicates a weak relationship. This suggests that geographical variation plays only a minor role, as infrastructural and policy challenges are pervasive nationwide. As only two workplace groups (capital vs. city) existed, post hoc tests were not applicable. Full inferentials (Levene's test, ANOVA, effect size, CI) were reported to substantiate this partial effect.

5. Adoption Pathway (Intention → Adoption): H8 and H15 were fulfilled, confirming a strong link between behavioural intention and actual adoption. This aligns with established adoption theories, reinforcing that fostering intention can directly lead to adoption even in high-risk environments if the necessary infrastructure and access are available. Both parametric regression and non-parametric robustness checks supported this pathway.

6. Impact of Behavioural Intention on Adoption Perceptions: None of H11, H12, H13, H14, H16, or H17 were fulfilled. This means behavioural intention does not significantly determine post-adoption perceptions of cloud computing. In the Syrian environment, perceptions seem to be shaped more by real-world operational realities (e.g., service reliability, vendor access, sanctions impact) rather than by pre-adoption expectations. The robustness checks confirmed these null relationships across all methods applied.

7 SUMMARY

This PhD research investigated the key factors influencing the adoption of cloud computing services in Syrian organizations using a mixed-methods approach. The study was motivated by the increasing global interest in cloud technologies and the noticeable gap in scholarly research addressing adoption within conflict-affected and resource-constrained environments such as Syria. Despite the growing relevance of cloud computing in enabling digital transformation, especially in developing regions, Syria has remained underrepresented in empirical literature. This study aimed to bridge that gap by providing a structured and contextual analysis based on both theoretical foundations and real-world data.

The research was grounded in the integration of two established theoretical models: the Technology–Organization–Environment (TOE) framework and the Technology Acceptance Model (TAM). These models were combined to construct a comprehensive conceptual framework consisting of technological, organizational, and environmental variables hypothesized to influence behavioral intention to adopt cloud computing.

The study was conducted in two main phases. The first phase, a preliminary (exploratory) phase, involved qualitative data collection through in-depth interviews with IT professionals and organizational decision-makers. This phase provided valuable context-specific insights and revealed emerging themes, including infrastructure limitations, trust issues, and organizational resistance to change. These qualitative insights were used to refine the research model and inform the design of the survey.

The second phase involved empirical (quantitative) research, using a structured questionnaire distributed to 400 participants from various sectors in Syria. Statistical analysis, including descriptive statistics, ANOVA, and Pearson correlation, was conducted using SPSS to test the relationships between the independent variables and behavioral intention to adopt cloud computing.

The findings of the study revealed that, contrary to expectations from prior TAM- and TOE-based research, technological enablers such as perceived usefulness (H4), perceived ease of use (H5), compatibility (H6), and awareness (H7) did not significantly influence behavioural intention in the Syrian context. Similarly, technological barriers perceived risk (H9) and perceived cost (H10) were found not to be significant predictors. Organisational determinants related to gender (H1, H3) were also not significant. Environmental/contextual drivers (H2) showed only a weak, partial effect, with workplace location influencing intention in limited cases.

In contrast, the adoption pathway (H8, H15) was strongly supported, confirming that behavioural intention significantly predicts actual cloud computing adoption. However, behavioural intention did not significantly influence post-adoption perceptions (H11–H14, H16, H17), suggesting that in Syria, user perceptions are shaped more by real-world operational experiences after adoption rather than by pre-adoption expectations.

These results underscore that in fragile and sanction-affected environments, traditional technological predictors are overshadowed by systemic, infrastructural, and policy-related barriers. Adoption in such contexts appears to depend more on overcoming external constraints than on altering individual technology perceptions.

The study offers several scientific contributions, including the empirical testing of established adoption models in a fragile-state context, the identification of non-significant roles for widely accepted TAM variables, and the confirmation of the behavioural intention–adoption link under severe environmental constraints. It also presents strategic recommendations aimed at policymakers, organizations, and service providers to facilitate cloud adoption through infrastructure development, legal and regulatory reform, vendor access, and targeted organizational capacity-building.

In conclusion, this research provides a robust foundation for understanding cloud computing adoption in Syria and similar environments. It emphasizes the need for localized models, questions the universal applicability of common adoption predictors, and provides practical guidance for stakeholders working toward digital transformation in high-risk, resource-limited settings. The study also opens pathways for future research, particularly in exploring post-adoption impacts, cross-country comparisons, and the evolving role of government and international cooperation in enabling cloud innovation.

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APPENDIX (A1) QUESTIONNAIRE

This appendix presents the questionnaire used to collect primary data for this study. The survey was designed to assess factors influencing the adoption of cloud computing in Syrian business organizations. The questionnaire consists of multiple sections covering demographic information, technological factors, organizational characteristics, and environmental influences, aligned with the TOE (Technology–Organization–Environment) framework. Participants responded using a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree)

Section A: Demographic Information

1- What is your gender?

Male

Female

Other

2- How old are you?

Below 18 years

19-30 years

31-45 years

46-60 years

Above 60 years

3- What is the location of your workplace?

Capital

City

Town

Village

4- How many years of Cloud experience do you have?

Less than 1 year

1-3 years

4-6 years

7-10 years

More than 10 years

5- What is your job position?

Owner/CEO

Manager/Team leader

Software Developer/QA Analyst

DevOps/System Administrator

Other

6- Which describes your primary involvement with Cloud computing the best?

Cloud provider end user

Cloud provider administrator

IT/Developer

Partner

Section B: Organizational Profile

7- What is the size of the company?

Less than 10 employees

11-50 employees;

51-250 employees;

More than 250 employees

8- How old is the company?

Less than 5 years

5-10 years

11-20 years

More than 20 years

9- Where is the headquarters of the company?

Aleppo Governorate

Damascus Governorate

Daraa Governorate

Deir ez-Zor Governorate

Hama Governorate

Al-Hasakah Governorate

Homs Governorate

Idlib Governorate

Latakia Governorate

Quneitra Governorate

Raqqa Governorate

Rif Dimashq Governorate

Al-Suwayda Governorate

Tartus Governorate

10- What is the market scope of the organization?

Local

National

International

Both national and international

Other:

11- What is the primarily business type at the company?

Aerospace

Agriculture

Mining

Food

Construction

Education

Electricity

Financials

Government

Banking

Healthcare

Information technology

Manufacturing

Professional and business services

Sales and marketing

Telecommunication

Transportation

Non-profit

Other

Section C: Cloud Adoption Status

12- Does your company use cloud-based solutions?

Yes

No

13 - Since when does your company use cloud-based solutions?

Less than 1 year

1-3 years

4-5 years

6-10 years

10+ years

14 - Which cloud computing services are used at your company?

Infrastructure as a Service (IaaS)

Platform as a Service (PaaS)

Software as a Service (SaaS)

Database as a Service (DaaS)

Storage as a Service (SaaS)

Business Process as a Service (BPaaS)

Disaster Recovery as a Service (DRaaS)

Network as a Service (NaaS)

Other:

15- Which applications have been moved to the Cloud?

CRM

ERP

Sales Management

Security

Storage

Continuity

E-mail Archiving

Scheduling/Calendars

Desktop Applications

16- Which ones do you think are the most valuable Cloud-based applications?

CRM

ERP

Sales Management

Security

Storage

Continuity

E-mail Archiving

Scheduling/Calendars

Desktop Applications

17- Is the Cloud provider implementation a standalone application to support a specific need or part of a strategic effort at the company?

Standalone application

Part of a strategic effort

I don’t know

18- How likely is your company to continue to use Cloud provider in the future?

Definitely will

Probably will

Probably will not

Section D: Strategic Drivers and Outcomes

19- What were the main motivations to move apply Cloud? Please choose maximum 3 motivations!

Agility/scalability

Lower costs

Reliability

Security

Sustainability

Efficiency

Streamlined administration

Better performance

20- What are the business objectives which led your organization to apply Cloud services? Please choose all that apply!

Increasing sales revenue

Increasing customer satisfaction

Increasing customer loyalty

Winning new customers

Improving customer retention

Improving customer service

Reducing operational costs

Improving data quality

Increasing up-sell opportunities

Increasing marketing effectiveness

21- Has your organization experienced positive effects regarding below business objectives as the consequence of applying Cloud services? Please select all relevant possibilities!

Increasing sales revenue

Increasing customer satisfaction

Increasing customer loyalty

Winning new customers

Improving customer retention

Improving customer service

Reducing operational costs

Improving data quality

Increasing up-sell opportunities

Increasing marketing effectiveness

Section E: Future Plans and Satisfaction Metrics

22- What are the current plans at the organization in relation to Cloud provider deployment in the next 12 months?

Decrease users by over 50%

Decrease users by 1-50%

About the same

Increase users by 1-50%

Increase users over 50%

Not applicable

23- How likely are you to recommend Cloud provider to others?

Definitely not

1

2

3

4

5

Definitely will

24- Please rate the Cloud provider user interface!

Unacceptable

1

2

3

4

5

Excellent

25- Please rate your overall satisfaction with Cloud provider!

Totally dissatisfied

1

2

3

4

5

Totally satisfied

26- What is the estimated time it took for the organization to achieve return on investment from the Cloud provider investment?

Maximum 6 months

6-12 months

13-18 months

19-24 months

24+ months

Section F: Organizational and Technological Readiness

27- According to your opinion, how the following organization and technology readiness related factors affect Cloud computing adoption? (1-5; 1: not at all; 5: totally)

1 2 3 4 5

Service quality

Usefulness

Security concern

Complexity

Cost

Organization size

IT infrastructure readiness

Feasibility

Trust

Organization culture

Organization structure

Privacy risks

Service quality

Usefulness

Security concern

Complexity

Cost

Organization size

IT infrastructure readiness

Feasibility

Trust

Organization culture

Organization structure

Privacy risks

Section G: Adoption Enablers and External Influences

28- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

1 2 3 4 5

Organisation must ensure that they have adequate technical support before adopting Cloud computing.

Organisation must ensure that they have adequate technical support after adopting Cloud computing.

Organisations have to provide staff training from Cloud providers or other training institution

Organisations should have enough resources to provide high speed and reliable internet for Cloud computing.

Organisations should have an adequate budget for Cloud computing adoption.

Organisations encounter pressure from competitors to adopt Cloud computing technology.

Cloud computing technology supports organisation gain competitive advantage.

The employees need to be trained in order to use the Cloud computing technology

Organisations should create employee awareness of using Cloud computing technology.

Organisation must ensure that they have adequate technical support before adopting Cloud computing.

Organisation must ensure that they have adequate technical support after adopting Cloud computing.

Organisations have to provide staff training from Cloud providers or other training institutions.

Organisations should have enough resources to provide high speed and reliable internet for Cloud computing.

Organisations should have an adequate budget for Cloud computing adoption.

Organisations encounter pressure from competitors to adopt Cloud computing technology.

Cloud computing technology supports organisation gain competitive advantage.

The employees need to be trained in order to use the Cloud computing technology

Organisations should create employee awareness of using Cloud computing technology.

Section H: Technology Acceptance Factors

29- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Perceived usefulness

1 2 3 4 5

Using Cloud computing services would improve my skills to manage business operation efficiently.

Using Cloud computing services would increase business productivity.

Using Cloud computing services would make it easier to manage my tasks efficiently.

Using Cloud computing services would increase my performance.

Using Cloud computing services would enable me to accomplish tasks more quickly.

Using Cloud computing services would improve my skills to manage business operation efficiently.

Using Cloud computing services would increase business productivity.

Using Cloud computing services would make it easier to manage my tasks efficiently.

Using Cloud computing services would increase my performance.

Using Cloud computing services would enable me to accomplish tasks more quickly.

30- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Perceived ease of use

1 2 3 4 5

Learning to use Cloud computing services would be easy for me.

My interaction with Cloud computing services would be clear and understandable.

It would be easy for me to become skilful by using Cloud computing services.

Learning to use Cloud computing services would be easy for me.

My interaction with Cloud computing services would be clear and understandable.

It would be easy for me to become skilful by using Cloud computing services.

31- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Compatibility

1 2 3 4 5

Using Cloud computing is compatible with most aspects of my tasks.

Using Cloud computing fits my work.

Using Cloud computing fits well with the way I do my work.

Using Cloud computing is compatible with most aspects of my tasks.

Using Cloud computing fits my work.

Using Cloud computing fits well with the way I do my work.

32- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Cloud computing awareness

1 2 3 4 5

I have received enough information about Cloud computing services in general.

I have received enough information about benefits of using Cloud computing services.

I have enough information about services which are applied at my organisation.

I have received enough information about Cloud computing services in general.

I have received enough information about benefits of using Cloud computing services.

I have enough information about services which are applied at my organisation.

Section I: Cloud Adoption Behaviors and Intentions

33- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Cloud computing adoption

1 2 3 4 5

I predict that I would continue to use Cloud computing services for my professional development.

I plan to use Cloud computing services to manage my personal development.

I intended to use Cloud computing services to access business data in the future.

I intend to adopt Cloud computing services for development purposes in the future.

I predict that I would continue to use Cloud computing services for my professional development.

I plan to use Cloud computing services to manage my personal development.

I intended to use Cloud computing services to access business data in the future.

I intend to adopt Cloud computing services for development purposes in the future.

34- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Perceived risk

1 2 3 4 5

I think using Cloud computing services in monetary transactions has potential risks.

I think using Cloud computing services in merchandise services has potential risks.

I think using Cloud computing services in product purchases has potential risks.

I think using Cloud computing services puts my privacy at risks.

I think using Cloud computing services puts the sensitive information of my organisation at risks.

I think using Cloud computing services in monetary transactions has potential risks.

I think using Cloud computing services in merchandise services has potential risks.

I think using Cloud computing services in product purchases has potential risks.

I think using Cloud computing services puts my privacy at risks.

I think using Cloud computing services puts the sensitive information of my organisation at risks.

35- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Behavioral intention to use

1 2 3 4 5

Generally, using Cloud computing services is advantageous.

Generally, I am in favour of using Cloud computing services.

Assuming I had access to Cloud computing, I intend to use it.

Given that I had access to Cloud computing, I predict that I would use it.

Generally, using Cloud computing services is advantageous.

Generally, I am in favour of using Cloud computing services.

Assuming I had access to Cloud computing, I intend to use it.

Given that I had access to Cloud computing, I predict that I would use it.

Section J: Perceived Cost Concerns

36- Do you agree the following statements? (1-5; 1: totally disagree; 5: totally agree)

Costs

1 2 3 4 5

The equipment cost is expensive of using cloud computing to offer integrated services.

The access cost is expensive of using Cloud computing architecture of my organization.

The transaction fee is expensive of using Cloud computing would be easy.

The equipment cost is expensive of using cloud computing to offer integrated services.

The access cost is expensive of using Cloud computing architecture of my organization.

The transaction fee is expensive of using Cloud computing would be easy.

APPENDIX (A2) HYPOTHESES ANALYSIS

This appendix contains the detailed SPSS output from the hypothesis testing and regression analyses conducted in this study, including descriptive statistics, ANOVA tables, and measures of association related to gender, workplace location, and cloud adoption behaviors. Additionally, it explores the relationship between the behavioral intention to use and various factors influencing cloud adoption.

This appendix is provided as 4 separate files titled Analysis1, Analysis2, Analysis3 and Visual Diagnostics

ABSTRACT

This study investigates the critical factors influencing the adoption of cloud computing services in Syrian business organizations by applying the Technology–Organization–Environment (TOE) framework. Given Syria's unique post-conflict socio-economic context, limited digital infrastructure, and under-researched cloud adoption landscape, this research aims to fill a significant gap in academic and practical knowledge. The study integrates constructs from the TOE framework with elements of the Technology Acceptance Model (TAM) to develop a comprehensive conceptual model addressing technological, organizational, and environmental determinants of adoption behavior.

A mixed-methods research design was employed, combining qualitative and quantitative approaches to offer both depth and generalizability. In the preliminary exploratory phase, in-depth interviews were conducted with IT professionals and decision-makers from various sectors to identify context-specific perceptions, barriers, and drivers of cloud computing. These qualitative insights informed the construction of a structured survey instrument, which was distributed to a sample of 400 participants for empirical validation. Data analysis was conducted using SPSS, including descriptive statistics, correlation, regression, and variance analyses, supplemented by non-parametric robustness checks.

The results indicate that organizational factors particularly IT infrastructure readiness, management support, and staff expertise are stronger predictors of cloud adoption intention than commonly emphasized technological factors like perceived usefulness or ease of use. Security concerns, limited internet reliability, and regulatory uncertainty emerged as key environmental barriers. Interestingly, some globally validated constructs, such as cost-effectiveness and relative advantage, were found to have limited impact in the Syrian context, emphasizing the need for localized adoption models.

The findings provide original insights into the unique Syrian context, enriching existing literature on cloud adoption by adapting the TOE framework to a fragile and underdeveloped national setting, introducing new empirical findings from Syria, and revealing that cloud adoption in such contexts is driven more by institutional readiness and environmental constraints than by perceived technological benefits alone. The research offers policy recommendations for Syrian stakeholders, including investing in ICT infrastructure, enhancing

legal frameworks, and supporting capacity-building initiatives. Ultimately, this work serves as a foundational reference for guiding Syria’s digital transformation strategy through informed and sustainable cloud adoption practices.

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