Chapter One

Introduction

1.1 Background of the Study

Cloud computing is a distributed computing technology that provides dynamically scalable computing resources including storage, computation power, and applications delivered as a service over the Internet. Cloud computing practices may also provide easier and quicker information retrieval and discovery, allow students to store and share documents, offer a more flexible environment by enabling ubiquitous access to materials, and facilitate interaction among students and instructors. Cloud computing in simple terms means storing and accessing data and programs over the Internet instead of our computer's hard drive. The cloud is just a metaphor for the Internet. In a computer network we typically represent the internet as a cloud. Cloud Computing is the use of hardware and software to deliver a service over a network (typically the Internet)[1].

With cloud computing, administrators can access files and use applications from any device that can access the Internet. An example of a Cloud Computing provider is Google's Gmail. Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models. Cloud Service Providers (CSPs) (e.g., Google, Microsoft, Amazon) are vendors who provide to their customers the facilities of cloud computing resources and services that are dynamically utilized based on customer's demand according to a certain business model[2]. Quality services in different areas such as business, education

and governance are provided to the customers online and are accessed via internet using a web browser, while data and software programs are stored on the cloud servers located in the data centres. Cloud computing has made a major breakthrough in the IT sector depending on it quality. With its emergence it has truly revolutionized the IT sector. It has played an important role in catering for the increasing demands for storage and infrastructure[3]. The exceptional capability of cloud is its ability to provide resources like hardware and software over a network.

Cloud computing service is related to requirements for installation and use of cloud computing applications by administrators[4]. Therefore, no requirements, no quality[5]. There are many factors that will affect the quality of a system or application such as reliability, tangibility, responsiveness, assurance and empathy of the quality of cloud computing practices in ICT polytechnics, Ogun State[6]. Reliability of cloud computing practices is the ability to be relied on or depended on as for the quality of cloud computing application accuracy, honesty or achievement. Tangibility is the appearance of physical facilities, equipment, personnel and communication materials that improve the cloud computing practices. Responsiveness is the willingness to use cloud computing services by administrators of ICT polytechnics in Ogun State to use the available equipment to perform their duty exceptionally. Assurance is the knowledge and courtesy of administrators and their ability to convey trust and confidence in their service delivery. And Empathy is the care and individualized attention administrators provide to the academic community with the use of cloud computing applications. Administrators' services in ICT polytechnics in Ogun State are not quality enough due to the inefficient use of cloud computing application available in the school.

Thereby, these services can be acquired through proper development of human capital, development of administrators through human capital development has become the Holy Grail to some organizations, a proof of how much the management truly cares about its workforce. The efficiency with which organizations manage, develop, motivate, involve and engage the willing contribution of those who work in them is a key determinant of how well these organizations perform. The significance of developing administrators in the application of cloud computing technology for information management has become more obvious given the growing complexity of the work environment, the rapid change in organizations and technological advancement which further necessitates the need for training and development of employees to meet the challenges. Human development of administrators in ICT polytechnics will help to ensure that organizational members possess the skills, knowledge and abilities to apply cloud computing technology in everyday activities of administrators so as to enhance their performance.

Human capital development presupposes investments, activities and processes that produce cloud computing knowledge, skills, and abilities[7]. Any effort to increase human knowledge, enhance skills, productivity and stimulate resourcefulness of individuals is an effort on human capital development. Human capital development is a process of increasing human skill, ability and knowledge in the use of cloud computing applications for increase in productivity and stimulate resourcefulness of trainees. The process should be systematic to the extent that there should be a plan for which previous activities will provide support for upcoming activities while facilitating the attainment of set goals. The process should be sustainable since the product (human capital) must make desired and

enduring impact on the organization or society. The process should be strategic to the extent that there are well-defined goals and targets whose attainments are time bound. It should be dynamic, responsive and result oriented; continually evolving and proactive to address emerging challenges[8]. Measures from Human Capital Theory will be used to establish human capital development for the purpose of this study[9].

According to the generally accepted value of human capital theory, improving organizational performance depends on employees' skill, knowledge, and aptitude as a fundamental principle of value creation. The "human capital theory," which was widely adopted after Gary Backer won the novel prizes, claimed that different levels of education and training correlate with different levels of wages and salaries, and that the more knowledge, skill, and ability one possesses, the more likely one is to land a better job. As such, human capital can be thought of as a physical means of production. Organizations make investments in human capital through training, education, and health. The study extended the human capital theory to say that "the component of human capital consisted of abilities, knowledge, skill, personal talent, behavior, and effort, when those three components plus time". The knowledge included IQ, intelligence, specific knowledge, and general knowledge for work. Skill is knowledge applied to work, including physical movements and job-related movements. Talent is an innate quality of the individual that can be enhanced through development. The expression of observable behavior, norms, ethics, and personal beliefs is called conduct. Individual make an effort when they strive to use their natural or unique resources, such as their talent, experience, knowledge, and capacity for hard work to succeed, and finally there is time. The administrators of ICT Polytechnics in Ogun State have been found to be missing in these

essential components of human capital development, which has negatively impacted the effectiveness of their work.

Human capital, which has historically been the main engine of growth for industrialized economies in the west and several South-east Asian nations, is obviously deficient in Africa. Asian nations like Singapore, Korea, and Japan prioritized high-quality technology innovation and the development of the necessary human capital, which enabled them to achieve rapid economic expansion. Africa's human capital development base is clearly inadequate. Inadequate institutions and support mechanisms for education and skill development continue to limit access to institutions of training and learning[10]. During human capital development, the focus of the trainers is to improve the data literacy skills of the trainees which in this case are the administrators of ICT polytechnics in Ogun State, Nigeria.

Data literacy skill is the ability to read, understand, create and communicate data as information, it focuses on the competences involved in working with data. Data literacy is the ability to understand and use data to inform decisions and is an interdisciplinary field lying at the intersection of data science, quantitative reasoning, and authentic context[11]. In addition to specific abilities, data literacy is characterized by habits of mind such as curiosity, resiliency, and ethical decision making. Data literacy is becoming more commonplace in formal and informal and is addressed in various efforts to reform undergraduate science education. The capacity to critically gather, handle, assess, and use data is known as data literacy. Another definition of data literacy is the capacity of non-specialists to use data. A data literate person follows the same phases of data processing

as data scientists and knows how to make use of them for its objectives. A data literate person gets along with basic understanding of the process and methods, data scientists are professionals with profound knowledge and skills in data management and advanced statistical methods. In other words, data literacy translates into being able to read and speak data, to understand data and being able to make use of them, in order to take a full part in society affected by the availability and accessibility of vast volume of data.

Data literacy are measured with amount of data collected, evaluated, managed, conceptualized and applied in order to improve the quality of cloud computing services among administrators in ICT Polytechnics, Ogun State as derived from data literacy skills and competency management model[12]. Data collection is the process of gathering and measuring information on targeted variables in an established system which then enables one to answer relevant questions and evaluate outcomes. Data evaluation is the process that determines whether data is usable for calculating risk estimates. Data management service is the practice of collecting, organizing, protecting and storing an organization's data so it can be analyzed for administrative purpose. Conceptualization is a process that involves coming up with clear, concise definition during administrative work while data application is the process of analyzing large-scale data to quickly surface rich insight or take autonomous action. The issue with administrative activities among administrators in ICT Polytechnics in Ogun State is not availability of advance technological equipment to support their computing services which has made cloud computing a difficult status to attain. In view of the above discussion, this study tends to investigate the influence of human capital development and data literacy skills of cloud computing services among administrators in ICT Polytechnics in Ogun State, Nigeria.

1.2 Statement of the Problem

Cloud computing connects many computing resources, storage resources, and software resources to form a vast shared virtual resource pool, from which users can purchase corresponding services, such as hydropower. Administrators are involved in maintaining databases relating to students and their academic progress. When administrators manage students' data and information appropriately through the application of cloud computing technology with quality services, it makes information and data access an easy one. However, preliminary investigation, close observation and literature review have revealed a decline in the quality of cloud computing technology in ICT Polytechnic, Ogun State. As a result, information and data management has been poor which has call for acquisition of data literacy skills on the path of the school administrators. As we know that the purpose of cloud computing technology is to manage students and staff information effectively but due to inability of the administrators to be able to use it, there is decline in information access and use and it will eventually lead to poor development on the nation's economy and infrastructural development because poor access to information is detrimental to student and institution's progress. Capital development of administrators and data literacy skills by ICT Polytechnics, Ogun State, Nigeria in the application of cloud computing technology has been identified to solve the observed problem of this study[13]. Administrators of ICT Polytechnics in Ogun State, Nigeria were perceived not to be able to make use of cloud computing technology in managing information and data mostly due to the fact that there is no provision for regular training in this sector which has reduced administrators' development.

1.3 Aim and Objectives of the Study

The aim of the study is to investigate the influence of human capital development and data literacy skills of cloud computing services among administrators in ICT Polytechnics, Ogun State, Nigeria. The specific objectives:

i. examine cloud computing services provided by administrators in ICT Polytechnics, Ogun State, Nigeria;
ii. identify the level of human capital development of administrators in ICT Polytechnics, Ogun State, Nigeria;
iii. investigate the level of data literacy skills among administrators in ICT Polytechnics, Ogun State, Nigeria;
iv. ascertain the influence of human capital development on cloud computing services among administrators in ICT Polytechnics, Ogun State, Nigeria;
v. examine the influence of data literacy skill on quality of cloud computing services provided by administrators in ICT Polytechnics, Ogun State, Nigeria and
vi. Investigate the combine influence of human capital development and data literacy skills on quality of cloud computing services by administrators in ICT Polytechnics, Ogun State.

1.4 Research Questions

The investigations were channelled by the following questions.

1. What are cloud computing services provided by administrators in ICT Polytechnics, Ogun State, Nigeria?
2. What is the level of human capital development among administrators of ICT Polytechnics, Ogun State, Nigeria?

3. What is the level of data literacy skills possessed by administrators in ICT Polytechnic, Ogun State, Nigeria?

1.5 Hypotheses

The following hypotheses have been developed and evaluated at a significance level of 0.05.

$H_0$1: There will be no significant influence of human capital development on cloud computing services provided by administrators in ICT Polytechnic, Ogun State;

$H_0$2: There will be no significant influence of data literacy skill on cloud computing services used by administrators in ICT Polytechnic, Ogun State;

$H_0$3: There will be no significant combined influence of human capital development and data literacy skills on cloud computing service provided by administrators in ICT Polytechnic, Ogun State.

1.6 Scope of the Study

The study focus on the influence of human capital development and data literacy skills on cloud computing services among administrators in ICT Polytechnics, Ogun State, Nigeria. The measures of cloud computing services are reliability, tangibility, responsiveness, assurance and empathy of the services. The measures of human capital development are personal talent of administrators, Behaviour of administrators, Effort of administrators and Time used by administrators on computing services while the measures of data literacy skills are data application, data collection, data evaluation, data management and conceptual framework of data. The geographical scope will cover Gateway (ICT)

Polytechnic, Saapade, Abraham Adesanya (ICT) Polytechnic, Ijebu – Igbo, D.S. Adegbenro (ICT) Polytechnic, Itori and Gateway (ICT) Polytechnics, Igbesa. The respondents were office secretaries, faculty officers and other administrators in ICT Polytechnic, Ogun State, Nigeria. ICT Polytechnics, Ogun State was chosen as the study area because the targeted problem is observed among administrators in the institutions.

1.7 Significance of the Study

Administrators, Management, and Researchers will significantly profit from this research. This study will focus on human capital development, and cloud computing practices among administrators in ICT Polytechnics, Ogun State, Nigeria. It will help administrators in tertiary institutions to follow the right path in acquisition of skills and data literacy in the application of cloud computing practices in information management.

The findings of this study will assist the management of tertiary institutions to provide the right equipment and training needed in enhancing the duty of administrators in the institutions.

The findings of this study will help students and researchers acquire more skills to improve and speed up their research work. This will establish a link and basis for future researchers and governments working on relevant research topics, the research work deliver pertinent and current data to scholars and students that embark on researches about different phases of human capital development and cloud computing practices and raise further questions for future researchers.

1.8 Limitation of the Study

The major issue that limited this study was retrieving information from respondents due to the nature of their work which makes it less receptive towards advancing research and time factor for retrieval of information.

1.9 Operational definition of terms

Cloud Computing Services: It is the standard at which the cloud computing services provided by administrators of ICT Polytechnics, Ogun State, Nigeria serve the students and staff of the institutions.

Reliability of Cloud Computing Services: It is the ability to be relied on or depended on as for the quality of cloud computing application accuracy, honesty or achievement among administrators of ICT Polytechnics, Ogun State, Nigeria.

Tangibility of Cloud Computing Services: It is the appearance of physical facilities, equipment, personnel and communication materials that improve cloud computing services among administrators in ICT Polytechnics, Ogun State, Nigeria.

Responsiveness of Cloud Computing Services: It is the willingness to use cloud computing services by administrators of ICT polytechnics in Ogun State to use the available equipment to perform their duty exceptionally

Assurance of Cloud Computing Services: It is the knowledge and courtesy of administrators of ICT Polytechnics in Ogun State, Nigeria and their ability to convey trust and confidence in their service delivery.

Empathy of Cloud Computing Services: It is the care and individualized attention administrators provide to the academic community with the use of cloud computing applications in ICT Polytechnics, Ogun State, Nigeria.

Human Capital Development: It is the process whereby administrators in ICT Polytechnic, Ogun State, Nigeria are trained and developed in the application of cloud computing technology.

Personal Talent of Administrators: This is the exceptional ability of administrators in ICT Polytechnics, Ogun State to attain difficult life goals that fit their interests, abilities, values and contexts.

Behaviour of Administrators: It is the range of actions made by administrators of ICT Polytechnics, Ogun State towards their administrative activities.

Effort of Administrators: It is the physical or mental activity needed by administrators in ICT Polytechnics, Ogun State to achieve their administrative goal through cloud computing services

Time Used by Administrators: It is the particular period used by administrators in ICT Polytechnics, Ogun State in their administrative duties.

Data Literacy Skill: It is the ability to collect, evaluate, manage and apply data in context including an understanding of data sources and constructs, analytical methods and techniques applied by administrators of ICT Polytechnics, Ogun State, Nigeria.

Data Application: It is the process whereby administrators of ICT Polytechnics, Ogun State analyze large-scale data to quickly surface rich insight or take autonomous action.

Data Collection: It is the process of whereby administrators of ICT Polytechnics, Ogun State gather and measure information on targeted variables in an established system which then enables one to answer relevant questions and evaluate outcomes.

Data Evaluation: It is the process that determines whether data is usable for calculating risk estimates by administrators of ICT Polytechnics, Ogun State.

Data Management: It is a specific set of technical abilities in the areas of information technology (IT) and computer science, such as the development and use of metadata (and different types of metadata). among administrators of ICT Polytechnics in Ogun State, Nigeria.

Conceptual Framework of Data: It is the first step in being data literate since it requires knowing what data is, how it functions in society, and how definitional changes can affect data collecting and generate new debates in ICT Polytechnics in Ogun State, Nigeria.

Administrators: They are the non-academic staff in ICT Polytechnics, Ogun State, Nigeria that are responsible for managing and supervising school faculty, education programs, and staff development.

Endnotes

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Chapter Two

Literature Review

This chapter reviewed related literature that enabled the researcher broaden her understanding on the research problem. The chapter is presented under the following headings:

2.1 Conceptual Review

2.1.1 Overview of Cloud Computing Services

2.1.2 Overview of Human Capital Development

2.1.3 Overview of Data Literacy Skills

2.2. Theoretical Framework

2.2.1 Servqual Theory of Service Quality

2.2.2 Human Capital Theory

2.2.3 Data Literacy Skills and Competency Model

2.3 Review of Empirical Studies

2.3.1 Human Capital Development and Quality of Cloud Computing Services

2.3.2 Data Literacy Skills and Cloud Computing Services

2.4 Conceptual Framework

2.5 Summary of Reviewed Literature

Endnotes

2.1 Conceptual Review

2.1.1 Overview Cloud Computing Services

Cloud computing is defined as a scalable Information Technology (IT) enabled capability in which resources of the computing infrastructure are provided as services over the Internet. These services are "service models" (e.g., software, platform, and infrastructure) and "deployment models" (e.g., private, community, public, and hybrid) that together provide ways to deliver cloud services. In higher education, cloud computing services are commonly used to provide the means for students to collaborate and interact in a distributed learning space. It has the potential to support advanced teaching and learning processes in the sense of developing one's collaborative social interaction during the problem-solving activities, reflections, knowledge sharing, and idea generation[1].

Since "nothing in IT lasts forever, and that technological evolution and economic factors can rapidly alter the trajectory of the industry," cloud computing characterizes not only a change in how business is conducted and IT assets are maintained more effectively, but also completely changes how the IT business operates. The NIST definition of cloud computing is the most widely used definition of cloud computing. According to NIST, cloud computing is "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with little management effort or service provider interaction." According to the cloud computing definition, Cloud computing, it is clear, offers a flexible IT architecture that adapts IT to business demands. Additionally, NIST has proposed the following five characteristics of

the cloud computing model: On-demand self-service: The customer association can later self-arrange computing capabilities as needed without requiring human interaction from the Cloud Service Provider (CSP); Access to a broad network: Computing capacities are made available across the entire network by diverse customer platforms; Pooling of resources, where network bandwidth, storage, memory, and processing resources of the CSP are gathered and used by multiple tenants without knowledge of the location of the virtual machine being used in the cloud; Rapid elasticity, where processing power can be scaled up and down naturally as needed; and consistent service, where the cloud frameworks' regular operations are carried out to customers[2].

In this sense, cloud computing may be described as a computing method in which vastly adaptive IT-related capabilities are made available as a service to external structures via internet technologies. Cloud computing is considered as a technology that combines virtualization, utility computing, and services utilizing software that can be accessed online. Because of technology, organizations are rethinking better ways to use IT resources that are auxiliary to their companies. Using a very flexible architecture that is accessible over the Internet, associations have the option to engage outside suppliers and on-request services. Additionally, shared computing resources including networks, servers, applications, services, and storage can be used to provide access to the on-demand services.3. There are three categories of cloud computing services: infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). The cloud meets the needs for broad network access, multi-tenancy, flexibility, economics, scalability, and abstraction while not quite being identical to the earlier computing models.

Higher education institutions have the option to use various forms of information and data clouds that they deem appropriate for their needs. Cloud computing can be organized using one of four models: public, private, communal, or hybrid. The IT administrations are external to the organization or IT division in a public cloud arrangement. The IT services in a private cloud, on the other hand, are installed inside the company, but individual business units pay the IT department for using institutionalized services while using the company's back-up systems. The community cloud encourages the sharing of infrastructure among various organizations employing the planned IT resources, and each organization has specific common goals and missions. A framework with at least two clouds, such as a private, public, or community cloud, is what makes up a hybrid cloud. The public cloud, with its multiple occupancy hardware services, offers the best use of the investment from the perspective of a service provider. This execution is more susceptible to problems than private systems because of the shared services (hardware and software), various occupancies, and constrained control allowed by the subscribing enterprise cloud[4].

Prominent companies like boards of directors and corporations frequently use this cloud when they require a large number of users to use common software programs inside of an extremely sophisticated security system. It can be imagined that many users in the context of a university with more than 20,000 students would require a desktop application and interface that was almost identical, as well as processing capability, to one another. IT offices must request an application set and a standard interface that can be changed as needed with minimal local input due to cost savings. The Hybrid Cloud is the most appropriate configuration since it combines private and public clouds. Due to e-

Learning instruction, general apps and information, such as data pertaining to modules or courses, can therefore be kept in a public cloud, whereas student applications and information can be retained in a private one. Typically, some apps that require careful monitoring and control are operated locally, while others are kept operating on a public cloud. A hybrid setup allows for flexibility when extra processing power is needed for small periods of time quickly, such as during exams. In these situations, the public cloud can take on the load for extra processing power or capacity. Due to the purchase, this wasn't quickly achievable in the private cloud timescales[5].

Cloud computing is a paradigm in which resources and/or services are provided over the internet. This leads us to the concept of SOA, which is an integration platform based on the combination of a logical and technological architecture oriented to support and integrate all kinds of services. In general, a 'service' in the framework of cloud computing is a task that has been encapsulated in such a way that it can be automated and supplied to the clients through a consistent and constant procedure. Any component can be considered to be a service, from the components which are closest to hardware, such as the storage space or the computational time, to software components aimed at authenticating a user or managing the mail, the management of a database or the monitoring of the use of the system resources[5].

The philosophy of cloud computing mainly implies a change in the way the problems are solved by using computers. The design of the applications is based upon the use and combination of services. In contrast to what happens in more traditional approaches, i.e. grid computing, the provision of the functionality relies on this use and the combination

of services rather than on the concept of process or on algorithms. Clearly, this brings advantages in different aspects, for example the scalability, reliability, and so on. For example, in the presence of a peak of resource demand, because of an increase of users or an increase of the data size, additional instances of a determinate service could be raised so that the application response time remains acceptable for users. In the corresponding case of a fall in demand, resources should be released. All of these actions are carried out in a way that is transparent to the user. The main features of this architecture are its loose coupling, high interoperativity and the presence of interfaces that isolate the service from the implementation and the platform[6].

In an SOA, the services tend to be organised in a general way in layers or levels (not necessarily with strict divisions) where, normally, some modules use the services that are provided by the lower levels in order to offer other services to the superior levels. Furthermore, those levels may have different organisational structures, a different architecture, etc. Depending on the type of services offered, we can find three main types of layer which, together, compose what is known as a 'stack': a storage cloud, which provides storage services based on blocks (chunks) or files, a data cloud, which provides data management services, based on registers, columns or objects, a computation cloud, which provides high performance execution services. The cloud computing paradigm benefits large projects. As is well known, many applications in science or business domains face a high computational load. This may result from the requirement of handling large amounts of data stored in static databases, which implies a high data storage capacity; or may be the result of a dynamic data stream, which requires a high throughput network connection.

The current benefits of cloud computing for application providers and end users can be summarised as follows[7]: Scalability in resource usage: a cloud appears as an illusion of infinite computing resources accessible on demand, and allows the users safe investment in infrastructures. Therefore, users may start with a minimal scale of resources and increase their resource occupancy in accordance with their needs. Flexibility in the pricing model: the scalability in resource occupancy stated above directly prompts flexible pricing models of clouds. Low administration effort: the administration and maintenance is on the server side, liberating the application user from this responsibility. *More mobility*: the cloud environment is accessible from any device as long as it has an internet connection, since all the workload is carried out on the cloud (data centre) instead of local facilities.

Depending on the relationship between the provider and the user, a cloud can be classified as: Public cloud, the one most commonly referred to, is owned and operated by independent vendors and accessible to the general public. Private cloud is an internal utilisation of cloud technologies which is maintained in-house and solely accessible to internal users within an organisation. Community cloud is shared by several organisations and supports a specific community that has shared concerns (e.g. mission, security requirements, policy, and compliance considerations). It may be managed by the organisations or a third party and may exist on premise or off premise. Hybrid cloud is a combination of two or more types of clouds (private, community, or public). For example, an organisation may bridge its internally operated private cloud with other public clouds together by standardised or proprietary technology in order to satisfy business needs[8]. Among the four deployment models, public cloud is what the term 'cloud computing'

was initiated for and commonly refers to. Other deployment models are variations of public cloud but share a similar set of technologies and levels of services. The three service levels of cloud computing will be discussed in the following section[8].

Cloud computing practices are generally classified into three layers: Infrastructure as a Service (IaaS): IaaS provides the raw materials of cloud computing, such as processing, storage and other forms of lower level network and hardware resources in a virtual, on demand manner via the Internet. Differing from traditional hosting services with which physical servers or parts thereof are rented on a monthly or yearly basis, the cloud infrastructure is rented as virtual machines on a peruse basis and can scale in and out dynamically, based on customer needs. Such on-demand scalability is enabled by the recent advancements in virtualisation and network management. IaaS users do not need to manage or control the underlying cloud infrastructure but have control over operating systems, storage, deployed applications, and in some cases limited control of select networking components (e.g. host firewalls). Typical IaaS examples are Amazon EC2 (Elastic Cloud Computing) and S3 (Simple Storage Service) where computing and storage infrastructure are open to public access in a utility fashion. For a fee (e.g. USD0.085 per hour for an on-demand small Linux/UNIX server instance, or USD0.12 per hour for a Windows one), a user can easily access tens of thousands of virtual servers from EC2 to run a business analysis, and then release them as soon as the computational work is done. Another example, Eucalyptus, based on an open source framework, is a cloud implementation that provides a compatible interface to Amazon EC2, and allows users to set up a cloud infrastructure on premise and experiment prior to purchasing commercial services[9]. Some researchers suggest to further divide IaaS into HaaS

(Hardware as a Service) and DaaS (Data as a Service), but it is more common that IaaS is considered as a whole concept.

Platform as a Service (PaaS): PaaS moves one step further than IaaS by providing programming and execution environments to the user. A PaaS product acts as an integrated design, develop, test, and deploy platform. The PaaS user can create applications using programming languages and APIs supported by the provider, and then directly deploy the applications onto the provider's cloud infrastructure within a few clicks. The PaaS user does not manage or control the underlying cloud infrastructure (including network, servers, operating systems, or storage), but has control over the deployed applications and possibly application hosting environment configurations. Such an approach can reduce most of the system administration burden (e.g. setting up and switching among development environment, test environment, and production environment) traditionally carried by the developers who can then concentrate on more productive problems. PaaS typically provides a complete set of development tools, from the interface design, to process logic, to integration. Some other appealing features of PaaS include built-in instruments measuring the usage of the deployed applications for billing purposes and an established online community for collaboration and problem solving[9].

An example of PaaS is Google's App Engine, which enables users to build applications on the same scalable systems that power Google applications. Google's App Engine aims to enable users to easily develop applications on the Internet in collaboration with other developers from around the world. To facilitate collaboration, PaaS providers often

intentionally cultivate online user communities and marketplaces (e.g. Google Apps Marketplace1) where developers can share, buy, and sell their codes, products, and services to each other. PaaS offerings lower the entry level for online application development. WaveMaker, recently acquired by VMware, provides an easy and intuitive way of building Java-based websites, enabling non-programmer users to build their own online applications in the cloud. These types of platforms comprise a modern instantiation of the End User Computing (EUC) paradigm which has long been envisioned by generations of IS researchers[9].

Software as a Service (SaaS): SaaS provides users with complete turnkey applications through the Internet, even complex systems such as those for CRM or ERP. Software or applications are hosted as services in the cloud and delivered via browsers once subscribed to by the user. This approach can eliminate the need to install, run, and maintain the application on local computers. SaaS is known for its multi-tenant architecture in which all the users share the same single code base maintained by the provider. Authentication and authorisation security policies are used to ensure the separation of user data. Such a sharing mechanism enables the cost and price of SaaS to stay competitive compared to traditional off-the-shelf and bespoke software. SaaS is expected to alleviate the user's burden of software maintenance, and reduce the expense of software purchases by on-demand pricing. A prominent example of SaaS is Salesforce.com's online CRM system. This system provides users with complete CRM applications as well as a user side customisation platform based on its PaaS by-product Force.com. Two types of customisations are available; one is 'point-and-click configuration' that requires no coding, the other is 'customise with code' that allows

developers to create new functionalities beyond the constraints of configuration, with Apex; Salesforce.com's own native programming language. Thus on its own website, Salesforce.com declares that there are currently '77,300 Salesforce implementations. All of them unique'. Similar to PaaS, SaaS providers also leverage the 'power of crowd' by providing online user communities and marketplaces where SaaS users and third-party vendors can share, sell, and buy add-ons, modules, or customisation services to enhance the core application.

An example of such a marketplace is Salesforce.com's AppExchange. This marketplace acts as a specialized aggregator and enables features such as requesting quotes, sharing demos, etc. The new add-ons bought from the marketplace can be deployed by a few clicks in a few minutes. IaaS, PaaS, and SaaS are inherently interrelated with each building on the former. These three layers reflect a full spectrum of cloud computing services. Cloud computing has promised many technological and sociological benefits. The computing power is generated from highly centralised and standardised data centres which contain up to several million servers, with considerable economies of scale. From an enterprise standpoint, cloud computing can deliver on-demand computing power at a very low (or no) upfront cost for infrastructure and ongoing maintenance. Cloud computing also promises to provide better performance, reliability, and scalability. Some evidence shows that these are being delivered. From an environmental standpoint, owing to the advanced electrical and cooling systems used by its centralised data centres, cloud computing has promised to bring low environmental cost and high energy efficiency, compared to the traditional scattered enterprise data centres. All in all, these seductive promises have attracted enormous interest from many organisations.

Cloud computing service is the capacity to ensure a specific degree of performance or to assign different priorities to various programs, users, or dataflows10. The entirety of a service's attributes that affect its capacity to meet the explicit and implicit needs of its users constitutes the quality of a cloud computing service (service quality assurance). The fulfilment of functional and non-functional requirements determines the quality of a cloud computing service. The services description will determine how well they satisfy the user's functional needs. In cloud services, there are a significant number of non-functional services that must be taken into account. As a result, it is believed that cloud computing service parameters are connected to a cloud service's non-functional characteristics. Reliability, flexibility, performance, security, and usability were chosen as the top five characteristics of cloud computing services in the study. System availability, fault tolerance, user experience levels, privacy, and safety are all addressed by reliability. Scalability, portability, and interoperability of a system are all examples of flexibility. Performance is concerned with system effectiveness, response time, throughput, and adherence to previously agreed-upon service requirements.

It frequently offers indicators for calculating SLAs and gauging the compliance of cloud computing services. Since customers primarily care about the response time, processing time, or throughput of the applications operating on top of cloud services and use these performance metrics to evaluate CSPs, this attribute is very important to both users and CSPs. Accountability, confidentiality, integrity, audit trails, etc. are all components of security. While usability places some emphasis on customer satisfaction and value. In addition to these characteristics, resource consumption and methods like monitoring utilization to spot over- or under-provisioning are key issues for both cloud users and

CSPs. A crucial step in determining and sustaining specific levels of cloud computing service quality is the assessment of consumption patterns.11. To do this, it is necessary to have the following relationships:

- Relationship with connection to the SLA. The SLA typically contains a description of the cloud computing service attribute. As it outlines the service level goals to make sure that the delivered cloud computing service satisfies user expectations, the SLA is a suitable way to express the cloud computing service assurances.

- Relationship with monitoring. The contract must be implemented carefully because the cloud computing service features, such as reaction time or throughput, have a high degree of fluctuation.

As a result, ongoing oversight of cloud computing service qualities is required for the service provider to uphold SLAs. The client frequently assesses SLA compliance. A popular approach to assure adherence to the agreed-upon requirements is to monitor the different SLA parameters. The monitoring of cloud computing service agreements is based on extracting metrics required to conduct measurements and allows the client to examine the behavior of the service of cloud computing service. IT technologies are used, for example, to monitor the server, applications, databases, and networks. In order to maintain an appropriate balance between the advantages to the CSP and the happiness of the client, the process connected with monitoring to assure prevention, correction, and control in cloud computing services is necessary.

According to definition, Quality service should be related to requirement, to imply that requirements should be there[12]. There are many factors that will affect the quality of a

system or application. Flexibility, the ability of the software to manage the functionality without destroying the system. Maintainability and readability, maintainability is a little similar with flexibility but it focus on modifications about error correction. Performance and efficiency, performance is about the response time of the software. Scalability, a scalable system responds user's actions in acceptable amount of time. Availability and Robustness, A robust software should be available even if there is failure state. Usability and Accessibility, User interface is the visible part of the software to the user, so it must be easy to use. Platform Compatibility, A quality software should run on as much various platforms as it can. Therefore, it will cover many users to use the software. The meaning of platform means operating system and internet browsers. Security, Security is important factor to specify the quality of software. You should implement a security policy and apply it correctly on the software and do not leave any entrance gap. Security policies like authentication and authorization techniques, data encryption with highlevel algorithms and network attack protection.

As we explained before about the cloud computing service, it is a challenge to implement Quality in cloud computing applications. There are many techniques to provide quality of service to the cloud applications. Scheduling, admission control and dynamic resource provisioning are some techniques used to achieve that goal.

Scheduling: Cloud service scheduling categorized into two categories: user level and system level. At user level scheduling deals with problems raised by service providing between both service provider and customer. Market based and auction based schedulers are fit for ruling the supply and demand of cloud resources. Market based resource

allocation is powerful in cloud computing environment where resources are handed over to user as a service. The system level scheduling handles with resource management in datacenter. Datacenter contain many physical machines, Million request sent from user's side, scheduling these requests to the physical machines done in datacenter. This scheduling affect the performance of datacenter. Service provisioning in cloud systems based on Service Level Agreement (SLA). SLA is the contract between service provider and customer mentioning the terms of agreement including the nonfunctional requirement represented as Quality of cloud computing service.

Admission Control: The main purpose of admission control is to provide strong performance. At admission control time, the Infrastructure Provider (IP) must consider the extra requirement along with the fundamental computational and networking necessities that may be required to be added to runtime so it become flexible. In many cases, these flexible requirements may be very large comparing it to the normal requirements. For example, if there are many users are working on cloud application with high divergence, the number of virtual machines are required more and that may be added at runtime many times multiple of the number of the basic ones. So that, the number of flexible requirements plays important role in the total requirements and therefore the cost of hosting the service.

Resource provisioning: Dynamic resource provisioning is the process of assigning available resources to the cloud application. Resource allocation will make services suffer if the allocation not managed in the right way. Resource provisioning will solve this problem by allowing the service providers to manage the resources of modules

individually. Resource Allocation Strategy (RAS) is all about integrating service provider services activities to allocate insufficient resources within the limit of cloud environment so that it meets the needs of the cloud application. It need the demand and type of resources for each application to complete the user task. The order and allocation time for resources are inputs for optimal RAS.

Essentially, the cloud computing philosophy suggests a shift in how challenges are tackled through technology. Using and combining services is the basis for application design. Instead of relying on the concept of processor algorithms, as with more conventional methods, such as distributed systems, the provision of functioning depends on the use and integration of services. In other words, this has benefits in terms of adaptability, dependability, scalability, and so on. For illustration, more instances of a specific service could be launched so that the application's response time stays appropriate for consumers during a spike of resource requirements due to a rise in customers or a rise in computational load. As a consequence of a decline in demand, available resources should be made available. Everything is done sensibly to the customer. Among the most notable cloud computing are its minimal connection, high degree of interoperability, and protocols that separate the provider's execution and environment[13]. It's not uncommon for an SOA to divide its operations into levels or layers (rather than in precise boundaries).

Some components make usage services rendered by lower tiers to allow other capabilities to higher ones. Aside from that, these divisions could have multiple corporate frameworks, architectural designs, and so on. According to the type of arrangement being

offered, there are generally three basic types of layers together, which form what is described as According to the kind of arrangement being offered. There are generally three basic types of coatings together, which include what is described as a cloud-based storage system that provides data storage depending on "files" or "blocks." Cloud computing is a collection of registers, columns, or entities that offer services and complete execution services are available by a compute cloud. It is commonly known that many corporate and scientific applications have high computing needs. Since processing enormous volumes of data stored in stable systems needs a high level of communication link, a continual data flow also suggests a large quantity of storage space. Several categories can be used to organize service-oriented systems. One frequently used characteristic for classifying these systems is the level of complexity that they offer to the system user.[14].

The software and computer program collectively stand in for the IaaS when compared to a single computer platform. The operating system controls and facilitates access to the system resources. The IaaS customer leases computer resources from the IaaS provider rather than purchasing and setting up its whole computing infrastructure. The customer only pays for what they use because services are often charged based on actual usage. Because of the dynamic scalability of cloud computing, they use (and pay for) fewer resources when the workload is low. When a customer has a more urgent need for assistance, IaaS can make them available to satisfy their needs. Most service agreements include a top dollar amount that customers are not allowed to exceed. Scientific researchers and practitioners are a good illustration of a typical IaaS customer. Due to the IaaS and the substantial infrastructure it offers as a service, these clients are able to plan

experiments and analyze data to a degree that would not be possible otherwise. One of the most well-known IaaS providers today is Amazon's Elastic Computer Cloud (EC2). IaaS service providers like RackSpace, Google Compute Engine, and Windows Azure are also well-known.

E-learning systems advent expand at an exponential rate due to the suspension of oncampus classes, tremendous expansion in the number of students, instructional content, services available, and materials made accessible. It's essential to select a platform that can scale to meet demand while still keeping expenses in check while optimizing resource processing, storing, and communication requirements. Cloud computing is what's happening here in the shape of delivery and retrieval of information and content. In contrast to previous 'traditional' learning environments, defining the promise of SaaS applications for resilient and comprehensive distance learning may help us comprehend the advantages of cloud computing mostly on a technological and pedagogical level. Throughout terms of achieving a beneficial system for online tools and interactive services, such as teaching materials, recordings, educational materials, peer instruction, and so on, we ought to offer the 'road' for supporting migration to such a model. Many educational institutions are now using cloud technology, and it's evident that it has a promising future in.

Education A cloud-based e-learning system known as SaaS enables users to take advantage of cloud computing. Its minimal hardware requirements allow for quick deployment by the end-user. Additionally, it frees up the provider from system support and maintenance duties, allowing the manufacturer to concentrate on the most important

aspects of their business while still receiving free automated upgrades and supplying necessary resources via Web 2.0. From a technological perspective, cloud computing systems and e-learning system design are both essential to the coherence, harmony, efficient use of resources, and long-term stability of the e-learning environment in education[12]. This will be equally handy for the situations like Coivd19 where the moment is restricted. It is appropriate for the program type education sector to pay for content peruse, making it available to more sophisticated programs and required applications. Numerous educational establishments can use a SaaS server. Scalability is built-in to the system because it is hosted on a cloud server. The software's performance will not deteriorate as student usage increases. To acquire the confidence of consumers and a comprehensive providing users system software, the SaaS provider needs a sophisticated level of security. The consumer data is dispersed throughout various services and therefore must be consolidated in obtaining a comprehensive picture of the business, resulting in an increased need for platforms and data integrators for education. The advantages of a cloud-based curriculum have previously been studied from a technological standpoint by specific authors. While affordability is the most frequently cited concern, other considerations include those highlighted for cloud use throughout the practice.

It is not necessary to back up and move data between devices using a hard drive. Creating a reservoir of information means that students can keep it for as long as they desire, and it will continue to grow with them. Recovering after a crash seems to be almost entirely superfluous in this situation. There's essentially no information lost if the user machine fails. While working from numerous locations, students can access their files and modify

them using virtualized programs that have also helped institutions implement E-Learning recently and notably during the lockdown. It offers academic organizations a minimal cost-effective alternative for their academics, staff, and students. Data access monitoring is made simpler by the notion that just one location must be controlled rather than hundreds of computers dispersed across a larger region. Furthermore, because the cloud has a single database for all users, cyber security modifications can be efficiently evaluated and deployed[13].

Subsequently, even though more efforts are required to determine how cloud-related pedagogies or assessments of learning purposes, from a scholarly perspective, one of the advantages of the cloud is its ease of access, as it is mainly created to permit users to collaborate from anywhere at any given time. It can reach more learners outside the traditional teaching environment and meet their requirements. It can provide more meaningful information to a broader spectrum of students in a more comprehensive range of contexts.

The integration of cloud technology and e-learning has received more attention from the institutions due to its high demand to continue education. Almost all the institutions of schooling deemed it to be an operative and suitable alternative for e-Learning. Nevertheless, an absence of research may provide a theoretical foundation from which a methodology could be constructed. The flexibility implicit in the cloud strategy, on the other hand, could've been highlighted as a considerable advantage in producing an analytical framework and creating successful teaching techniques. The drawback in this field is that few studies provide a strategic or tactical of the subject. Conversely, the

overall characteristics of the cloud are associated with social engagement and collaboratively learning pursuit in the literature[13].

Today's cloud computing, applications, and capabilities may tremendously aid the profitable market of e-learning. The inadequacies of traditional local physical labs and computing platforms can be significantly improved with the help of a cloud-based e-learning system. However, before the cloud can be widely used and embraced to facilitate and promote e-learning, basic issues and obstacles must be removed. In order to effectively use cloud computing for e-learning and teaching, academic institutions must both provide IT support and put instructors and students through a learning curve. Use current public or commercial cloud resources or services, third-party solutions, or both as you see fit. To determine the optimal cloud model for the needs of the class, the instructor should also speak with the university's IT department and be well-versed in cloud capabilities. The setup, assignment, and management of cloud resources and student accounts must be taught to the instructor. Additionally, guidance and instruction must be given to students on how to access and utilize the cloud-based course resources.

The learning curve for instructors and students may be challenging or simple, depending on the course's requirements and design. Faculty in some disciplines, such as computer science and associated courses, can find it simpler to understand and use the cloud than faculty in other disciplines. A cloud-based system incorporates the built-in benefits of cloud computing into e-learning, including cost savings, fault tolerance, improved accessibility, and distant connectivity. The advantages of cloud computing can be fully realized with careful pre-implementation planning. Any of the methods below can be

used by businesses to transition from their current e-learning system to cloud-based e-learning. The conversion of an e-learning program entails a number of processes, including the implementation of the server and client modules as well as the installation of the operating system and middleware. User requirements, the availability of the existing IT infrastructure, and a cost/benefit analysis are all required in a migration feasibility study. By effectively mapping existing resources to the cloud tiered architecture employing virtualization to decrease resource under-utilization, a system's financial cost can be kept to a minimum. A poor internet connection can greatly hinder cloud-based education and e-learning, even if connectivity and speed have increased significantly over the past ten years to an acceptable level globally. When data and services are accessible from non-regional cloud datacenters, the problem is made worse. Users and students of cloud-based e-learning systems may experience undue stress as a result of this issues[14].

If students need to use specialized software, equipment, and resources in physical laboratories, the cloud may not be the best platform for teaching certain topics and disciplines. Robotics, mainboards, physical network devices, and digital forensics can all be categorized as equipment if a hardware dongle is needed. Although it might not be feasible in all circumstances, it is conceivable to use the cloud in part for this purpose. For such subjects, the utilization of cloud power needs to be carefully examined and studied. The solution to this issue might lie in tools that closely resemble the hardware environment. The hybrid cloud approach should include using both on- and off-cloud resources and software.

The rise of cloud computing is mostly due to a number of exceptional benefits, including economic ones. The main economic advantage is that it functions much like the subscription model used by cloud providers. The adoption of the cloud undoubtedly speeds up the development of new associations, as doing so could allow them to save up to three months' worth of time, money, and resources that would otherwise be needed for power, office space, IT operations, and time that could then be used to boost the value of their operations. Reduced energy use also has a financial benefit because firms that completely migrate to the cloud stop using their own energy to run their hardware28 and instead become the end users of a large pool of resources. The greatest choice characterizing impact for organizations is the economic benefit. Out of the 800 IT experts overviewed in a report, "half" would embrace the cloud only for reduction in costs30. Forbes research shows that by the year 2020, large American organizations can "realize energy savings of $12.3 billion per annum" and small-scale to medium-scale estimated organizations might diminish their utilization of energy by "90%" [15].

The capacity to scale resources, such as hard disk space, up or down in response to a customer's requirement for a larger workload is another major benefit of the cloud. The flexibility of resources is a crucial benefit, but it deceives the clients into thinking there are endless resources while, in reality, the data center's limit will be governing this. The accessibility to cloud services is the most critical factor among a variety of other factors; continuous availability, regardless of whether the cause of downtime be issues related to infrastructure or attacks on security, is critical to associations, particularly to those who are in the financial sector needing coverage at all times. The possibility of outages is a recognized issue; the apparent recognition is that by cloud adoption, the ‘single point of

failure' is wiped out, no doubt the provider disseminates crosswise over numerous data centers even then there will be a common software framework hence the supplier itself can be said to be a 'single point of failure' alongside the likelihood that shall stop to exist10. A provider with possibility arrangements of resource pooling is fundamental; the main answer for ensuring all time availability is to adopt numerous suppliers[16].

According to Intel's analysis, "65%" of the 800 IT professionals surveyed said they had experienced more security assaults than while using an infrastructure on-premises[34]. The primary concerns that enterprises have while considering the deployment of public cloud are also covered in this inquiry. Regarding the provider's safety efforts, there appears to be a clear lack of certainty. Data protection is thought to be the largest challenge for businesses. How sensitive data is exposed to cloud providers and how some vendors "are not willing to permit auditing of their network or physical security measures" are two other major challenges that discourage enterprises from adopting. Other major obstacles to adoption include how sensitive data is exposed to cloud service providers and how some vendors "are not willing to permit auditing of their network or physical security measures." A fundamental problem of mistrust arises as a result of a lack of transparency and security assurances. It is obvious that in order for businesses to take full advantage of the many benefits that cloud adoption offers, they must be able to put their trust in their cloud provider, who must establish a convincing reputation in turn[17]. Cloud computing offers more flexibility (commonly referred to as elasticity) than the prior computing solutions in matching IT assets to business capacities. By enabling access to company data and applications from a wider range of services and places, it can also increase workforce flexibility. Associations can concentrate IT on projects of higher value by

lowering or eliminating recurring updates to the server, other computing-related concerns, and consumptions in terms of time, money, or application development.

Evidently, the ability to manage, create software, and operate data centers is not a core capability for the majority of enterprises. It can be much easier to reduce or eliminate these capacities with cloud computing, allowing the association to concentrate on important concerns like the policy and strategy for continuously improving the learning environment. Most data centers have low energy efficiency due to inefficient resource use or bad design, which is currently thought to be both environmentally and financially unsustainable. By applying cost-cutting techniques and their improved capacity to manage computing resources, By applying cost-cutting techniques and their improved capacity to manage computing resources, cloud service providers can use significantly less energy and other resources than traditional data center operators[18]. Given all the aforementioned considerations, cloud computing services, including cloud hosting, data storage, software services, and infrastructure, may be ideal for higher education organizations. HLIs can use cloud-enabled virtual services including calendars, file storage, website creation, email, contact lists, and sharing of archives. The benefits of using cloud computing in the context of HLIs include easier access to content and infrastructure, pay-as-you-go services, minimal costs for updates and maintenance, the freeing up of internal resources, flexibility, and increased reliability.

The cutting edge universities are constantly looking for ways to become clearly more self-sufficient while keeping up with the delivery of the best learning practices due to the extremely intense pressure situations encountered in the educational system and the

desire to be the best establishment. The government's adjustments to the allocation of funds and assets are the main forces behind this development. Due to rising educational costs, universities must operate independently, necessitating the creation of additional funding rather than absorbing the majority of government subsidies. In addition to the sponsorship subsidies now in place, universities are also beginning to look towards "cloud-based e-learning" or "Education as a Service" (EaaS) as a way to reduce costs, improve competency, and improve learning quality. Many third-party cloud-based e-learning platforms, such Docebo and CloudLearn, struggle to have a noticeable impact on the education industry. Distance learning (DL), often known as e-learning, has emerged as a crucial component of the educational process, particularly for those whose employment, health, disability, or geographic circumstances make it difficult for them to attend a traditional classroom[19].

Distance learning not only addresses these concerns but also offers flexibility in terms of time, location, and scheduling. A cloud-based e-learning framework would create new learning environments where tests and lectures are delivered over a cloud system using virtualization. Students can have access to information through cloud-based systems, which can be accessed at any time, from any location, using any web-enabled device. Many universities and institutions have only recently advanced these activities. The lack of proper infrastructure, training resources, "e-content," and inadequate, uninteresting interface design all contribute to the limited impact of e-learning frameworks in the academic setting. They recommend an effective framework that should include the following: intuitive components, such as tests, quizzes, simulations, and videos; coherent, consistent navigation; simple design elements, such as text size, color, and type;

memorable content; uncluttered pages; community-oriented components, such as forums made by students; support; and easy access to staff. The main issue is a lack of IT infrastructure[20].

Many current frameworks, like Moodle, are run and maintained on campuses with subpar infrastructure, like poor hardware and networking, which can result in a bad learning experience, demotivation, and lack of retention to learn. The solution is cloud deployment, which will eliminate the aforementioned problems. A few cloud services are currently being used in the educational sector, with Microsoft Live@edu serving as the most popular one and providing students with browser-based access to email, SkyDrive, and the Office suite. It offers free access to the most recent Microsoft products from anywhere. Recent changes to this service include the addition of PowerPoint, Access, Word, Excel, Outlook, Publisher, and OneNote as part of Microsoft Office 365. The deal incorporates cloud shared coordinated effort storage to allow sharing archives among representatives in their projects. Google App Education (GAE) is one of the many cloud-based services for education. The Google components Talk, Docs, and Mail, for instance, provide comparable rich benefits to its Microsoft partner, enhancing the learning experience and collaborative efforts of online students. Google has also proposed a program for educational purposes utilizing its Google Apps for Education Suite, which includes productivity tools like Google Docs. Along with the classroom management system, email service, shared storage like Google Drive, site development, hosting, and collaboration tools are also included in this suite[21].

The benefits and savings gained by the university's use of Google Apps services were detailed in a contextual study at the University of Westminster. This service's main function is to use Google Apps for collaboration, storage, and email for non-sensitive material. An estimated £1,000,000 in sustenance was seen. As an alternative to the cloud services provided to institutions of higher education, IBM Cloud Academy offers consultation services and best practices. These arrangements include virtual desktop solutions, collaborative tools, infrastructure computing, and other tools. In this way, cloud computing has the potential to become an essential component of education. It can give users immediate access to a wide range of scholarly resources, teaching resources, and research software. This makes up a sizable portion of the innovative services that are quickly emerging online. The cloud computing providers are creating international forums (for instance, IBM created the IBM Academy in 2009) for teachers, analysts, and other IT faculty to meet up and exchange ideas. At very low operating expenses, these initiatives improve educational data access and quality. According to IBM, "Cloud computing enables educators and students to gain access to a variety of research tools and applications as well as a substantial library of educational resources."[22].

Similar to the industry, researchers have shown that the main benefit is somewhat financial in nature. Because to cloud virtualization, organizations will experience cost savings in maintaining their IT infrastructure, particularly in the use of energy, licensing, hardware, and specialist labor. Another major benefit is that content is noticeably consolidated into a single archive that can be quickly and easily accessible from any location at any time, as opposed to being dispersed across multiple local servers, which is thought to improve students' learning experiences; the management of content and

administration is simplified. Since all the content is consolidated, the staff can concentrate on delivering a better learning experience rather than wasting time on a useless structure. They also acknowledge the potential for mobile learning to promote research because it will enable global teamwork over a common environment, increasing success and the production of great work. Obviously, there are drawbacks to cloud-based schooling as well as advantages; similarly to enterprises, there are issues that need to be resolved regarding information security, privacy, and an inadequate framework. It is not advisable to interfere with the data privacy regulations and their treatment, which also address another issue, namely acceptance. Organizations will undergo a significant transition as they move to the cloud and away from the conventional pattern of instruction. Others may find it repulsive while others may grasp it. However, studies argue that this won't be the case; educators will always take an important role in education and the regular contact time of lectures can never be replaced. Teachers have the perception that these e-learning frameworks could replace them.[23].

According to The Education Endowment Foundation, "there is positive substantiation showing the vital role that technology plays in accelerating and deepening learning" in 2014. The improvement of educational programs and creation of an embedded learning environment known as cloud pedagogy will result from the integration of learning, teaching, and cloud computing. "The art of teaching while encouraging omnipresence learning via cloud-based applications" is how cloud pedagogy has been defined. The author also made reference to the use of web 2.0 tools and web-based solutions, where computing resources are pooled for improving the teaching and learning process.

A cloud-based platform or cloud-based applications are used in any type of teaching or learning that is accomplished using cloud-based learning technologies, or in other words, any type of teaching or learning. It is sometimes referred to as "internet learning" or "eLearning that is accessible in the cloud," which implies that resources are held in a virtual domain at a different place and made available from a variety of web-enabled devices, including portable PCs, tablets, and mobile phones. Different representations consider anything that is accessible outside of an organization's firewall because this includes traditional outsourcing being done on the cloud. However, there has been relatively little study done on cloud pedagogy, and fresh methods of teaching and learning are still being established. Developments in cloud-based learning come in a variety of forms. Students and teachers currently use cloud services like Dropbox, YouTube, or email for their daily tasks. Numerous creative and effective methods for the transmission and distribution of educational material are provided by these programs. It offers the ideal setting for improving problem-solving, multimedia, inventive and creative thinking, and ICT (Information and Communication Technology) education [24].

The term "cloud" basically refers to a group of computers working together as a single unit. These computers are connected to the Internet and form a processing model that takes into account asset scaling in response to real-time demands. The concept of a widely accessible, adaptable, and straightforward network of PCs is used in cloud pedagogy to support online learning. This combines everything, from virtual classrooms offered by accredited educational institutions to small learning modules for use in private organizations or other private initiatives. With the aid of cloud applications, lectures may be delivered from anywhere on the planet. The programs remove the restriction of

physical classroom boundaries, and as long as the student has a functional internet connection, it permits learning from anywhere in the world. Students from different countries can collaborate using the learning platform, such as electronic boards, and work in study groups. Different educational institutions around the world can manage a similar instructional module concurrently. They can collaborate and share knowledge through virtual learning platforms. With the help of this innovation, students can access their learning resources from any computing device, regardless of platform, as long as the device can connect to the cloud. Additionally, the system responds appropriately to the client's needs in the event of an increase in traffic or the amount of resources made available to the system's clients, ensuring that the client's experience is generally consistent.

With the program-based delivery of material through cloud-based pedagogy, course books may also be replaced, and this as a service would offer the business much more than simply the content. The resources can be presented as word processors, spreadsheets, or databases. A good example may be found in California, where in 2009 State Governor Arnold Schwarzenegger introduced a scheme that required the State to stop purchasing books and instead provide students with free digital devices [25].

The usage of cloud computing has been steadily increasing, and this has not been lost on the educational sector. Education institutions have also gotten behind the effort to integrate cloud computing into their daily operations. Despite the fact that the rate and scope of adoption vary with location and the economic situation of regions, cloud services are being used and adopted everywhere, with the educational sector being no

exception. Large corporations like Microsoft have begun initiatives to provide universities with free cloud services. Document storage, email, the creation and sharing of reports, and the ability to create websites are included as services. The main users of IT resources in a typical institution of higher learning are eminent instructors, students, developers, administrative personnel, researchers, and analysts. HLIs typically have an internal IT administrations office where all of their ICTs are managed. It has been proven that these services can be moved to the cloud, where they can be accessed via the internet. The development and use of various technologies in the academic environment have increased thanks to cloud computing frameworks [26].

Several developments have been made possible thanks to the cloud's resources and infrastructure. Researchers found that the University of California adopted cloud computing to help staff members fulfill conference and research deadlines successfully, allocate resources wisely, and avoid the costly pitfalls of under- or over-provisioning. Marist Colleges have incorporated cloud computing technologies into its operations in the US. Due to the fact that this cloud computing system shared a data center with other educational institutions, costs were reduced. They made the decision to connect with the so-called community cloud. The whole ICT department of North Carolina State University (NCSU) has adopted cloud computing. They made the choice to house their cloud setup inside. This has reduced the cost of technology and education while also accelerating the production of their students and workforce in information technology. Additionally, specific higher education institutions who embraced cloud computing perceived the competency element. Washington State University implemented a virtualization environment that is seen as an agent enabling cloud computing, and thus

increased their effectiveness. The use of Google Apps' email services resulted in savings.[27].

Some of the problems that advanced education in Africa and other poor nations have when integrating ICTs into their instructional modules can be solved by cloud computing. The authors identified issues like a lack of ICT infrastructure, erratic and unreliable electrical power, and high ownership costs as factors limiting ICT use in advanced education in Africa. They claimed that the pay-as-you-use model and on-request access features of the cloud can help reduce businesses' reliance on capital expenditures. Some challenges with higher education in developing countries could be considered as being countered by cloud computing. A growing body of literature shows that HEIs have started implementing cloud computing with regard to African countries like Kenyan Methodist University in Kenya, University of Nairobi, University of Mauritius, and Kigali Institute of Education in Rwanda. The preferences and challenges of cloud computing in Tanzanian HEIs were also observed. Concerns about security have been raised in an inquiry conducted in South Africa on the use of cloud computing in higher education.[28].

The Google Cloud administrations, which include Google Talk, Gmail Calendar, Google Spreadsheets, and Google Docs, are among the cloud computing services that HEIs have adopted. As a result of these services, IT costs are decreasing and IT services are improving in various associations. HEIs are increasingly adopting cloud computing in underdeveloped countries, but it is still important to understand contextual issues that may vary from country to country. The cloud apps have been embraced in HEIs in many

different ways and are used for a variety of tasks there. While some are used explicitly in the process of imparting knowledge, others are used for various exercises that aid in the teaching process. According to a research, respondents indicated that they utilize cloud services for a variety of tasks that support their teaching, including publishing lecture notes, posting assignments, providing continuous evaluation marks, and using gatherings to facilitate discussion with students. Other applications include publishing articles in journals, sharing data, conducting research, and scheduling meetings with students.[29].

The development of cloud computing goes through several stages, just like the development of any other technology. The diffusion of the innovation curve can be used to explain how cloud computing has evolved through time in various associations. The five phases of dissemination of the innovation curve are as follows: Innovators, Early Adopters, Early Majority, Late Majority, and Laggards are the first four categories. These are characterized as • Innovators: organizations or people who are interested in technology and have a positive outlook on the unique innovation. Early majority: a bigger portion of organizations and people who are realists and focus on the procedural model for the novel invention. Early adopters: associations or individuals who are enthusiastic about the novel innovation and are willing to take risks in adopting the same. Laggards: associations or individuals with outrageous states of mind toward the novel innovation and frequently don't consider adopting it as the standard. Late majority: associations or individuals who are essentially skeptical of the novel innovation and have negative demeanors toward it. Regarding HEIs, it is crucial to pay attention to the various cloud computing adoption levels. In poor countries, where cloud computing is still in its infancy compared to wealthy countries, adoption levels vary. Understanding the level of

development may also help senior administrators and IT managers at higher education institutions choose appropriate cloud computing services. IT managers can understand the development stages at which the innovative invention will occur and can properly prepare for the shift.[30].

By employing Partial Least Squares examination, they expounded that two elements (experience and age) play an important role in a man's aim to use cloud computing. Junior colleges have turned out to be early adopters of the technology of cloud computing. Experts employed the Technology Acceptance Model to analyze whether students of junior college would adopt the technology of cloud computing. Their investigation came to the conclusion that students would probably choose the technology of cloud computing if it is not difficult to use and does not require elaborate training procedure. As of now, in North America, about 70% of HEIs have adopted (or are adopting) their email frameworks to the cloud. Nearly 50% have taken up a cloud-based framework of collaboration to enhance sharing of data across the campuses. This market study report identifies that one of the key factors that will favorably influence the development of this market in the ensuing years is the growing interest in online content improvement and digitization.

Making content for teaching and training students requires the use of e-learning tools like Learning Management Systems (LMS) and Learning Content Management Systems (LCMS). The cost of using e-learning tools is considerable, which will increase interest in cloud computing in the education industry. Additionally, the need for installing LMS on separate servers and the requirement for experts to handle the product are eliminated

by cloud computing. In terms of the topographical regions this study assesses, North America accounted for almost 43% of the total market share in 2015. The market will rise as a result of higher education institutions increasingly utilizing cloud computing services for email frameworks, information sharing between campuses, and other purposes. As a result, the region will continue to rule the market during the observation period. The adoption of various gadgets like tablets, e-readers, and portable PCs as well as the availability of the internet would also accelerate the growth of the market in the region.[31].

This year, advanced education is expected to see an increase in cloud technology expenditure. According to a percentage of IT pioneers or experts, their institutions will increase their cloud computing investment in 2017. 60% of respondents said they were using cloud technologies in their IT strategies. In any case, it will be a few more years until most applications used in colleges are cloud-based. Currently, just 39% of applications are cloud-based; by 2021, that number may rise to 62 percent.[32].

Despite the enormous benefits of cloud computing, concerns about the security and confidentiality of data stored there, the location of data, privacy, and regulatory compliance, vendor lock-in, dependability, and the legal jurisdiction of the cloud vendor have been identified as barriers to its adoption in higher education. These findings are consistent with research conducted by Carnegie Mellon University analysts. The review also discovered that for institutions of higher learning, the challenges in adopting cloud technology are not limited to the risks mentioned above; rather, the relative novelty and underdevelopment of cloud services is also one of the major concerns for adoption. Four main concerns and anxieties about cloud computing are listed in a whitepaper: Security

and integration, regulatory concerns, risk management, consequences for IT staffing, etc. Since sensitive data is stored outside of institutional firewalls in the cloud, adopters are concerned about privacy and security. As a result, any hacking or other types of attacks on the cloud seller's infrastructure will have an impact on all customers whose information was saved on that framework.[33].

According to researchers, a further reason for the slow rate of adoption of cloud services is the failure of cloud service providers to demonstrate consistency with SLA (Service Level Agreements), as if cloud sellers don't meet the requirements of the SLA and promptly address downtimes, performance shall be significantly impacted. Jurisdiction and legal concerns also cause concerns as they can tie an establishment into unfavorable or inadvertent agreements. Once cloud vendors' services are used, institutions no longer have control over the physical environment where their information is collected. While the average client may not be concerned about where their information is stored, colleges hold extremely important data about thousands of people and processes, such as the findings of research and discoveries that demand a very high level of privacy and confidentiality. The Canadian institution Lakehead University is an example of a business that is dealing with legal concerns as a result of Google's deployment of public cloud computing. The university's faculty union filed a complaint alleging that the Google-provided email platform does not protect their academic freedom and privacy because Google is a U.S. company and, as such, is subject to American law, which requires it to provide information to the U.S. Government when necessary, even without the consent of the concerned university.[34].

These issues compromise data privacy protection and dampen HLIs' enthusiasm for cloud adoption. However, the adoption rate of cloud technology in developing countries is still low. As a result, universities in this region must operate primarily under the copyright laws of the chosen cloud sellers as well as those of the region where the vendors' frameworks are located. As a result, one of the criteria for choosing vendors must be based on how promising the copyright laws are for the universities. Similar to other nations with low wages, Malawi's HEIs are struggling with problems that result in poor teaching, learning, and limited research production. Some of the problems with ICTs include slow transfer rates, a lack of software and hardware resources, a lack of IT systems inside of establishments, inadequate skills, and a lack of awareness of ICTs among staff members in associations.[35] Additionally, there are other socio-economic problems in Malawi that indirectly affect the choice and application of ICTs in HEIs. Poor economic performance, ineffective internal administration of frameworks, and ineffective governance structures within firms are what has an impact on foreign direct investment. Another issue is the lack of energy supply in rural areas, the unpredictability of the power grid (regular power outages), and the vandalism of the ICT infrastructure, which affects how ICT users and service providers.

The use of ICTs in poor nations has consistently been significantly hampered by the lack of suitable network infrastructure. Every technological tool, method, and access model used to promote efficient data management and interchange is referred to as network infrastructure. The majority of the SADC region's members are developing nations, and many facets of their economies are still in development. In the majority of undeveloped countries, the telecommunications infrastructure is quite constricted, and the expenses are

very high. The limited accessible infrastructure is primarily found in larger urban areas, which excludes and denies the remaining population in other, more rural areas.

Again, a problem in poor countries is the high expense of installing and maintaining ICT infrastructure and machinery. For the majority of the population in underdeveloped countries, PCs, portable PCs, cell phones, and some ICT hardware are pricey and out of reach. The population that can buy ICT hardware is reduced as a result. Subsequently, due to exorbitant costs, many potential customers refrain from using the internet. The majority of people in the SADC region are unaware that cloud applications and cloud computing exist. This is primarily attributable to the higher percentage of illiteracy in underdeveloped countries. Except for South Africa and its neighbors93,94,95, the majority of Sub-Saharan African nations have low e-readiness scores. This is supported by the fact that there is a general lack of community awareness of the potential benefits and capabilities of the cloud. The high level of ignorance in the area contributes to the low rate of cloud computing adoption.

The reliability of the internet is one of the main obstacles stopping Southern Africa from adopting the cloud widely. Since the cloud requires a rapid and dependable internet connection, this is a must for the cloud services to be effective. However, according to the researcher, due to the lack of reliable, speedy internet access in the region, the adoption of cloud computing is still limited in Southern Africa. According to researchers, the lack of dependable internet connectivity has prevented most poor nations from adopting the cloud. They made several things clear, including the area's subpar

infrastructure, lack of knowledge and a pessimistic mindset, poverty, lack of resources, and more.

About 69 percent of colleges and universities cite cost reduction as the primary justification for using the cloud. The following most well-known reasons for the relocation of operations to the cloud are each cited by between 40 and 50 percent of respondents: an improvement in flexibility, versatility, and speed. Actually, seven out of ten respondents (71%) said that switching to cloud computing has resulted in lower application expenses. Among other bonuses, as stated, improved client service is one of them by 77 percent of advanced education respondents and an increase in productivity, mentioned by 76 percent. The most widely recognized concern was identified as security and privacy, determined by 55 percent of respondents[36].

People frequently adopt new technology in the hopes that it would speed up the completion of their duties and improve the quality of their output. One of the key factors influencing a person's decision to adopt a new technology is performance expectations. Cloud clients are very likely to have poor performance when accessing cloud apps due to the inadequate network infrastructure and low levels of bandwidth in many SADC countries. When there is a bad network connection between the cloud server and the consumer, poor cloud execution is frequently seen. Performance is viewed by researchers as both a chance and a risk for cloud adoption. The simplicity of use is important when evaluating cloud computing technologies, according to an investigation. This is due to the fact that a user's experience is crucial when determining if an application is successful. Easy-of-use or effort expectations have been shown to be one of the key factors taken

into account when deciding whether to use cloud applications in previous studies on the adoption of cloud computing.[37].

Higher education institutions (HEIs) must adopt a wide range of applications for various usage on campus. These applications require one another in order to function. For cloud providers and adopters, the lack of communication between these applications is a significant barrier. Researchers' inquiry revealed that "Support and integration of institution services" is the key factor influencing the adoption of cloud computing in educational organizations. They emphasized that when institutions had to decide whether or not to use cloud computing, this factor had a significant role. Even if cloud service providers pledge a 99.9% SLA to their clients, cloud users are nonetheless concerned about the dependability of cloud services. Any organization that conducts business would prefer to avoid a situation in which their operations are suspended due to a cloud service blackout. According to the authors, occasionally an outage is unavoidable, and cloud users should bear this in mind while determining whether or not to adopt cloud-based solutions. Reliability manifests as a risk and is therefore taken into account as the primary factor in the adoption of cloud computing. It establishes the categories of applications that can be moved to the cloud. Some general benchmarks can be established for higher education in relation to the commercial sector when developing a cloud strategy. Making a framework based on the requirements of the different partners involved—from faculty to students, alumni to members of the board—and closing in all partners ahead of schedule, as well as putting up an organization-wide cloud methodology that addresses IT challenges specific to campuses and advanced education—are all requirements for a strong and robust cloud system plan for establishment in learning education.[38].

The two main issues that arise with the use of cloud computing are privacy and security worries. The following recommendations and strategies for protecting educational data should be used to address these problems: It has been discovered to be the most often used method for guaranteeing cloud data security. It is the process by which information is modified or altered so that no one can understand it without permission. Therefore, when this technique is used, anyone who does not have the password or code for decrypting the encrypted data is unable to understand the material being delivered. This protects the data by guaranteeing its integrity and validity and avoiding the improper disclosure of the confidential educational data.[39].

Digital signatures can also be used to solve security and privacy problems. An electronic signature known as a "digital signature" is used to verify the identity of individuals who access cloud services. Users using this method must enter the correct login information in order to access the programs or information they need. This guarantees the validity, accountability, and integrity of data saved in the cloud[40]. The more levels or steps there are between the seller and the user, the greater the potential that the data will be compromised. In order to avoid interference from a middleman, the university should establish direct communication with the cloud service provider. This will guarantee that data only moves in one direction, from the cloud service provider to the higher education institution.

Although the cloud offers cost savings, efficiency, and enhanced agility, prudence is required when moving to the cloud. It is advised to move low-risk applications first and migrate gradually to the cloud. In this method, the institution can have some time to

assess if the cloud project or vendor chosen is worthwhile or not; if it is, only the remaining apps should be transferred gradually. In order to get through the hurdles of privacy and security concerns, it is also important to make sure that the university's systems are compatible with those of the cloud service provider. Since both parties would have verified their compatibility prior to the migration of sensitive data to the cloud, this can be accomplished by stepwise migration41. Before selecting a cloud provider, it is crucial to carefully research their security protocols, configuration, and security measures to make sure that the data stored on their cloud is secure. Additionally, the specifics of the actions to be taken in the event of a security breach should be examined, comprehended, and guaranteed to comply with the standards established by the CSA (Cloud Security Alliance) and NIST (National Institute of Standards and Technology). This will guarantee that the cloud service provider's security level is appropriate and that adequate backups are in place to mitigate the consequences of calamities like floods, fires, earthquakes, and other issues. Due to the privacy level required for maintaining research findings or other secret data, such an analysis is therefore necessary before cloud services are adopted in the educational sector in order to guarantee confidentiality as well as availability.

This method entails storing data across various clouds while maintaining its confidentiality, availability, and integrity. As a result, several service providers are needed86. Utilizing fault-tolerant protocols to manage security issues like intrusion, data integrity, and service availability across many clouds helps to lower the risks of downtime and data loss, avoid vendor lock-in, and improve performance. The ability to use a different cloud for a different purpose is given to educational institutions when data

is split across multiple clouds. For example, Microsoft Azure can be used to provide IaaS and PaaS services, and the Google public cloud has been found to be the best for providing email services. As cloud technology has developed, the services provided by cloud vendors and migration solutions have made it simpler to synchronize data across various clouds. For instance, the countability offered by cloud vendors makes it convenient for users to manage multiple cloud providers at once. The same applies. The expenses incurred by various cloud service providers vary depending on the pricing models; apps that are used frequently and for longer periods of time may incur lower costs than those that are only used occasionally.

As a result, clients should carefully assess the expenses associated with data splitting across several clouds. The use of multiple clouds is a more reliable and better approach for handling failures because it is extremely unlikely that the services from multiple providers may be down at the same time, despite the emphasis on choosing the most appropriate model for service delivery and deployment along with a reputable cloud vendor for a reliable and secure cloud. This method gives educational institutions the option to relocate easily, which is advantageous in the event that the service provider modifies the terms of its contracts or raises pricing. In this situation, the institutions could switch to another cloud service provider with more favourable terms and costs[42]. The following actions should be made to get ready for the implementation of cloud pedagogy and to improve it: This method gives educational institutions the option to relocate easily, which is advantageous in the event that the service provider modifies the terms of its contracts or raises pricing. In this situation, the institutions could switch to another cloud service provider with more favourable terms and costs. The following actions

should be made to get ready for the implementation of cloud pedagogy and to improve it. To prepare the current IT infrastructure for the deployment of private and public cloud services, a roadmap should be created. Data types that cannot be kept in public clouds due to security or regulatory concerns should be recognized. • It is important to identify and protect internal competencies that are essential for managing the efficient implementation of cloud services. • Prior to moving existing apps or data to the cloud (even a private cloud), it is important to assess the technological hurdles that need to be overcome. To find potential issues, it is advisable to experiment with a range of internal and external services. • The networking environment must be suitable for cloud computing. • Internet service providers should upgrade their networks to increase internet speed in addition to making it available in remote areas without a connection. • Institutional leaders should choose a standardized cloud learning program that will be used by all staff members. • Workshops should be held to spread knowledge about cloud computing and the educational applications that can be used in institutions. • Stakeholders and governments from many nations should support improvements to the ICT infrastructure. Government help can take the form of making money available to support such advances. • Institutional leaders should support the use of technology in teaching. To encourage the use of technology in the classroom, some regulations ought to be placed in place. • Governments and stakeholders should offer subsidies to students so they can purchase the tools necessary to access cloud apps.

2.1.2 Overview of Human Capital Development

Human capital development is a way to fulfil the potential of people by enlarging their capabilities and enabling them to participate actively in their own development. In this respect, the right quality of personnel must be in place to transmit and impart this knowledge, skills and abilities. Yet, the availability of a competent and effective labour force does not just happen by chance but through an articulated recruitment exercise based on merit and technical competence. Therefore, it is basically the active participation of people with the know-how in the human capital development process and the consequent need to have higher institutions that permit and indeed encourage that participation can guarantee the availability of quality human capital that could meet the need of the global labour market. The quality of human capital constitutes the ultimate dignity of a nation. Indeed, it is the interactions of people with natural resources that constitute development. It is along this line of thought that a researcher use the larger political economy to admonished that: Human Resources, not capital, not income or material resources constitute the ultimate basis for the wealth of nations. Capital and natural resources are passive factors of production; human beings are the active agents who accumulate capitals; exploit natural resources; build social, economic and political organizations; and carry forward national development[43].

Human capital theory holds that the well-being of a society is a function not only of the traditional stocks of financial capital, labour and natural resources but also of the knowledge and skills of individuals. This "human capital" can be used like any other asset to generate outcomes of value to individuals and society. In particular, the theory predicts that increased knowledge and skill will yield improved economic outcomes for both individuals and societies. This idea has attained increased prominence in the past

couple of decades because of the widely held view that we are in a "knowledge economy," in which knowledge and skill convey a greater premium than in the past. A scholar traces the origins of human capital theory to the work of Adam Smith in the 18th century and John Stuart Mill in the 19th[44]. However, the modern formulation of human capital as part the overall economic production function is generally traced to mid 20th century Nobel Prize winning works by Schulz and Becker. Both of these works have had fairly recent updates. The primary concern of these economists was why economic development has advanced faster than the growth of the stocks of traditional capital and labour and, more specifically, how to explain the large residual component in traditional economic production functions. Human capital theory locates this explanation in knowledge and skill and particularly in education and work experience as the primary sources of these attributes[45].

Human capital development presupposes investments, activities and processes that produce vocational and technical education knowledge, skills, health or values that are embodied in people. It implies building an appropriate balance and critical mass of human resource base and providing an enabling environment for all individuals to be fully engaged and contribute to goals of an organization or a nation. Any effort to increase human knowledge, enhance skills, productivity and stimulate resourcefulness of individuals is an effort human capital development[46]. Human capital development is a process of increasing human knowledge, enhance skills in vocational and technical education for increase in productivity and stimulate resourcefulness of trainees should be systematic, sustainable and strategic. The process should be systematic to the extent that there should be a plan for which previous activities will provide support for upcoming

activities while facilitating the attainment of set goals. The process should be sustainable since the product (human capital) must make desired and enduring impact on the organization or society. The process should be strategic to the extent that there are well-defined goals and targets whose attainments are time bound. It should be dynamic, responsive and result oriented; continually evolving and proactive to address emerging challenges.

Until literally recently, an institution's human capital department was often consigned to lower rungs of the corporate ladder, regardless of the fact that its directive is to replenish and cultivate what is often cited legitimately as an institution's greatest resource, it's workers. However in recent years acknowledgment of the significance of human resources management to an institution's overall health has grown dramatically. This acknowledgment of the significance of HRM extends to petite businesses, for while they do not commonly have the same volume of human resources requirements as do bigger institution, they too are confronted with employees management problems that can have a decisive impact on business health. As author commented in a review that, "Hiring the right people; and training them well; can often mean the difference between scratching out the barest of livelihoods and steady business growth'. Personnel problems do not discriminate between small and big business. You find them in all businesses, regardless of size[47].

There are principles guiding human capital management. Business consultants note that modern human resource management is guided by numerous prevailing principles. Possibly the paramount principle is a simple acknowledgment that human capital are the

most significant assets of an organization; a company cannot be doing well without efficiently managing this resource. Another important principle, articulated by an Author in his book, is that business success "is most likely to be achieved if the personnel policies and procedures of the enterprise are closely linked with, and make a major contribution to, the achievement of corporate objectives and strategic plans." A third guiding principle, similar in scope, holds that it is the HR's responsibility to discover, protect, guide, and nature employees whose skills and desires are companionable with the operating needs and future goals of the corporation. Other human capital factors that shape corporate culture; whether by encouraging integration and cooperation across the company, instituting quantitative performance measurements, or taking some other action; are also commonly cited as key components in business success. Human capital, as summarized by the author, "is a strategic approach to the acquisition, motivation, development and management of the organization's human capital department. It is devoted to shaping an appropriate corporate culture, and introducing programs which reflect and support the core values of the enterprise and ensure its success."

Human capital management is a requisite function for the both the private and public sector organizations. The process deals with numerous operational objectives such as recruitment, providing proper training to the workers, selection of the employee, assessment of the employee, motivating and maintaining a proper relationship with the employee and maintaining welfare and health for the workers in the organization through laws created by the concerned state and country.

The human capital management is a process whereby organizations make use of their limited skilled employees. The main purpose is make effectual utilization of the existing human resource for the organization. Apart from this, human capital management works in the diverse area like conducting of jobs, planning the employee's needs and recruitment, determination of wages and salaries, resolving the disputes and creating better working and safety environment for the workers[i]. The organization utilizes their human capital management for the appropriate exploitation of their resources. Moreover, the department plays a significant role in the on the whole development of the workers for encouraging personal and career development[48].

Alternatively, it helps in improving professional skills and knowledge of the workers. Human capital management makes available quality work life for the workers. Consequently, the importance of the Human capital management with respect to the organizational performance is apparent. Big number of organizations has established their human capital management department and they comprehend its need in today's world of business. The responsibility of the higher performance work practices in the sphere of the human capital management is significant. Even though literature present proof that the Human resource management is crucial for organizational performance, the effect of effective human resource management on organizational performance is relatively less discussed area in the literature.

One of the core objectives of the human capital management in the organization is to

present an excellent work life for the workers. The quality of work life can be defined as the activities through which the workers stateliness and growth in the organization is developed. It assists the workers to work together in the organization and the actions, changes, and improvements which are essential for the accomplishment of goals and improving the quality of life and improving the efficiency of the organization. In the recent times, organizations are not only focusing on workers for the work related aspects but also focuses on the holistic well-being of a worker. It is the fact that, if the workers life can't be compartmentalized and the disturbance in the life of the worker will affect the professional life. Hence, the human capital management works for the on the whole development of the employee by reducing their stress and creating a healthy atmosphere in the place of work[48]. The impact of these higher performance work practices will be evaluated on organizational performance on significant grounds which are creativity and innovation, core employee retention, customer satisfaction and organizational performance.

The institution and their workforce are bound to follow the sets rules or guidelines in the contract. The constitution and the quantities of the employment agreement are designed according to essential needs of the workforce. The accord balances the requirements from both the side's workers and institution. The process helps in setting up a dynamic outline without any obligation and doubts in the place of work. The employment contract also makes available information about the job, responsibilities, and rights of the workers. It is very complicated for any organization to design agreements which are fruitful for everyone. It puts forward several other information like what to do and what to avoid in a productive approach. Consequently, the

employment contract is very crucial in securing the position of the organization and the employees.

Employability Skills:- In order accomplish the desired objective and objective there are employability skills oriented with the position in an organization. A higher institution in Nigeria is much concern about their recruitment process for selecting the right applicant for the right position with effective employability skill to enhance the process performance of the organization. The chief employability skills are as follow: The administrator must have effective communication skills to coordinates with the other employees of the organization. He must have the ability to work in a team to motivate other staffs for productive outcome**.** The capacity to analyze the situation is essential for solving any issue in the organization. The supervisor must be respectable and have the ability of control the workers. The position must aware about the technical thing and computer in order manage the technical resources in the institution. The most vital thing is the decision-making ability and the supervisor must be confident enough to manage the vital decisions within the organization Apart from the employability skill, personal skills are also vital to managing the responsibilities and duties oriented HRM. The applicants must be aware of the different cultures of the working peoples and should respect all cultural values. He should be self-managed and well organized to take the job load of the position. He should have creative and innovative approaches in managing any issues within the institution**.** The candidates must build up professionalism in order to repay maximum for the organization or to achieve the goal of profitable business. He must have the tolerating power to work in the pressure environment. He must have leadership quality, disciplined and knows time management.

The main challenge facing governments of African countries is how to build human capital through sustained investment in education and training to produce highly qualified and trained workforce who can compete effectively in the global knowledge economy. The effort of countries in Africa to develop their human capital base through education and training to boost growth and facilitate economic transformation is often constrained by limited budgetary resources. In addition, lack of political will on the part of policy makers and the difficulty in retaining those trained with the limited resources are often cited as other major human capital development challenges. Many countries in Africa are among the least developed countries (LDCs) of the world and a common feature of these countries is low income and limited public resources to carry out many developmental programmes[49].

Consequently, they are unable to provide enough academic and training institutions to absorb the increasing number of people seeking access to education and training. The available educational and training institutions often lack adequate teachers/trainers and the necessary tools and equipment to undertake effective teaching and training towards building productive human capital base. Teachers and available teaching tools and equipment tend to be overstretched by high number of pupils and students thereby compromising the quality of education and training. Available teachers are often poorly motivated with low morale due to low salary and limited training tools and equipment.

In addition, high incidence of school dropout remains a major challenge to the development of human capital base of many African countries. This is often associated with the problem of poverty on the continent. 42% of school-age African students leave

their studies before completing their elementary education, with Chad, Uganda, and Angola having extremely high dropout rates ranging from 68% to 72%. Mauritius and Botswana had the lowest rates, with 2% and 7%, respectively. Additionally, a lot of basic school dropouts are unable to benefit from secondary education due to a number of factors, such as limited access because of the high basic school dropout rate, a lack of secondary school spots even for students who are able to pass well, or the high cost of secondary education relative to household income level. It is frequently impossible for many impoverished African families to support their children, especially girls, beyond the level of basic education.[50].

In addition to the lack of resources, African countries frequently misalign their goals. Because of their limited public funding, African nations are reportedly spending less productively, particularly on ammunition, in an effort to keep their regimes in power longer while losing enormous amounts of money to corruption. Only four African nations made the list of the 50 least corrupt nations, down from the 50 most corrupt nations in the world in 2007, according to Transparency International's corruption perception index. In fact, the seeming mismanagement and misallocation of scarce resources by governments could account for a major portion of the continent of Africa's inadequate human capital foundation. A significant obstacle to the development of human capital in many African nations is the challenge they face in trying to keep skilled labor on the continent. Better work possibilities in affluent nations are frequently the driving force for labor migration from developing and least developed African nations to the developed world. Additionally, it is influenced by the inability of African nations to implement economic policies that generate enough local employment

possibilities for highly educated workers in contemporary production, innovation, and the adoption of foreign technology. Long-term "brain drain" losses caused by the unchecked emigration of limited human capital, whose contribution is most needed for domestic economic development, have cost Africa much. Over 30% of the highly skilled workers in some African nations are thought to have emigrated to OECD nations[51]. Additionally, nearly 88% of adults who move from Africa to the US have completed high school or above. According to the IOM, over 50 million migrants worldwide, or one-third, are from Africa. In the face of growing globalization, population pressures, and decreased cost of international travels, the issue is projected to worsen. However, the ability of globalization to shift jobs to Africa through FDI can make it easier to turn the "brain drain" into a "brain gain" phenomena. The numerous political and civil crises that many African countries have experienced, which have led to the emigration of a large portion of the continent's productive labor, are related to the problem of brain drain. Many prosperous Africans who were forced to flee their nations due to political and ethnic unrest have yet to return, including those from Rwanda, Burundi, Congo DR, Liberia, Sierra Leone, Sudan, Somalia, and Cote d'Ivoire, among others.[52].

Economic development theorists generally agree that a nation's human resource quality has a substantial impact on its ability to advance and expand economically. When a nation's educational attainment is taken into account, it can be used to gauge both its current economic standing and, more crucially, its potential for future growth. The success of a nation in terms of GDP, the climate for investment, and eventually the facilitation of its economic transformation in an increasingly competitive global

economic environment is primarily determined by its national resource base. Education and the development of human capital are the key factors that determine productivity and technological advancement. The presence of a highly educated workforce supports the expansion of research and development (R&D), which in turn drives technical innovation and productivity.[53] According to Swan's typical neoclassical growth model, created in the 1950s, an economy's production increases in accordance with the law of marginal returns to scale in response to increasing inputs of labor and capital (all physical inputs). This assumption has the implication that as input stocks rise, economic growth slows, necessitating continuous technical advancement to keep the economy moving in the direction of growth. Thus, technological advancement is an exogenous factor.

The idea of capital was expanded to incorporate human capital by the endogenous growth model, which was created in the middle of the 1980s. Technology and human capital are both endogenous according to the endogenous growth model, which means that educated, competent, and healthy people will not only make labour more productive but will also be able to utilise capital and technology more effectively. The new growth paradigm views labour input from its quality and hence views human capital as knowledge, expertise, and skill gathered via education and training, in contrast to the conventional neoclassical model, which placed emphasis on the quantity of labour. Human capital theory's social and economic significance is emphasized. It was stated that an investment in people is the most valuable form of capital. Indeed, the explanation for the mysteries of the rapid and long-lasting high growth performance in the established and growing economies of China, South Korea, and other East Asian

nations may be found in the role of human capital as the driver behind increasing capital productivity and supporting technical advancement. Fundamentally, a nation's prosperity is based more on its human resources than its natural resources, without a question. It is the one form of capital that a country possesses the most of. Human capital was thought to make up about half of American national wealth in the 1960s and at least two-thirds of the country's GDP growth.[54]

Nearly half of Taiwan's impressive recent expansion in manufacturing production was invested in human capital.[55] Indeed, the rapid expansion and change of the education and training institutions was a major factor in the astonishing growth of newly industrialized nations like Singapore, South Korea, and Hong Kong. Indeed, despite the fact that these nations do not have the same amount of natural resources as Africa, investments in human capital have been the main driver of growth and development in Japan, Taiwan, and several other East Asian nations. Another significant obstacle to the ability of most African nations to draw foreign direct investment (FDI) is the limited nature of human capital. Undoubtedly, High levels of education in Africa give educated workers the capacity to readily handle newer manufacturing techniques, absorb innovative technology brought in by FDI, and boost their potential to quickly catch up with technologically advanced nations. Only when the host nation has the human resource absorptive capacity to the new technology that accompanies the investment can FDI contribute to economic progress. Undoubtedly, investment in human capital is a key factor in attracting FDI since most investors include as one of their most important criteria for investment in a country, the level and capacity of its human capital. Clearly, a country that is unable to develop the skills and knowledge of its

people and to utilise them effectively in wealth creation will be unable to develop. Larger inputs of higher quality labour result in greater production by virtue of labour's status as a factor of production. Investment in human capital enables a country to effectively exploit the benefits of technical and technological advancement as well as maintaining the advancement.

Human capital measurement is quoted as saying that "measuring is certainly vital to quantify the impact of human capital investments and highlight areas for improvement, but in this field, measuring is a challenging issue."[56]. Surprisingly, a literature analysis on human capital revealed a significant return on investment. Return on investment, or ROI, is still seen as a useful metric, and its application is expanding globally. How many consulting firms use financial measurement, production and/or goods and service measurement including units generated, customer happiness, number of errors, and measure of time such as tardiness and absence is not well known. When measuring human capital, it is necessary to take into account the measurement needs of various audiences. Workforce analytics must be used to measure human capital, which includes several classifications of human resources such as job type, grade, gender, geography, and ethnicity, as well as views of human resources such as temporary, subcontract, and consultant resources. Additionally, workforce analytics include labor turnover (administration costs, recruitment costs, selection costs, cost of covering while a job is open, induction training costs for new hires, lost productivity during the time the employee was out on leave, and learning curve costs for the new hire), absenteeism, staff rotation, and staff vacancies. To measure human capital, however, a company must take into account an employee's attitude and conduct in addition to internal and external

performance indicators including productivity, the caliber of the goods and services provided, sales, and financial performance. Measure everything you can first, including headcounts, turnover, promotions, trend lines, information from the main HRIS system, and problems with data quality. Second, the extension of measurement involves concentrating on a few key measures, greatly improved data quality, information from HRIS, and data from additional HR databases (such as recruiting, payroll, and engagement surveys). Operational data integrations, which include data from non-HR sources including finance, marketing, quality control, and new metrics like revenue per employee, value added per employee, and customer service levels, come in third. Human capital is quantified using the ROI or return on investment along with time, cost, level of employee engagement, customer satisfaction, revenue, and organization financial performance even though there is no agreement among HR experts on how to do so.[57].

Human capital theory and the subject of human resource development are closely related and interconnected because human capital has been seen as a source of value in successful organizations. Additionally, human capital is a fundamental component of human resource practices that involve employee training and development and are connected to other areas of HRD. It can be divided into numerous primary categories, including pay and benefits, hiring, job analysis, job rotation, participative management, labor relations, well-being, and performance management. Because performance improvement occurs in organizations that are economic entities, PI (performance improvement) must, at its core, draw on economic theory. Human capital theory has been regarded as one of the economics theories of HRD (Economics Theory consisted

of Human Capital Theory, Scare Resource Theory, and Sustainability Theory).[58].

Human capital as an economic theory needs to be taken seriously if we want to remain sustainable in a competitive knowledge-based economy. The importance of labor maximization and how an organization can accumulate employees' knowledge, skill, and ability by investing in people through training and education to improve an employee's capacity to work successfully are both explained by the human capital theory, which can enhance a firm's performance. HRD is defined as "any process or activity that, initially or over time, has the potential to develop adult knowledge, expertise, productivity, and satisfaction in the workplace, whether for personal or group, team gain, or for the benefit of an organization, community, nation, or ultimately the whole of humanity[59]." The study of human capital researchers' well-defined techniques for calculating the return on education and training investments could help the field of HRD. According to the definition, there is a connection between information, skills, and abilities as well as training and development that results in performance at various levels, all the way up to an international level.

Successful organizations adopt the human capital concept to their organization, successful organization insist on system thinking, get accurate data and facts, focus on value in the organization as well as the organization's need to clarify human capital strategy carefully while understanding the organization's internal labour market, build a suitable strategy, never make a decision before collecting and analysing the facts in human asset, making acquisitions work, linking to customer satisfaction and a need to have concern for the implication of business risk. However, human capital theory

cannot function alone. It needs to integrate with various HRD theories such as system theory, psychology theory, and other economics theory such as scare resource theory and sustainable resource theory[60]. In addition, Because there is a dynamic relationship between knowledge and behaviour in cognition human capital, human capital must be employed in conjunction with the notion of knowledge management.

However, a researcher makes the case that in order to improve organizational performance, resource-based theory and human capital theory must work together. There are numerous theories that deal with this same subject, such as the absorptive capacity theory. However, both on an individual and a group level, cognitive human capital exists. Cognitive human capital refers to the ideas, schemas, heuristics, attitudes, and knowledge structures that, in the context of an organizational resource, When resources are combined with them and/or are motivated by a strategic framework, activities are taken that add value to the organization61. Therefore, it should come as no surprise that in order to completely optimize the utility of human capital, other theories and concepts must be used and operated alongside it. Even the human capital idea is largely acknowledged in the HRD industry for failing practices. However, commercial uncertainty has increased in our complicated environment. According to this study, a lot of businesses struggled to implement the human capital theory due to measuring issues such lack of precision and uncertainty. From this point, it is still unclear whether trained workers could transfer what they have learned to use in their work as a source of accumulating human capital to gain knowledge and expertise, an exact human capital's measurement from training, and employee absorptive capacity.

ROI is a valuable measurement too. However, ROI can provide a problem to the organization[62]. According to him, "when the management, team has applied human capital, they typically anxiously await only to be appointed when they are not immediately available." An ROI method must strike a balance between a number of factors, including feasibility, simplicity, credibility, and reliability. A company needs to be worried with absorptive ability, training transfer, and employee motivation in order to completely maximize the accumulation of human capital. When a company invests in its human resources and those people develop into talented or knowledge workers, this poses one of the biggest issues for the HR profession. Due to the expense of losing talent, organizations should have a succession plan in place to keep high performing personnel (talent) within the organization. Because investing in human capital can result in a sizable annual budget, organizations must have a plan to retain existing talent as well as recruit new talent.

Academics have shown a great deal of interest in the idea of human capital. Additionally, the amount of research on human capital has grown over time. Intellectual capital is subdivided into human capital. Intangible assets are frequently more valuable than actual assets for knowledge-based enterprises. The whole capital, which was divided into financial capital and intellectual capital, includes organization capital. Organizational, interpersonal, and human capital made up intellectual capital. Customers, internal company processes, learning, and growth are other linked components of intellectual capital. The concept of human capital also needs to be developed from broader angles. Human capital focused only at the individual level rather than at a unit and organizational level where human capital resource can operate

at a wider level, according to the phrase "Human capital resource is the reason to close the gap and to advance the field of human resource development[63].

The level (firm, group, person), content (skills, education, health), theoretical framework (resources, KSAOs), and links with outcomes (e.g., value-creating) of human capital resources were all conceptualized by researchers in many different ways[64]. Each conceptualization might make sense within a specific study, but inconsistent findings across studies make it difficult to develop a more comprehensive science centered on human capital resources. Communication and specificity solely at the person level, which does not contribute at the organizational level, are the two issues with human capital. Therefore, a subset of human capital resource called human capital needs to be utilised. To improve competitiveness and integrate with organizational strategy, human capital resources concentrate on multi-level organizational structures with broader viewpoints. From the individual to the organizational level, human capital resource is viewed as an individual asset (KSAOs). It is distinguished at three levels: structure, function, and unit level.

Investing in human capital can be used for informal learning as well as formal education. A change in the training program for human capital is another implication. Each employee must be responsible for acquiring a broad education, training, and competence on their own. Organizations only provide specific training necessary for employees to work for them; general training, including competence in English, administrative tasks, labor law and regulations, or typing abilities, among other things, must be acquired by the employee[65]. According to this idea, a company will decide to

use a certain training since it "is training that can be used only in the specific firm that provides that training." Individuals must concentrate on the wider dimensions of employability and not just competencies, according to the current employee point of view, which makes some fascinating recommendations. To stay employable, you must put more of your attention on your competencies. Additionally, the individual must concentrate on building networks, preserving technical brilliance, consistently outperforming average teamwork abilities, exhibiting favorable political behavior, and successfully managing their image. It is necessary to look more closely at human capital studies in the future. Human resource development (HRD) experts may look closely at the connections between human capital and other factors, such as how it might improve HRD in specific industries and how it can be crucial in fostering employee engagement.

2.1.3 Overview of Data Literacy Skills

Data is beginning to replace some of the functions that traditional media have provided in terms of connecting people and ideas[65]. This and other statements amply demonstrate the level of interest that data generates. It's obvious that data-intensive science is growing. Any information that can be saved digitally, such as text, numbers, photos, video or movies, audio, software, algorithms, equations, animations, models, simulations, etc., is referred to as data. Data might be experimental, computational, or observational because there are many different types of data. The results of any systematic investigation that includes a process of observation, experimentation, or the testing of a hypothesis are

known as research data. Data also originates from literary and artistic creations, cultural heritage artifacts, and the big data phenomenon. enormous data is influenced by the interaction of cultural, technological, and intellectual events. It is not just enormous data; it is also defined by the ability to explore, aggregate, and cross-reference large data sets.

The ability to store enormous amounts of data by high bandwidth networks has sparked a great deal of interest in research data in the natural sciences, social sciences, as well as the arts and humanities. This interest has been fuelled by other components of today's highly developed information and communication technology (ICT) infrastructure. Some of the distinctions between data and information are eliminated by the fact that academics are less concerned with storing or using raw data and instead focus on the usage, reuse, and embedding context of data. So, it is possible to classify research data as information. Data sharing, data administration, data curation, and data citation are all part of the spectrum of data-related activities. The RECODE (Policy Recommendations for Open Access to Research Data in Europe) project's findings emphasize the variations in how various stakeholders are involved in these initiatives. For instance, research funding organizations in the UK are at the forefront of European policy development, and we may observe significant advancement in Austria, Germany, Ireland, and Norway. Clearly, there has been significant development in this area, including outside of the European Union. For instance, a number of research sponsors in Australia, Canada, and the United States demand open access to research data.[65].

The actions of the researchers involved in data-intensive science have a significant impact on its success. Data sharing, a key idea in data-intensive science, is particularly

responsive to the actions of researchers. It involves making research data available for use by others. Researchers may disclose their data for a variety of reasons. Sharing data could be a requirement for getting access to other people's data and could be a requirement for getting financing, as determined by various funding bodies with differing degrees of rigor. To be precise, requirements for making research data public vary by nation, organization, or field of study. In these circumstances, the findings of an international survey of researchers' behaviours and opinions regarding data sharing reveal that while only a minority of academics actually share their data, the majority of researchers from diverse disciplines have a favourable attitude toward it. RDM became necessary in the UK during the past five years as research funders there became more concerned with enhancing the management of research data and emphasized the need of including data.

A researcher presents the results of a study that examined the ways in which Danish institutions manage the storage, preservation, and accessibility of research data. One of the issues that was cited as contributing to the social sciences research's poor reproducibility was disciplinary. The topic of data sharing is obviously complicated because there are many reasons why academics choose not to share their data. For instance, data documentation requires a lot of labor. However, the primary problem is lack of interest, which is brought on by the well-known reality that in most academic subjects, the benefits come from publication rather than data maintenance[66]. It appears that in order to achieve greater openness, researchers must abandon continuous proprietary control and get over their concerns about abuse or misunderstanding. Each discipline also has its own "data culture," and certain data may be more standard in form

and hence easier to transfer than other peculiar formats. Security and control issues also come into play in this situation. In general, there might be a conflict between funder and publisher demands for data sharing and the social and technological constraints that prevent it. However, the academic community is inescapably moving toward better access to research data, and this development has an impact on every step of the research process.

On a more general level, influences that a user would perceive as legitimate since the information therein is believed to be credible and deserving of believing are referred to as cognitive authorities. The next aspect of data quality is authenticity, which assesses how well the data are thought to reflect the proper methods of conducting scientific research. This includes the validity and dependability of the data collection tools, the validity of the theoretical underpinnings, and the completeness, accuracy, and validity of the data. The data must be comprehensible in order to assess authenticity. When documentation and metadata are present, there is enough context to assess if the data is intelligible. Data must be usable in order to accomplish this. Data must be discoverable, accessible, and in a useable file format in order to be usable. To access the data, which must exhibit adequate integrity to be delivered, the persons evaluating data quality must have a suitable instrument at their disposal. Data integrity presupposes that it can be established that the data is, at the bit level, similar to some previously accepted or validated condition. Data integrity is essential for usability, comprehension, authenticity, and subsequently overall quality.[66].

People that possess data literacy are able to access, comprehend, evaluate critically, manage, handle, and use data in an ethical manner. This definition of managing is significantly more broad than the ones provided before and includes preservation and curation. Understanding how to search, how to filter and process, how to produce and synthesize is necessary for data literacy, which is the capacity to analyze, sort, and filter enormous amounts of information. It is obvious that these are also the traits of information literacy given that they are listed in the well-known and generally accepted definition of the term, which includes the capacities to identify information needs, locate information, evaluate it, and use it to address a specific issue.

People who are data literate must be able to choose, synthesize, and combine data with other information sources and existing knowledge. They must understand data kinds and formats as well as the significance of the source data. Knowing how to discover, gather, organize, analyze, summarize, and prioritize data are among the data literacy skills. Given that these are the only two abilities left on the list, the final two merit special consideration. The ability to adapt data literacy to particular purposes is enhanced by the development of hypotheses, problem identification, data interpretation, and the selection, planning, implementation, and monitoring of courses of action. This literacy transcends disciplinary borders and the conventional organizational frameworks of academic library groups, focusing on ownership and rights problems. Data literacy is to enable adequate research data management in a broad sense, which is similar to its ultimate purpose. The projections regarding the future directions for academic libraries include the provision of data literacy instruction as a service. By defining data more broadly and emphasizing the fact that employers expect data librarians to play the job of data literacy educators, its

significance is further highlighted. Those who will utilize the data and need education on how to understand and interpret it are the main target audience for data literacy. For researchers, particularly graduate and doctoral students, who must learn data literacy skills in order to become data literate science workers, this presents a challenge. We must supplement researchers' scientific training with instruction in data literacy in order to foster a culture of semantic researchers, which will allow researchers to approach research data appropriately and effectively[67].

The reason Data and literacy are related because as people produce and use data, society is undergoing significant change. As was said while defining data literacy, this is the basis for the argument that data literacy and computer science should be treated separately. There are many opportunities to improve decision-making processes, push for transparency and a more inclusive democracy in this fast-paced online environment where enormous volumes of data are produced every second. Data is now more accessible (albeit not totally) and data science is interacting with social issues and working for social good, which makes data more visible in the public realm. These changes have also changed the properties of data throughout time. Therefore, it would be accurate to claim that we are talking about data literacy given how significant and even powerful data has become as well as how its impact on institutions and people as a whole is always growing. Since it is a means of participating in this datafied or even data-driven world, data literacy is regarded to be "a life skill" in this sense. It is a talent that can empower people when working with data and genuinely understanding it. It is also a solution for people to protect themselves when it comes to the perils of a data-driven society, including naming what is happening. The subject of being a data literate has been

raised in the past with the intention of defining a data literate teacher. However, as their work demonstrated, it can be difficult to define a data literate teacher[67]. However, it is important to ask and provide an answer to this question since it identifies the components of data literacy and describes what it entails for particular people. There is currently no consensus among academics over what precisely constitutes data literacy.

Definition and knowledge of data have an impact on data literacy, which in turn has an impact on the competencies and skills required to be data literate. As has been said, there is no single definition of data literacy, and this fragmentation persists when identifying the necessary abilities and skills. While some sources define data literacy as having more sophisticated and technical abilities, others define it as having more fundamental skills along with soft skills like critical thinking and asking questions about data. Despite the fact that there are numerous frameworks for data literacy skills and competencies, the report from a scholar titled "Strategies and best practices for data literacy education" (hereafter referred to as "the report") stands out as a significant source in this case because it compares thirty-two sources and demonstrates the stark differences between them. Twenty-three data literacy competencies (and sixty-four related skills, knowledge, and tasks) under five key categories, including conceptual framework, data collection, data management, and data visualization, were identified after reviewing a large number of sources. The paper outlined data evaluation and data application[68]. Databilities (Data to the People), a data literacy competency framework created by a private company that uses the scholar's study in practice, will also be used in addition to this source. Since these two works together create the aforementioned skills and competences and offer a

thorough but not full summary of the literature, they will be used as a road map throughout this chapter.[67].

Data collecting involves data discovery and collection, which calls for assessing and guaranteeing the quality, relevance, and validity of the data as well as the reliability of the sources the data is gathered from. Knowing the reason for collecting or acquiring data is crucial because it can only answer inquiries for which it has records and pertinent variables. Therefore, defining the aim of data collecting up front, recognizing what good data is, where to obtain it, and evaluating the data source from which it was gleaned will all help people make sense of data and give them power in the future.

Data management happens after (or simultaneously with) data collection or data acquisition. Its range is quite broad; in fact, the term "data management literacy" was established specifically to focus on this area, stands closer to big data, and emphasizes the importance of the data lifecycle when managing data. Information technology (IT) and computer science-related technical abilities, such as those related to data conversion and the development and use of metadata (including many forms of metadata), are necessary for this area of data literacy. Despite this technical feature, open access to data has made data management a hot topic among non-IT groups, including librarians, teachers, and researchers. The New England Collaborative Data Management Curriculum (NECDMC), which includes modules about types, formats, and stages of data, contextualizing data, storing and securing data, data archiving, and data presentation, is one initiative establishing data management education programs in order to upskill such groups in data management.

The phrase "management of data quality" is pertinent and, according to scholars, is on a higher level than "data management" since it addresses issues with data quality and accuracy in addition to data management as a whole. Data management's section on "securing data" needs special attention because, as cloud computing has grown in popularity, concerns regarding personal data and online data security have increased. People need to be aware of their rights and how to secure their data, especially online, as the fundamental idea of privacy may be in danger. On the other hand, data owners must ensure that data is handled securely and safely, to safeguard their truthfulness and rightful rights. It is accurate to say that data management is ambiguous, and it is still unclear what it specifically means. However, it needs strong data comprehension, specialized technological skills, knowledge of software, and enough digital navigation abilities.

Understanding data and determining its worth are the first steps in data evaluation. Although it is easier to effectively analyze data when context is given, being data literate also entails being able to construct hypotheses accordingly and identify correlations that are not immediately obvious. The part on "interpreting and understanding data" of Databilities (Data to the People) specifically focuses on visual components of data, understanding tables, graphs, and charts, which calls for statistical and quantitative knowledge. Understanding data, however, should entail more than just being able to use statistics; it should also entail being able to ask questions such "Where did the data come from? ", "Why was that particular method used when visualizing data?", "What other indicators could be used?" "Are the chosen indicators relevant?" and other similar inquiries. The practice of "detecting and removing errors and inconsistencies from data in order to improve the quality of data" is known as data cleaning. Data cleaning is

frequently necessary before dealing with data. Arguably, the term "data cleaning" has several tiers. Sorting through the data, removing what isn't really needed for that particular situation, and vetting the veracity of the data sources are all possible aspects of cleaning data. Data application, which is closely related to DDDM since it entails assessing decisions made using data, might be said to be more concerned with the "practical" element of data. Thus, "translating data into actionable, instructional, or administrative practice" is one way to define "applying data."

The ethics of data is one of the aspects of applying data that receives increased attention as a result of its extensive use. Data ethics has its origins in "computer and information ethics," but there has been a change to ethical data for all types, and this shift has brought forth three categories of ethical difficulties."The ethics of data, including big and open data (generation, analysis, recording, sharing, privacy, transparency)" "The ethics of algorithms (including artificial intelligence and agents, machine learning)" The phrase "The ethics of practices (Responsibilities and Liabilities of People and Organizations, Strategies, Policies, Professional Codes, Consent, User Privacy, Secondary Use)" Online personal data, for example, when associated with online privacy and data ethics, leads to a contentious argument regarding the good vs the evil usage of data. Due to the growth of online platforms, there is now increasing awareness of the bad uses of this type of data, especially when it comes to platform mechanisms like user agency, user-generated content, and data veillance, which use personal online data to forecast people's behaviours.

Data literate students, teachers, and principals are just some of the many facets of the multifaceted field of data literacy education. In a larger sense, it also encompasses scholars, librarians, and decision-makers in the field of education. When data literacy is contextualized in the classroom, it emphasizes data-driven decision making as well as tying data to "real-world problems" through manipulating data, posing questions to data, organizing and cleaning data, and utilizing statistics. For teachers, "data" in data literacy instruction includes information on students' academic performance. Therefore, instructors who are data literate are those who use student assessment data to adapt curriculum to students' requirements, assess teaching methods appropriately, and guide their activities. Data literacy for teachers requires a variety of abilities and knowledge, such as the capacity to "summarize and explain data, assess patterns and trends, articulate inferences and conclusions." At this point, it's crucial that teachers make decisions based on factors other than their emotions or past experiences. Teachers cannot become "more than just an opinion" without data guiding their decisions, to put it simply. Data literacy, however, cannot be implemented into educational systems without interdisciplinary collaboration and multi-stakeholder approaches, including governors and school administrators. Without these, data literacy cannot progress beyond a passing interest.

2.2. Theoretical Framework

2.2.1 Servqual Theory of Service Quality

While conducting researches using ServQUAL in industries, the proponents of this model popularly referred to as PZB identified ten potentially overlapping dimensions or criteria that customers used while judging service quality. These original ten dimensions -

tangibles, reliability, responsiveness, competence, courtesy, credibility, security, access, communication and understanding of customers were identified[68]. They were further factorized or consolidated into five broad constructs namely, tangibility, reliability, responsiveness, assurance, and empathy - due to their tendency to repetition. Tangibility covers the existence of physical and functional facilities, equipment experiences/knowledgeable personnel and communication materials used in rendering and promoting effective services in libraries. Reliability involves ability to provide the promised services or resources needed by users dependably and accurately in a way that could satisfy the expectations of library users. Responsiveness measures the "willingness of organization's staff to help customers and provide them with prompt services". This refers to the timeliness and promptness at which administrators attend to the students and staff of the institutions. Assurance measures knowledge, competences and courtesy of employees and their ability to convey trust and confidence in customers towards the service firm.

Empathy measures caring, individualized attention which organizations provide to their clients. In an administrative work and information science profession, this conveys approachability, ease of contact with providers and the readiness to give listening ears to user's query. It also includes approachability, ease of contact with service providers, and willingness to understand customer's needs. Most of the findings on quality services revealed that reliability and responsiveness were valued above every other dimension, while other respondents showed preference for tangibility, assurance or empathy[68].

2.2.2 Human Capital Theory

In the world of labor market, people bring different levels of education, knowledge, skill, and abilities as well as their expectancy to the workplace. According to a researcher: a more educated, better-trained person is capable of supplying a larger amount of useful productive effort than one with less education and training[69]. The value of human capital theory is widely accepted in order to increase organizational performance, so an organization relies on employees' skill, knowledge, ability as a key concept of value creation. Human capital widely used after Gary Backer won the novel prizes initiated "human capital theory" stated that a different level of education and training contribute to a different level of wages and salaries, the more knowledge, skill and ability, the more likely to get a better job. According to another scholar, human capital is a physical means of production[69]. Organizations invests in human capital via education, training, and health. Human capital theory broadened the idea that "the component of human capital consisted of abilities, knowledge, skill, personal talent, behavior, and effort"; the knowledge included IQ, intelligence, specific knowledge, and general knowledge for work. Skill is knowledge applied to work, including physical movements and job-related movements. Talent is an innate quality of the individual that can be enhanced through development. The expression of observable behaviour, norms, ethics, and personal beliefs is called conduct. People make an effort when they strive to use their natural or unique resources, such as their talent, experience, knowledge, and capacity for hard work to succeed, and finally there is time.

Education, training, migration, and health are just a few of the numerous ways that human capital can be built up. Employees acquire knowledge, skills, and abilities in a variety of ways through such forms. Companies engage in human capital because they

see people as an asset and anticipate that their investment will pay off and provide value in the future. In other words, a person invests in their education or training with the hope that the knowledge and skills they acquire would help them grow in their careers. In the past, corporate operations and human resources have been seen as expenses that should be kept to a minimum. Human resources are increasingly, however, seen as human capital, which creates a source of value. Still, there is a tremendous paradigm shift which has occurred in the concept of human capital from the traditional to the present view. These shifts changed human resource function by moving from an activity-based process to result-based which is more connected and aligned with business strategy and views human capital as a value creation to be used in strategic management. Moreover, Employees are viewed as an asset under the human capital idea, and they should be developed, and multidimensional technology merged. However, the paradigm shift in human capital from an activity-based (focus on a particular measurement, input focus, preparing for routine tasks, etc.) to a result-based (focus on result and total performance such as business impact, cost-benefit analysis, output focus, and performance effectiveness) paradigm has an impact on human capital policy and practice by focusing more on the bottom line than top down management.

2.2.3 Data Literacy Skills and Competency Model

Despite the fact that there are numerous frameworks for data literacy skills and competencies, the report from a researcher titled "Strategies and best practices for data literacy education" (hereafter referred to as "the report" or "the report") stands out as a significant source in this case because it compares thirty-two sources and demonstrates

the stark differences between them70. Twenty-three data literacy competencies (and sixty-four related skills, knowledge, and tasks) were identified after reviewing numerous sources, and they were organized into five main topics: conceptual framework, data collection, data management, data evaluation, and data application (see figure 2). Databilities (Data to the People), a data literacy competency framework created by a for-profit organization that uses the report in practice, will also be used in addition to this source. Since these two works together create the aforementioned skills and competences and offer a thorough but not full summary of the literature, they will be used as a road map throughout this chapter.

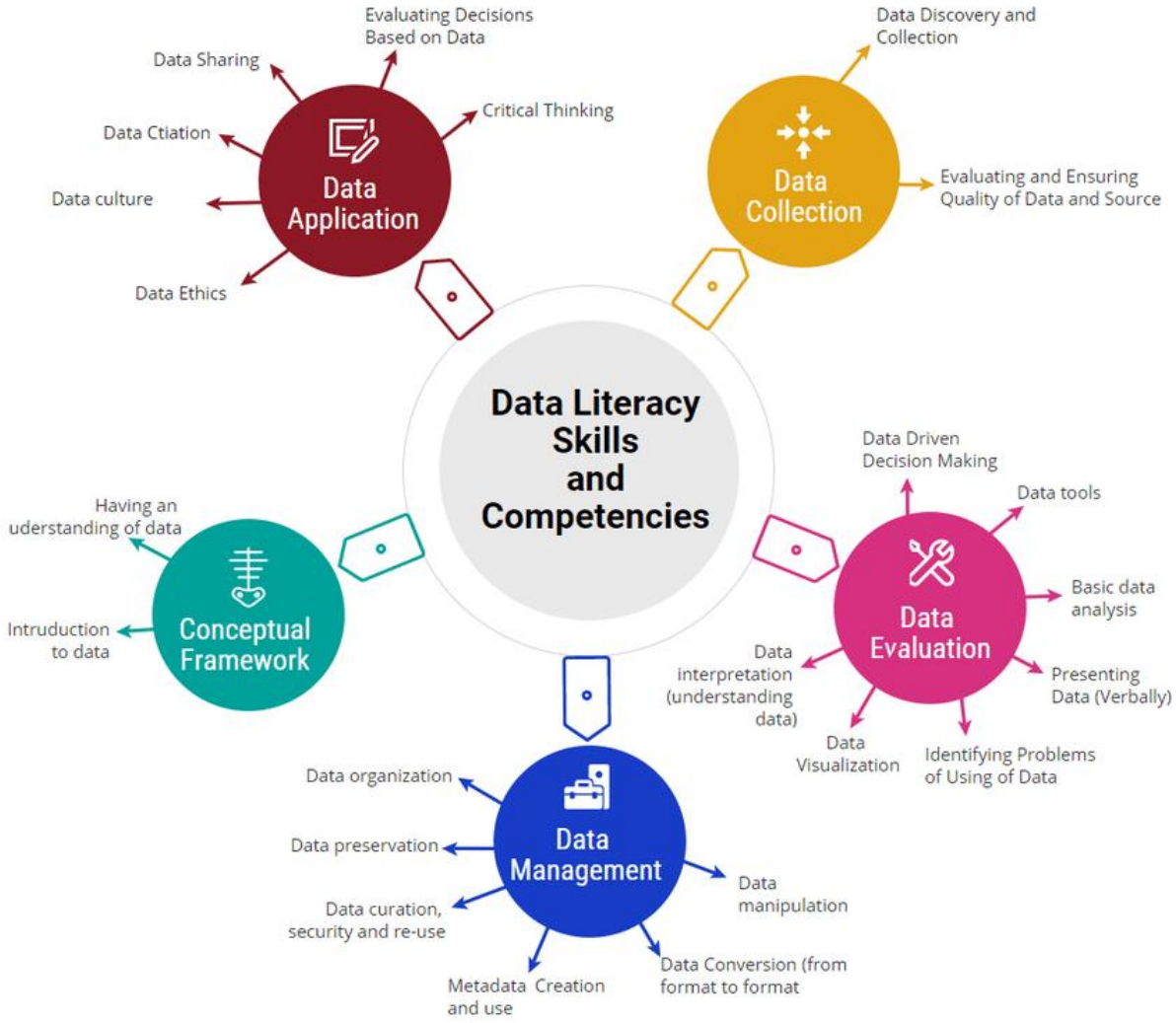

Figure 2.1: Schematic representation of data literacy skills and competencies.

Source: [101]

Conceptual Framework / Introduction to Data: The first step to becoming data literate is being able to conceptualize data, which includes being able to comprehend what data is, the function it serves in society, as well as how definitional changes might affect data gathering and generate new debates. In order to learn more about the data in question, it will be beneficial to create "data biographies" that help to address concerns like who collected this data, for what goals, what are the recognized restrictions, etc.

Understanding the relationship between data and society, how and by whom it is generated, its potential uses, and the ramifications of its use become crucial at this stage. Understanding data involves knowledge of data types, the origin of data, data sources, data gathering techniques, and various data usages, in addition to this aspect. It also demands expertise and innovation. The importance of knowing who has access to data cannot be emphasized enough, as data ownership has a significant impact on the power dynamics that determine biases and inequities. After all, asking the questions outlined in this chapter and being knowledgeable about and interested in data would pique one's interest in it, which is the first step in developing data literacy. It becomes evident that those who have a solid grasp of data can advance in their data literacy journey while others without it can just "memorize" data chores rather than confidently using their talents.

Data Collection: The act of gathering data is known as data discovery and collection, which calls for assessing and confirming the accuracy, usefulness, and validity of the data as well as the reliability of the sources from which the data is gathered. Data can answer many questions, but only those for which it has records and relevant variables, so it is crucial to determine the objective before beginning to collect or acquire data. As a result, defining the aim of data collecting up front, recognizing what good data is, where to obtain it, and evaluating the data source from which it was gleaned will all help people make sense of data going forward and give them power.

Accessibility becomes crucial in data collecting since it frequently becomes difficult to access data owing to insufficient organizational and technical infrastructure. As a result,

access to data is not only important in terms of an individual's talents and abilities, but also heavily depends on macrostructures. Data must be discoverable and accessible to be valuable for both people and collaborative efforts. Data gathering techniques can range from simple and straightforward ones, such simply noting the shapes of various fruits, to complex ones that might call for advanced software abilities or deep statistical and mathematical understanding. It becomes apparent that "data collection" has many different meanings and therefore generalizations about it are illogical. While asking "which data?" may be useful when determining which skills would be useful, it will be fair to say that accuracy remains vital for any level or type of data as it highlights issues and aids in the development of an action plan or solution. The quality of the inferences made from the obtained data is ensured by work, comprehension of "data accuracy, appropriateness and completeness" factors, and the ability to discover and retrieve data. While anyone can gather data, the fact that most data is acquired and captured in the digital age adds a new dimension to data collection. It soon becomes clear that the term "data collection" covers a wide range of applications, making generalizations about it nonsensical. While it may be helpful to ask "which data?" when deciding which skills might be useful, it is fair to argue that accuracy is still crucial for any level or type of data because it reveals problems and helps establish a plan of action or remedy. Work, understanding of "data accuracy, appropriateness and completeness" characteristics, and the capacity to find and retrieve data all contribute to the quality of the conclusions drawn from the acquired data. Anyone can collect data, but the fact that the majority of it is done so in the digital age gives it a new level of complexity. Then there are worries regarding the privacy of personal data when it is collected by smart cities and

governments, particularly when "surveillance" is involved. Although legislation like the General Data Protection Regulation (GDPR), which governs how personal data is processed in the EU, tries to address these issues, people who want to work with such data should also be aware of privacy issues and legal restraints. They should also know how to query such data and where to find it. *Data Management:* This occurs after (or simultaneously with) data collection, acquisition, or storage. Its breadth is fairly broad; in fact, a subcategory of data literacy called "data management literacy" was specifically developed to focus on this area, stands closer to big data, and emphasizes the importance of the data lifecycle when managing data. Technical expertise in information technology (IT) and computer science is necessary for this aspect of data literacy, including the development and use of metadata (including many forms of metadata). Despite this technical feature, the term "data management" is starting to be used more frequently by non-IT groups, particularly librarians, teachers, and academics, thanks to the growth of free access to data. The New England Collaborative Data Management Curriculum (NECDMC), which includes modules about types, formats, and stages of data, contextualizing data, storing and securing data, data archiving, and data presentation, is one initiative establishing data management education programs in order to upskill such groups in data management.

The phrase "management of data quality" is pertinent and, according to scholars, is on a higher level than "data management" since it addresses issues with data quality and accuracy in addition to data management as a whole. Data management's section on "securing data" needs special attention because, as cloud computing has grown in popularity, concerns regarding personal data and online data security have increased.

People need to be aware of their rights and how to secure their data, especially online, as the fundamental idea of privacy may be in danger. On the other hand, data owners must ensure that data is handled securely and safely, to safeguard their truthfulness and rightful rights. It is accurate to say that data management is ambiguous, and it is still unclear what it specifically means. However, it needs strong data comprehension, specialized technological skills, knowledge of software, and enough digital navigation abilities.

Data Evaluation: Understanding data and determining its worth are the first steps in data evaluation. Although it is easier to effectively analyze data when context is given, being data literate also entails being able to construct hypotheses accordingly and identify correlations that are not immediately obvious. Under the heading "interpreting and understanding data," Databilities (Data to the People) primarily emphasizes on the visual features of data; more specifically, being able to read tables, graphs, and charts, which calls for statistical and mathematical knowledge. Understanding data, however, should entail more than just being able to use statistics; it should also entail being able to ask questions such "Where did the data come from? ", "Why was that particular method used when visualizing data?", "What other indicators could be used?" "Are the chosen indicators relevant?" and other similar inquiries. The practice of "detecting and removing errors and inconsistencies from data in order to improve the quality of data" is known as data cleaning. Data cleaning is frequently necessary before dealing with data. "Data cleaning" could have several stages. To some extent, cleaning data may involve going over it, removing what isn't really necessary for that particular situation, and determining its veracity. With regard to political campaign fundraising, the lesson from Data

Journalism provides a good illustration of how to clean data by removing the irrelevant components from the sample in order to determine who gave how much money.

Data visualization, which is seen as a "rich" aspect of data, is a complimentary, if not essential, component of data literacy since it makes it simpler and more obvious to recognize the structure and possible patterns in datasets. Knowing that data does not always tell the truth at this phase is crucial since data visualizations can be manipulated and deceptive. A study of this case using a US election example is astounding. In his work, he demonstrates how misleading visualizations can be created even when the data being displayed is accurate. Overall, data-literate people should pay special attention to correctness and dependability while examining any sort of data visualization or when constructing one. Data storytelling must be discussed while discussing data visualization because it is gaining popularity, especially in the journalism field where newspapers use data in a variety of ways to report the news.

Data Application: Data application, which is closely related to DDDM since it entails assessing decisions made using data, might be said to be more concerned with the "practical" element of data. Therefore, "translating data into actionable, instructional, or administrative practice" might be understood as "applying data."

Data Ethics: The ethics of data is one of the aspects of applying data that receives increased attention as a result of its extensive use. Data ethics has its origins in "computer and information ethics," but there has been a change to ethical data for all types, and this shift has brought forth three categories of ethical difficulties. ▪“ Big and open data ethics, covering generation, analysis, recording, sharing, privacy, and transparency” ▪ The ethics

of algorithms, including machine learning, artificial intelligence, and agents. ▪ "The ethics of practices (Responsibilities and liabilities of individuals and organizations, strategies, policies, professional codes, consent, user privacy, secondary use)" Online personal data, for example, when associated with online privacy and data ethics, leads to a contentious argument regarding the good vs the evil usage of data.

The growth of online platforms has increased awareness of the bad uses of this type of data, especially in relation to problems with platform features like user agency, user-generated content, and data surveillance, which use personal internet data to anticipate people's actions.

2.3 Review of Empirical Studies

2.3.1 Human Capital Development and Cloud Computing Practices

Cloud computing has a significant standing in both local and international HEIs. In North America, 70% of HEIs have migrated to the cloud, and 50% have adopted cloud computing collaborative approach to improve on-campus information sharing. Scholar claims that nearly all HEIs in the West area have a fundamental stake in departmental adoption of cloud computing. For instance, a researcher claims that the University of California, Berkeley concentrated one of its courses on delivering SaaS applications. Additionally, by renting Google's cloud, the Medical College of Wisconsin Biotechnology and Bioengineering Center in the United States discovered that using cloud computing is quite advantageous and gives them a significant amount of

computational capacity servers[71]. Furthermore, some HEIs have embraced due to financial considerations. For instance, funding cuts have harmed Washington State University. Nevertheless, the use of cloud computing has made it possible for the school to grow its educational services. The IT market is regarded as the largest market in the Gulf region in Saudi Arabia. The Saudi government has set aside a sizable budget to upgrade the learning environment and provide the greatest technology resources. However, compared to the older colleges in SA, certain new start-up universities in Saudi Arabia lack e-learning facilities[71]. While cloud computing has been widely employed in universities across the world to provide higher-quality services to higher education, Saudi universities are still working to integrate it in the context of remote learning and e-learning. Therefore, it is crucial to be knowledgeable about adopting cloud computing within SA universities.

A scholar reported these difficulties, including security procedures, legal guidelines, and implementation[71]. The researchers identified a number of crucial success variables related to the migration process and proposed a paradigm for successful migration to the cloud environment at Saudi universities. Except for the physical location component, the results showed that the most of these characteristics were statistically significant. The suggested framework might help in the decision-making process about migration and can offer useful information on cloud computing projects. Despite being the first step in examining the elements facilitating the migration process, the proposed framework had not been put into practice. A different new e-learning architecture based on a virtual private network and private cloud was proposed by a researcher[72]. The suggested structure enables university students to more affordable access to an e-learning environment for resource

sharing. The framework enhances availability and dependability and is scalable; however it only has limited access within university networks.

A scholar analyzed the impact of how individual users perceive cloud computing applications[73]. The researchers presented a framework centered on the correlation between a number of factors (IT self-efficacy, perceived cloud ease of use, computer anxiety, and users' perception of the usefulness and effectiveness of cloud computing applications) that affect how students at a university in Southeast Michigan perceive cloud computing technology. The Technology Acceptance methodology (TAM) methodology was also used to examine how students adopted cloud computing. Despite the TAM's continued importance in technology appraisal after its implementation, there are few explanatory factors and no useful values[74]. The TAM was also utilized by a researcher to look into the causes and effects of higher education's embrace of cloud computing for knowledge management. A Turkish university's undergraduate students were given a questionnaire, which was then evaluated using structural equation modeling. The results demonstrated that educational institutions encourage the use of cloud computing through raising knowledge management awareness. Although this study was effective, one problem was its lack of explanatory power[75].

A scholar focused on SaaS76 when examining the variables influencing the adoption of cloud computing in HEIs. For this study, the researchers suggested a framework that was combined with the Diffusion of Innovation (DOI) theory and derived from the Technology, Organization, and Environment (TOE) framework. Although the suggested framework quickens the process of computing technology installation, it does not take

into account the resources or social support needed for the individual to adopt the new behavior. An effective structure for the Higher Education Ministry that serves all the universities in Iraq was the subject of research. The proposed framework provides some characteristics such as low cost, flexibility, mobility, and business continuity. However, there are some issues that need further investigations: security, reliability, and loss of sensitive data. Furthermore, there is a lack of standards to enable multiple clouds to work as a single entity[77]. A scholar discussed how cloud computing could help higher education institutions in South Africa by providing a framework for the cloud-based virtual computing labs. Findings depicted revealed the cost saving on hardware and software and the flexibility of the cloud-based virtual computing labs. However, the usage of the proposed framework was limited to the campus[78].

A scholar suggested a hybrid computing model that enables Saudi Arabia's higher education institutions to share knowledge and carry out various research projects79. The suggested model enhances the efficiency and caliber of instruction by offering assistance with regard to readings, tests, and projects. Additionally, it delivers a wealth of knowledge in one location and saves organizations money on updating with the newest IT. However, the scholar's suggested model80 did not take security concerns into account. According to a report, cloud computing continues to have a substantial impact on higher education in the contemporary world[81]. Cloud computing services are being adopted by higher education due to financial benefits, increased productivity, better learning methodologies, and increased knowledge penetration. However, there is disagreement about a variety of topics, including ownership, integrity, and privacy of data. Additionally, there aren't enough modern security methods for institutions to utilize cloud computing.

The TAM framework's characteristics that influence the adoption of cloud computing in higher education[82]. Findings showed that the elements are important for improving faculty members' and students' awareness of cloud computing adoption. There is, however, little explanation and no practical benefit. Another exploratory study using the Technology Organization Environment (TOE) paradigm was done to determine the elements that influence Saudi Arabia's higher education institutions' adoption of cloud computing[83]. Complexity, relative advantage, and data problems were assessed by statistical analysis, and the findings demonstrated their importance. Although the study's authors improved our understanding of the elements influencing cloud computing adoption, they left out the effects of bandwidth and reliability.

Numerous studies conducted in higher education show that using computational environments enhances learning. This prompted Segrelles and Molto (2016) to introduce virtualized computing environments based on cloud computing using the On-demand Deployment of Infrastructures to Support Educational Activities (ODISEA) platform. A Spanish university has conducted an evaluation of the advantages. Findings showed that ODISEA offers students extremely widespread access and has significant economic advantages for institutions of higher learning. Despite the platform's great versatility, it does face difficulties because of how difficult it is for its layers to communicate with one another[84]. In a case study, the advantages of utilizing Google Docs for academic purposes were investigated, and the factors influencing the uptake of cloud computing at a university in Zimbabwe were examined. In order to gain a thorough understanding of the problems preventing the adoption of cloud computing, questionnaires and interviews were undertaken. Findings showed that Google Docs has many advantages for academics,

but lecturers also lack expertise about how to use cloud computing. To explain cloud computing, many workshops had to be held for all academics. Although the researchers employed various research design strategies, security concerns weren't taken into account[85].

To examine the evidence of cloud computing use in the educational sector, a researcher performed a survey[86]. The literature review contained a total of 27 studies. The study's findings showed that there isn't much research on cloud computing's use in educational settings. Providing IT assistance for instructional activities is difficult for higher education institutions. Therefore, institutions of higher learning must take into account the opportunities provided by cloud computing. In order to do that, a researcher presented a cloud computing architecture for institutions of higher learning that includes cloud computing deployment models, services models, and user domains. A plan for switching from the conventional system to cloud computing was also outlined. Although the suggested architecture boosts efficiency and agility, it hasn't yet been tested. Software as a business (SaaS) is the most popular cloud computing business paradigm that affects the education market[87]. So, a researcher investigated if SaaS is a practical choice for South African higher education institutions. Undergraduate students were questioned about utilizing Office 365 as a SaaS. Findings showed that utilizing Office 365 has various benefits, including program installation, updating, and maintenance. Office 365 also helps universities save money and have easier access to resources, which is helpful. But there are alternative options besides Office 365 that offer all the same functionality but at a lower price [88].

An open-source cloud-based HRM framework was proposed to offer efficient HRM solutions for small businesses. It also enables users to carry out various HR operations simply and with a friendly interface[89]. The suggested cloud-based HRM online service includes a variety of modules, including Leave, Benefits, Employee Self Services, Personal Information Management, and Salary Information Management. The users can easily choose any service from this online service to complete the required action. For instance, all payroll-related difficulties will be addressed if the user chooses the Salary Information Management model. It is important to note that the transaction model and the subscription model were the business models utilized to implement the web service. In the transaction model, the user uses the online service only sometimes and is charged a set amount for each use, but in the subscription model, the customer is charged a set fee every month or occasionally even every year.

In order to address the issues with traditional HRIMS of high education institutes, such as high cost, inconsistent data, and insufficient intelligent analysis to make decisions90, a researcher presented a cloud-based HRIMS (cHRIMS). Three layers make up the cHRMIS architecture: the top layer is the end-user service layer, the middle layer is the application service layer, and the bottom layer is the platform infrastructure layer. Each layer includes a variety of functional modules or components that are in charge of carrying out various HR duties in accordance with standards. The top layer gathers all HRMS apps and service modules together and offers a user-friendly interface for sending service requests that are tailored to the user's requirements. For top-level administrators, the middle layer enhances operational effectiveness and business operations. System

management, virtual resources, and physical resources are included in the base layer. As a result, cHRIMS seeks to boost HR performance while cutting costs.

A researcher examined the benefits and drawbacks of using cloud technology from the viewpoint of businesses. The analysis was based on the elements that businesses must take into account before implementing such emerging technology[91]. Cost, security, performance, and interaction with the existing IT infrastructure are some of these variables. The study looked at how some uninformed businesses can't comprehend the thought of putting critical data outside of their organization. On the other hand, because cloud computing is the newest information technology trend, other businesses tend to adopt it. According to the survey, SMEs should be the first business type to use cloud technology because their procedures are less complicated than those of huge corporations. The research revealed that security and privacy, availability and open access, dependability, interoperability, economic value, shifting in IT organization, and political difficulties are the main obstacles to enterprise cloud adoption. It also demonstrated several benefits of implementing such novel technology, including lower costs, rapid access to hardware resources, low IT barriers, service scalability, and the potential for new application classes.

To increase the enterprise's expandability, an innovative cloud-based HRM strategy was proposed92. The four key services offered by the proposed cloud-based HRM portal are HRM Web, Validation, Configuration Management, and HRM for agent service. The data are supplied and the request is answered by HRM Web Service if the agent uses HRM Web Service to seek HRM service. The data are then sent by Web Port to the

database, where the necessary data is kept. The data is then retrieved from the cloud storage (database) using Web Port, and at the same time, HRM Web implements the implementation to produce a report that the user requests. The Configuration Manager is tasked with keeping an eye on the cloud storage where HRM data and information are maintained. Data validation issues are handled by the validation manager, and since data validation is completed prior to data retrieval, error recurrence is reduced. Additionally, each resource is loaded according to standard load-sharing principles for the best possible service.

A scholar presented the "6+1" structure of the HRMS in conjunction with cloud computing technology to study the development of the HRM cloud service platform. The "6" structure of HRM implementation involves six layers, including Page Layer (which collects data), Page Control (which controls the standardization and integrity of the collected data), Professional Algorithm Layer (which processes data), Logic Layer (which controls adding, inquiring, deleting, and modifying of data), Data Table Definition Layer (which specifies the fields, field control conditions, and field properties for each data table of the database), and Database Layer (which establishes the connection between the database and the professional algorithm layer[93]. The "+1" stands for the sub-working platform to implement the cloud-based HRM service characteristics. All aspects of HRM company are covered by the cloud service platform, which offers services to manage everyday tasks as well as job management, recruitment, HR planning, training, salary, careers, and labor relations. The research showed that the proposed platform is highly extensible, efficient, and Pay-as-you-go with no regional restrictions.

The study revealed that the difficulties facing the HRMS cloud service platform are cloud security, network issues, and a lack of platform developers.

An empirical analysis of the HR requirements brought on by Taiwan's cloud development was presented94. With the help of 20 companies, they conducted the analysis using quantitative and qualitative approaches in order to offer a thorough picture of the evolution of cloud HR. The results indicated that (1) Due to the expensive expense of developing HRs, businesses avoid hiring recent graduates in favor of hiring those with experience. (2) The expense of educating new personnel and keeping experienced workers on staff has increased due to the competitive enterprises' increased turnover rate of cloud-related specialists, (3) The HR industry lacks talent to create cloud computing-related software architecture, (4) Most businesses lack middle managers with knowledge of cloud services and emerging application trends, (5) Businesses want HR professionals with experience in evaluating big data and cloud applications.

A new cloud-based technology infrastructure for SMEs to implement HRM was presented[94]. The cloud service platforms, cloud service providers, and HRM users make up the conceptual model of the cloud-based HRMS for SEMs. They used game theory to examine the interactions between SME users and cloud service providers. (1) SMEs and cloud service providers are viewed as sensible economic actors, (2) SMEs can decide whether to supervise or not, and cloud service providers can decide whether to exert or not, depending on the choices made by both parties. It was discovered that cloud service providers must increase their technical know-how in order to suit SMEs' expectations and address their companies' sustainability concerns. However, SMEs have the freedom to

select the cloud services and cloud service providers that best suit their needs. They advised standardizing HRM processes within SMEs in order to benefit from the tools and solutions the cloud has to offer.

A scholar proposed In order to address the issues with HRM teaching in colleges and universities, such as the use of a single teaching technique, the neglect of teaching content, and the absence of sharing of teaching practices95, a new model of cloud-based HRM platform has been developed. The proposed approach, which aims to change the HRM training method, is based on an engineering education mode of conceptualizing, designing, implementing, and operating (CDIO). The setting for cloud-based Different services are offered by HRM to colleges and universities, such as refining teaching techniques, upgrading course materials, and exchanging expertise to invite businesses to join their HRM experience for mutual benefit. The students can take advantage of the methods and resources of other institutions, for example, they can do their assignments by contacting students from other universities via the platform, which reduces the distance between the universities. It enables students to publish survey needs for the practical project in order to obtain the necessary data through cloud platform analysis findings.

2.3.2 Data Literacy Skills and Cloud Computing Services

In Quality of cloud computing service - a performance- and security-focused driven approach to cloud computing is suggested. This paper's primary objective is to assess service quality using cloud technology. security[96]. The study suggests a model that works

for Quality of cloud computing service to clouds with various security settings. A suggested cloud-based video-on-demand service model that guarantees both quality of service and scalability. The paper's main emphasis is the Quality of cloud computing service for video cloud storage services. The conventional strategy involves maximizing performance, cost, and a few other factors. In order to reach a positive conclusion, the research undertakes a characterization of start-up delays and applies a modeling technique. A proposed quality of service model for the cloud. The article covered clouds Quality of cloud computing service pertaining to cloud monitoring. The article offered a methodology that can serve as a roadmap for cloud performance monitoring. It is suggested to use mixed integer linear programming to optimize the quality of service in clouds.

Examining Quality of cloud computing service To optimize their services, cloud providers must use specific criteria of service[97]. Two optimization strategies were applied in the paper to some Quality of cloud computing service goals to achieve different trade-offs. Q-aware, or quality of service-based cloud resource provisioning, is suggested. at the job, Quality of cloud computing service was deemed to be a significant issue by cloud providers when providing resources, and they subsequently recommended a Quality of cloud computing service metric-based technique for analysis of workloads. Quality of service approaches in cloud computing: A systematic mapping study is proposed. Quality of cloud computing service was identified by cloud providers as a key difficulty when supplying resources, and they subsequently suggested a Quality of cloud computing service methods to identify the area that should receive more attention and proposed a course of action.

Quality of cloud computing service SDN stands for software-defined networking. A poll is suggested. There were several options proposed in terms of Quality of cloud computing service. Relevant surveys were conducted in a variety of locations, for Quality of cloud computing service, highlighting challenges and lessons[98]. Service that is safe and backed by quality of serviceIt is suggested to use an object-oriented architecture for mobile cloud handoff. The quality of cloud computing services in terms of mobile cloud computing, energy, and handoff difficulties are the main topics of the article. A four-layer paradigm for energy efficiency is proposed in the study. Quality of cloud computing service in mobile Cloud computing. Quality of cloud computing service When talking about virtualization on the cloud, one researcher concentrated on provisioning virtual machines in cloud computing environments based on analytical performance and cloud service quality. It was concluded that among other factors, workload, virtualization, and application monitoring have the most effects on cloud performance. The evaluation of workload changes in applications to improve the quality of cloud computing service was provided as the final step.

The following was highlighted as the impact of ICT on students: the use of ICT had equipped them with skills to search for information and this had helped them gain more knowledge of some of the things they study in many subjects, increasing their confidence in making contributions during class discussions, helped in understanding abstract ideas and concepts[99]. As ICT is used as a tool for students to discover learning topics, solve problems, and provide solutions to the problems in the learning process. ICT makes knowledge acquisition more accessible, and concepts in learning areas are understood

while engaging students in the application of ICT. Students are now more frequently engaged in the meaningful use of computers.

A scholar explored the use of Information and Communication Technology used by medical students. They found 77% of the respondents were of the opinion that ICT should be included in their syllabus[100]. Nearly all respondents expressed their desire to have a computer lab in their college. One hundred respondents out of 128 opined that medical education is not effective without ICT based resources and services. ICT has also enabled learning through multiple intelligence as ICT has introduced learning through simulation games; this enables active learning through all senses. Effective use of different information communication technologies has become imperative for students in learning environments. The utilization of modern ICT facilities can make students, teachers' and administrators retrieve their required information within a short period. They can access and disseminate electronic information like e-books, news, e-journals which can advance teaching and learning process at all levels of education. Effective utilization of ICT resources can help facilitate good communication within and outside any organization. There must be a good communication mechanism among teachers', students' and school administrators' within and outside the school for goals achievement at all levels of education.

2.4 Conceptual Framework

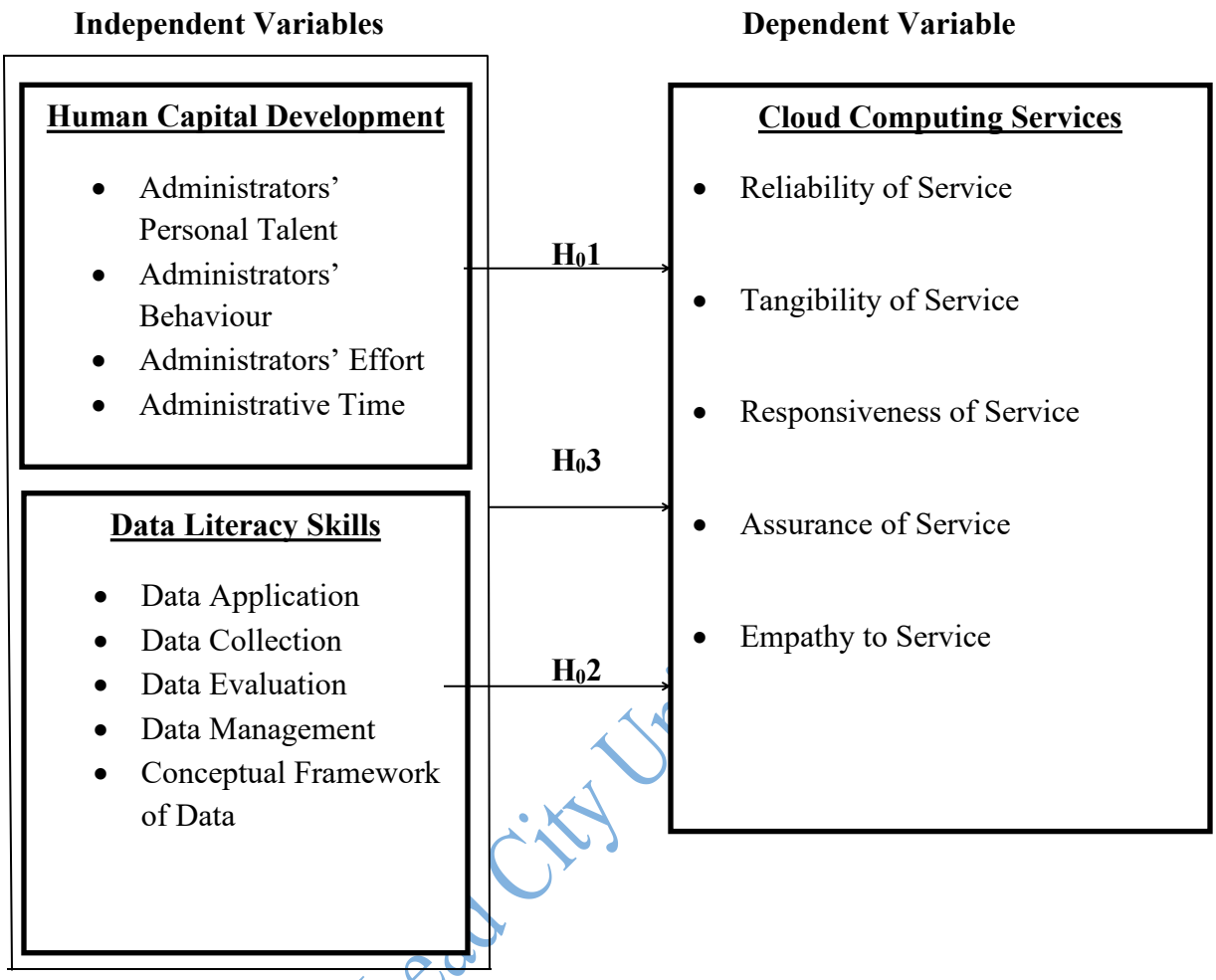

Figure 2.2 Research Model

Source: Researcher's Conceptual Model, 2023

The conceptual model of this study was developed based on the tittle of the research which is the influence of human capital development and data literacy skills on cloud computing services among administrators in ICT Polytechnics in Ogun State. The independent variables are human capital development which will be measured with personal talent, behavior, effort and administrative time[69] and Data Literacy Skills which were measured by data application, data collection, data evaluation, data management and conceptual framework of data[70] cloud computing services, the dependent variable

were measured with reliability, tangibility, responsiveness, assurance and empathy to services[68]. Therefore, the three hypotheses were linked as follows: in hypothesis one; human capital development will be tested on cloud computing services, in hypothesis two; Data Literacy Skills will be tested on cloud computing services, in hypothesis three; human capital development and Data Literacy Skills will be tested on cloud computing services among administrators in ICT Polytechnics in Ogun State. Overall, these formulated hypotheses will be subjected to a statistical test to determine the direction of results, conclusion, and possible recommendations for this study.

2.5 Summary of Gap in Literature Reviewed

This paper reviewed the influence of human capital development on cloud computing practices among administrators in ICT Polytechnic, Ogun State. The history of cloud computing evolution is presented. Three service models (SaaS, PaaS and IaaS) and four deployment models (private, public, hybrid and community cloud) are described. Description of cloud platforms by different CSPs (Amazon, IBM, Microsoft, Google) are discussed; it also discussed open source tools (Open Nebula, Apache CloudStack, Nimbus and Eucalyptus) and commercial tools (RightScale, Gravitant, VMTurbo and Scalr). Various general challenges of cloud computing and the number of difficulties involved in those challenges are identified and the possible solutions are presented. These solutions would help the researchers to have proper directions for future research and to get into the efficient implementation of the techniques. Security objectives and security issues related to the location of data centres, network and other common issues are discussed. There is a need of designing efficient solutions to address security issues such as data transfer across gateway, long-term viability, compromised services, regulatory

compliance, virtualisation in cloud computing paradigm. We believe this paper helps researchers who would like to begin their research career in the area of cloud computing.

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Chapter Three

Methodology

The methods that will be employed in this investigation are presented in this chapter. It covers the research design methodologies used, as well as the population, sample, data collection, and variable operation.

3.1 Research Design

This study will used a descriptive survey research design. The design will be used to determine the influence of human capital development and data literacy skills on quality of cloud computing services among administrators in ICT polytechnic in Ogun State, Nigeria.

3.2 Population of the Study

The participants in this study are one hundred and eighty-six (186) administrative Staff in ICT polytechnic, Ogun State, Nigeria.

Table 3.1: Population of the Study

S/N	Name of Institution	Number in each Institution
1.	Gateway (ICT) Polytechnic, Saapade	47
2.	Abraham Adesanya (ICT) Polytechnics, Ijebu - Igbo	43
3.	D.S. Adegbenro (ICT) Polytechnics, Itori	40
4.	Gateway (ICT) Polytechnics, Igbesa	56
	Total	**186**

Source

3.3 Sample Size and Sampling Technique

The sample size is one hundred and twenty-six (126) administrative staff in ICT Polytechnic, Ogun State is total enumeration adopted since the population is just few.

3.4 Description of Research Instrument (s)

The instrument that will be utilized is a structured questionnaire, which will be used to collect data from respondents because it allowed the researcher to readily assess the structured questions and responses in order to meet the study's goal. The Likert scale design that will be used in this study will allow the researcher to give options for respondents to choose from. Data on the factors under study was collected using self-reported questionnaires. In this study, the Human Capital Development and Cloud Computing Practices scale will be employed.

Section A: This section was created by the researcher to collect demographic information from respondents, and it provides biodata about respondents based on four factors: gender, age, educational qualifications, and years of experience.

Section B: Cloud Computing Service scale which Indicates how the knowledgeable and skillful the administrative staff are with the use of cloud computing practices, the scale is of four point which are: Very high = 4, High = 3, Low = 2, Very low = 1 and 14 items. The research instrument will be divided into various sections which will be designed to elicit responses on the topic under review. The research instrument was adapted[2].

Section C: Human Capital Development scale which indicates how impactful the training given to the administrative staff on cloud computing practices are with 10 items. The scale is also of four-point which are: Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1**.** This instrument was adapted[2]. Cronbach Alpha will be reported.

Section D: Data Literacy Skills scale which indicates how administrative staff acquire skills on cloud computing services are with **10 items**. The scale is also of four-point which are: Strongly Agree = 4, Agree = 3, Disagree = 2, Strongly Disagree = 1**.** This instrument was adapted[3]. Cronbach Alpha will be reported.

3.5 Validation of Research Instrument

The instrument's items acquired through a survey of related literature and adaptations of questionnaires used by other researchers. The supervisor and other specialists in the field of information management provide input on both the face and content product validity. Corrections were integrated into the final questionnaire and distributed to the study participants.

3.6 Reliability of the Instrument

The researcher runs the questionnaire through a reliability test to ensure that all of the items assessing each variable in the study are consistent. The instrument's reliability will be tested in a pilot study with 30 copies of the questionnaire which will be given to administrative staff in Technical University, Ibadan which is not part of the population of the study.

Table 3.2: Result of Pilot Study

Variables	**Cronbach Alpha**
Cloud Computing Service	0.830
Human Capital Development	0.910

Data Literacy Skills	0.721

Source: Field survey, 2023

3.7 Distribution of Research Instrument

Primary data was collected through a structured questionnaire in accordance with existing research to address the study's objectives. This instrument works well with descriptive survey research because it allows for the collection of data on respondents' opinions and perceptions on current events at a specific point in time.

The Department of Information Management, Lead City University, provided a letter of introduction and a project attestation form, which will be utilized to request authorization to conduct the survey from the management of ICT Polytechnic, Ogun State. A day training session was held for three (3) research assistants to help with questionnaire administration, retrieval, and initial sorting. The researcher and research assistants were engaged with the institution's HR department to protect the anonymity of their responses while also advising them on the importance of adequate responses and the benefits embedded in the study's findings. The administrative staffs of the ICT Polytechnic, Ogun State were given a total of 186 copies of the questionnaires.

3.8 Methods of Data Analysis

The data was analysed using descriptive and inferential statistics by the researcher. For study questions one and two, descriptive statistics (mean, frequency distribution, standard deviation, and percentage) will be used. The null hypotheses 1 and 2 were investigated using inferential statistics while multiple regressions were used for hypothesis three. All

hypotheses in the study will be assessed at a significance level of 0.05. Statistical Package and Service Solution (SPSS) Version 25 will be used to analyze the data collected for the study.

Endnotes

1. A. Ziani, Z. A. Sadouq, & A. Medouri, *Use of cloud computing and GIS on vehicle traffic management.* **International Journal of Intelligent Enterprise**, 6(2-4), 2019. 382- 392.

2. B. Kaufman, *The firm's choice of HRM practices: economics meets strategic human resource management*. **Industrial and Labor Relations Review,** 64 (3), 2019. 526-557.

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4 Administrative staff of ICT Polytechnics in Ogun State. Population extracted from Registry Department of the Polytechnics 2023.

Chapter Four

Results and Discussion of Findings

This chapter covers the presentation of data, analyses of the data and interpretation of results. For the analyses of data, the first two sections focus on descriptive analysis of the data while the third section focuses on inferential statistics. The first section shows the presentation of the analyses of demographic data using tables showing frequencies and percentages. The second section shows the presentation of the analyses of research questions using tables showing frequencies, percentages and mean distribution of the responses. The third section presents the test of hypotheses using regression analysis while the final section focuses on the discussion of findings.

A total number of one hundred and eighty-six respondents were expected to fill the online questionnaire but only one hundred and thirty-eight responded. Out of the copies returned by the respondents, one hundred and twenty-six copies were certified as duly filled and considered usable. The response results are presented in Table 4.1.

Table 4.1: Response Rate

Response	Frequency	Percent (%)
Returned and used	126	67.7
Not returned	48	25.8
Returned but not used	12	6.5
Total	**186**	**100**

Source: Field Survey, 2023

4.1 Demographic Data of Respondents

This section, which is descriptive, presents the results of the demographic characteristics of the respondents. Table 4.2 describes the gender, age, educational level and years of work experience of the respondents.

Table 4.2: Demographic Characteristics of Respondents

Variables	Measurement	Frequency	Percentage
Gender	No response	2	1.6%
	Male	48	38.1%
	Female	76	60.3%
	Total	**126**	**100.0%**
Age	No response	1	0.8%
	20 – 25 years	87	69.0%
	26 – 30 years	12	9.5%
	31 – 35 years	0	0.0%
	36 – 40 years	4	3.2%
	41 – 45 years	5	4.0%
	46 years and above	17	13.5%
	Total	**126**	**100.0%**
Educational level	ND	77	61.1%
	Bachelor's degree/HND	30	23.8%
	Master's degree	16	12.7%
	PhD	3	2.4%
	Total	**126**	**100.0%**
Years of experience	No response	5	4.0%
	5 – 10 years	85	67.5%
	11 – 15 years	2	1.6%
	16 – 20 years	15	11.9%
	21 – 25 years	14	11.1%
	26 – 30 years	5	4.0%
	Total	**126**	**100.0%**

Source: Field Survey, 2023

The demographic characteristics by gender, as shown in Table 4.2, shows that 76 respondents representing 60.3% were female while 48 respondents representing 38.1% were male, indicating that most of the respondents were female. The gender profile also reveals that 2 respondents representing 1.6% were not interested in disclosing their gender. The demographic characteristics of respondents as shown by age in Table 4.2 shows that 87 respondents representing 69.0% were between 20 and 25 years; 17 respondents representing 13.5% were 46 years and above; 12 respondents representing

9.5% were between 26 and 30 years; 5 respondents representing 4.0% were between 41 and 45 years; 4 respondents representing 3.2% were between 36 and 40 years; and no respondent between 31 and 35 years. The age profile also shows that a respondent representing 0.8% was not ready to disclose his/her age. Hence, the age profile indicates that majority of the respondents were 25 years or below.

The demographic characteristics by educational level in Table 4.2 reveals that 77 respondents representing 61.1% had ND; 30 respondents representing 23.8% held Bachelor's degree/HND; 16 respondents representing 12.7% held Master's degree; and 3 respondents representing 2.4% held PhD. The educational level profile, therefore, suggest that the highest educational qualification of majority of the respondents was National Diploma. The profile by years of experience shows that 85 respondents representing 67.5% had between 5 and 10 years of work experience; 15 respondents representing 11.9% had between 16 and 20 years of work experience; 14 respondents representing 11.1% had between 21 and 25 years of work experience; 5 respondents representing 4.0% had between 26 and 30 years of work experience; and 2 respondents representing 1.6% had between 11 and 15 years of work experience. The profile also shows that 5 respondents representing 4.0% did not disclose their years of experience at work. The profile by years of experience thereby suggests that majority of the respondents had between 5 and 10 years of working experience.

4.2 Analysis of Research Questions

Research Question One: What is the quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria?

Table 4.3: Descriptive analysis of responses on quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria

Reliability	**Very High**	**High**	**Low**	**Very Low**	**Mean**
The school administrators ensure accuracy of students' information at all times	60 (47.6%)	45 (35.7%)	16 (12.7%)	5 (4.0%)	3.27
Students receive services required, sought the attention of the administrators	38 (30.2%)	60 (47.6%)	18 (14.3%)	10 (7.9%)	3.00
Students depend on administrators' service on their information at all times	46 (36.5%)	43 (34.1%)	22 (17.5%)	15 (11.9%)	2.95
Weighted Mean					**3.07**
Tangibility	**Very High**	**High**	**Low**	**Very Low**	**Mean**
There is facility put in place for proper storage of students' record	57 (45.2%)	47 (37.3%)	10 (7.9%)	12 (9.5%)	3.18
There are no instances of records misplacement	42 (33.3%)	33 (26.2%)	30 (23.8%)	21 (16.7%)	2.76
There are computers put in place to enhance easy retrieval of students' records	72 (57.1%)	34 (27.0%)	13 (10.3%)	7 (5.6%)	3.36
Weighted Mean					**3.10**
Responsiveness	**Very High**	**High**	**Low**	**Very Low**	**Mean**
The students feel satisfied whenever they have encounter with the school administrators	50 (39.7%)	44 (34.9%)	24 (19.0%)	8 (6.3%)	3.08
The students are given prompt attention by the administrators and they are willing to attend to them at all time	49 (38.9%)	47 (37.3%)	19 (15.1%)	11 (8.7%)	3.06
The students are always willing to meet the administrators whenever they have complaint about their results	55 (43.7%)	36 (28.6%)	22 (17.5%)	13 (10.3%)	3.06
Weighted Mean					**3.07**
Assurance	**Very High**	**High**	**Low**	**Very Low**	**Mean**
Students records are secured in the custody of the school administrators	80 (63.5%)	31 (24.6%)	10 (7.9%)	5 (4.0%)	3.48
Students do not have reasons to complain about any missing records in their file	37 (29.4%)	36 (28.6%)	23 (18.3%)	30 (23.8%)	2.63
Students records are always intact and accessible on request	58 (46.0%)	48 (38.1%)	13 (10.3%)	7 (5.6%)	3.25
Weighted Mean					**3.12**
Empathy	**Very High**	**High**	**Low**	**Very Low**	**Mean**
Students receive prompt attention any time	52	42	22	10	3.08

they need the services of the administrators	(41.3%)	(33.3%)	(17.5%)	(7.9%)	
Students are not delayed on the queue	43 (34.1%)	31 (24.6%)	30 (23.8%)	22 (17.5%)	2.75
Students are impressed with the services of the administrators	47 (37.3%)	48 (38.1%)	22 (17.5%)	9 (7.1%)	3.06
Weighted Mean					**2.96**
Overall Weighted Mean					**3.06**

Decision rule for mean: < 2.5 = low; 2.5 = moderate; > 2.5 = high
Note: Very High (4), High (3), Low (2), Very Low (1)
Source: Field Survey, 2023

According to Table 4.3, for reliability, 47.6% of respondents reported the school administrators ensure accuracy of students' information at all times to a very high extent, 35.7% of respondents to a high extent, 12.7% of respondents to a low extent, and 4.0% of respondents reported very low extent. On average, the responses on respondents who reported school administrators ensure accuracy of students' information at all times have a mean of 3.27. For the next item, 47.6% of respondents sought the attention of the administrators to a high extent, 30.2% of respondents to a very high extent, 14.3% of respondents to a low extent, and 7.9% to a very low extent. On average, the responses on respondents who sought the attention of the administrators have a mean of 3.00.

More so, 36.5% of respondents depended on administrators' service on their information at all times to a very high extent, 34.1% of respondents to a high extent, 17.5% of respondents to a low extent, and 11.9% of respondents to a very low extent. On average, the responses on respondents who depended on administrators' service on their information at all times have a mean of 2.95. As shown in Table 4.3, the mean values for all items on reliability are high. Also, the weighted mean for reliability is 3.07. This result suggests that, overall, the reliability of services provided by administrators in ICT Polytechnic, Ogun State is high.

For tangibility, Table 4.3 reveals that 45.2% of respondents reported that facility were put in place for proper storage of students' record to a very high extent, 37.3% of respondents to a high extent, 7.9% of respondents to a low extent, and 9.5% of respondents reported very low extent. On average, the responses on respondents who reported that facility were put in place for proper storage of students' record have a mean of 3.18. For the next item, 33.3% of respondents reported there were no instances of records misplacement to a very high extent, 26.2% of respondents to a high extent, 23.8% of respondents to a low extent, and 16.7% of respondents reported very low extent. On average, the responses on respondents who reported there were no instances of records misplacement have a mean of 2.76.

In addition, 57.1% of respondents reported that there were computers put in place to enhance easy retrieval of students' records to a very high extent, 27.0% of respondents to a high extent, 10.3% of respondents to a low extent, and 5.6% of respondents to a very low extent. On average, the responses on respondents who reported that there were computers put in place to enhance easy retrieval of students' records have a mean of 3.36. According to Table 4.3, the mean values for all items on tangibility are high. More so, the weighted mean for tangibility is 3.10. This result suggests that tangibility of services provided by administrators in ICT Polytechnic, Ogun State is high.

For responsiveness, Table 4.3 indicates that 39.7% of respondents accepted, to a very high extent, that they felt satisfied whenever they had encounter with the school administrators, 34.9% of respondents to a high extent, 19.0% of respondents to a low extent, and 6.3% of respondents to very low extent. On average, the responses on respondents who felt satisfied whenever they had encounter with the school

administrators have a mean of 3.08. Likewise, 38.9% of respondents were given prompt attention by the administrators and were willing to attend to them at all time to very high extent, 37.3% of respondents to a high extent, 15.1% of respondents to a low extent, and 8.7% of respondents reported very low extent. On average, the responses on respondents who were given prompt attention by the administrators and were willing to attend to them at all time have a mean of 3.06.

Also, 43.7% of respondents indicated that they were always willing to meet the administrators whenever they had complaint about their results to a very high extent, 28.6% of respondents to a high extent, 17.5% of respondents to a low extent and 10.3% of respondents reported very low extent. On the average, the responses on respondents who were always willing to meet the administrators whenever they had complaint about their results have a mean of 3.06. As shown in Table 4.3, the mean values for all items on responsiveness are high. In addition, the weighted mean for responsiveness is 3.07 which suggests that responsiveness by administrators in ICT Polytechnic, Ogun State is high.

As shown in Table 4.3, for assurance, 63.5% of respondents reported that records were secured in the custody of the school administrators to a very high extent, 24.6% of respondents to a high extent, 7.9% of respondents to a low extent, and 4.0% of respondents reported very low extent. On average, the responses on respondents who reported records were secured in the custody of the school administrators have a mean of 3.48. For the next item, 29.4% of respondents did not have reasons to complain about any missing records in their file to a high extent, 28.6% of respondents to a very high extent, 23.8% of respondents to a very low extent, and 18.3% to a low extent. On average, the

responses on respondents who did not have reasons to complain about any missing records in their file have a mean of 2.63.

More so, 46.0% of respondents reported that records were always intact and accessible on request to a very high extent, 38.1% of respondents to a high extent, 10.3% of respondents to a low extent, and 5.6% of respondents to a very low extent. On average, the responses on respondents whose records were always intact and accessible on request have a mean of 3.25. As shown in Table 4.3, the mean values for all items on assurance are high. Also, the weighted mean for assurance is 3.12. This result suggests that, overall, the level of assurance by administrators in ICT Polytechnic, Ogun State is high.

For empathy, Table 4.3 indicates that 41.3% of respondents accepted, to a very high extent, that they received prompt attention any time they needed the services of the administrators, 33.3% of respondents to a high extent, 17.5% of respondents to a low extent, and 7.9% of respondents to very low extent. On average, the responses on respondents who received prompt attention any time they needed the services of the administrators have a mean of 3.08. Likewise, 34.1% of respondents were not delayed on the queue to very high extent, 24.6% of respondents to a high extent, 23.8% of respondents to a low extent, and 17.5% of respondents reported very low extent. On average, the responses on respondents who did not experience delay on the queue have a mean of 2.75.

Also, 38.1% of respondents indicated that they were impressed with the services of the administrators to a high extent, 37.3% of respondents to a very high extent, 17.5% of respondents to a low extent and 7.1% of respondents reported very low extent. On the average, the responses on respondents who were impressed with the services of the

administrators have a mean of 3.06. As shown in Table 4.3, the mean values for all items on empathy are high. In addition, the weighted mean for empathy is 2.96 which suggests that empathy by administrators in ICT Polytechnic, Ogun State is high. The overall weighted mean for quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria is 3.06. This suggests that, based on this study, there is high level of quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria.

Research Question Two: What is the level of human capital development among administrators of ICT Polytechnics, Ogun State, Nigeria?

Table 4.4: Descriptive analysis of responses on level of human capital development among administrators of ICT Polytechnics, Ogun State, Nigeria

Personal talent	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**Mean**
My career are originated through my skills and talent	60 (47.6%)	45 (35.7%)	14 (11.1%)	7 (5.6%)	3.25
I prefer my career choice to be in demand	51 (40.5%)	61 (48.4%)	10 (7.9%)	4 (3.2%)	3.26
The job in the future affects my career preference	28 (22.2%)	33 (26.2%)	32 (25.4%)	33 (26.2%)	2.44
Weighted Mean					**2.98**
Behaviour of administrators	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**Mean**
The students are involve in establishing the rules and procedures	32 (25.4%)	47 (37.3%)	24 (19.0%)	23 (18.3%)	2.70
I protect the school information technology equipment	57 (45.2%)	50 (39.7%)	12 (9.5%)	7 (5.6%)	3.25
I always arrive at work early	73 (57.9%)	46 (36.5%)	4 (3.2%)	3 (2.4%)	3.50
					3.15

Weighted Mean					
Effort of administrators	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**Mean**
Test reports are reported in a reasonable amount of time	43 (34.1%)	57 (45.2%)	18 (14.3%)	8 (6.3%)	3.07
There is effectiveness of administrative effort on academic decision	53 (42.1%)	50 (39.7%)	18 (14.3%)	5 (4.0%)	3.20
My progress report is always encouraging	60 (47.6%)	55 (43.7%)	7 (5.6%)	4 (3.2%)	3.36
Weighted Mean					**3.21**
Time	**Strongly Agree**	**Agree**	**Disagree**	**Strongly Disagree**	**Mean**
I am always on point thinking about improvement and setting long range goals	64 (50.8%)	49 (38.9%)	11 (8.7%)	2 (1.6%)	3.39
I do not dodge relatively complex tasks	63 (50.0%)	47 (37.3%)	10 (7.9%)	6 (4.8%)	3.33
I do not procrastinate since I work better under pressure	52 (41.3%)	54 (42.9%)	16 (12.7%)	4 (3.2%)	3.22
Weighted Mean					**3.31**
Overall Weighted Mean					**3.16**

Decision rule for mean: < 2.5 = low; 2.5 = moderate; > 2.5 = high
Note: Strongly Agree (4), Agree (3), Disagree (2), Strongly Disagree (1)
Source: Field Survey, 2023

In line with Table 4.4, for personal talent, 47.6% of respondents strongly agreed that their career were originated through their skills and talent, 35.7% of respondents agreed, 11.1% of respondents disagreed, and 5.6% of respondents strongly disagreed. On the average, the responses show a mean value of 3.25. For the next item, 40.5% of respondents agreed that they preferred their career choice to be in demand, 48.4% of respondents strongly agreed, 7.9% of the respondents disagreed, and 3.2% of respondents strongly disagreed. On the average, the responses indicate a mean value of 3.26.

For the last item on personal talent, 26.2% of respondents agreed that the job in the future affects their career preference, the same percentage of respondents also strongly disagreed, 25.4% of respondents disagreed, and 22.2% of respondents strongly agreed.

On the average, the responses show a mean value of 2.44. As shown in Table 4.4, the mean values for all items on personal talent are either low or high. However, the weighted mean for personal talent is 2.98. This result suggests that personal talents of administrators of ICT Polytechnics, Ogun State, Nigeria is high.

According to Table 4.4, for behavior of administrators, 37.3% of respondents agreed that they were involved in establishing the rules and procedures, 25.4% of respondents strongly agreed, 19.0% of respondents disagreed, and 18.3% of respondents strongly disagreed. On the average, the responses show a mean value of 2.70. Also, 45.2% of respondents strongly agreed that they protected the school information technology equipment, 39.7% of respondents agreed, 9.5% of respondents disagreed, and 5.6% of respondents strongly disagreed. On the average, the responses indicate a mean value of 3.25.

As shown in Table 4.4, for the last item on behavior of administrators, 57.9% of respondents strongly agreed that they always arrived at work early, 36.5% of respondents agreed, 3.2% of respondents disagreed, and 2.4% of respondents strongly disagreed. On the average, the responses show a mean value of 3.50. As shown in Table 4.4, the mean values for all items on behaviour of administrators are high. Likewise, the weighted mean for behaviour of administrators is 3.15. This result suggests that respondents accepted behaviour of administrators of ICT Polytechnics, Ogun State, Nigeria is high.

As indicated by Table 4.4, for effort of administrators, 45.2% of respondents agreed that their test reports were reported in a reasonable amount of time, 34.1% of respondents strongly agreed, 14.3% of respondents disagreed, and 6.3% of respondents strongly disagreed. On the average, the responses show a mean value of 3.07. More so, 42.1% of

respondents strongly agreed that there was effectiveness of administrative effort on academic decision, 39.7% of respondents agreed, 14.3% of respondents disagreed, and 4.0% of respondents strongly disagreed. On the average, the responses indicate a mean value of 3.20.

For the last item on effort of administrators, 47.6% of respondents strongly agreed that their progress report was always encouraging, 43.7% of respondents agreed, 5.6% of respondents disagreed, and 3.2% of respondents strongly disagreed. On the average, the responses show a mean value of 3.36. According to Table 4.4, the mean values for all items on effort of administrators are high. Likewise, the weighted mean for effort of administrators is 3.21 which suggests that the effort of administrators of ICT Polytechnics, Ogun State, Nigeria is high.

In line with Table 4.4, for time, 50.8% of respondents strongly agreed that they were always on point thinking about improvement and setting long range goals, 38.9% of respondents agreed, 8.7% of respondents disagreed, and 1.6% of respondents strongly disagreed. On the average, the responses show a mean value of 3.39. For the next item, 50.0% of respondents strongly agreed that they did not dodge relatively complex tasks, 37.3% of respondents agreed, 7.9% of the respondents disagreed, and 4.8% of respondents strongly disagreed. On the average, the responses indicate a mean value of 3.33.

For the last item on time, 42.9% of respondents agreed that they did not procrastinate since they work better under pressure, 41.3% of respondents strongly agreed, 12.7% of respondents disagreed, and 3.2% of respondents strongly disagreed. On the average, the responses show a mean value of 3.22. As shown in Table 4.4, the mean values for all

items on time are high. Also, the weighted mean for time is 3.31. This result suggests that management of time by administrators of ICT Polytechnics, Ogun State, Nigeria is high. The overall weighted mean for human capital development among administrators of ICT Polytechnics, Ogun State, Nigeria is 3.16. This also suggests that respondents perceived human capital development among administrators of ICT Polytechnics, Ogun State, Nigeria as high.

Research Question Three: What are the level of data literacy skills used by administrators in ICT Polytechnic, Ogun State, Nigeria?

Table 4.5: Descriptive analysis of responses on level of data literacy skills used by administrators in ICT Polytechnic, Ogun State, Nigeria

Data collection	**Very High**	**High**	**Low**	**Very Low**	**Mean**
Existing policies aid in ensuring the collection of institutional research output	39 (31.0%)	57 (45.2%)	22 (17.5%)	8 (6.3%)	3.01
The management provide guidance on files organization e.g. creating system to instantly access administrative records	50 (39.7%)	51 (40.5%)	21 (16.7%)	4 (3.2%)	3.17
Analysis of retrieved data are done by administrators	49 (38.9%)	57 (45.2%)	13 (10.3%)	7 (5.6%)	3.17
Weighted Mean					**3.12**
Data evaluation	**Very High**	**High**	**Low**	**Very Low**	**Mean**
No data is missing because it is necessary to have overview of students/academic needs	50 (39.7%)	59 (46.8%)	12 (9.5%)	5 (4.0%)	3.22
Data are structured to achieve the administrative objectives of the management	54 (42.9%)	52 (41.3%)	16 (12.7%)	4 (3.2%)	3.24
Data is easily accessed due to availability of i-Cloud	44 (34.9%)	58 (46.0%)	15 (11.9%)	9 (7.1%)	3.09
Weighted Mean					**3.18**
Data management	**Very High**	**High**	**Low**	**Very Low**	**Mean**
Existing capacity building programmes help to develop skills to handle data management	43 (34.1%)	62 (49.2%)	17 (13.5%)	4 (3.2%)	3.14
There is data management plans (for example: providing templates or examples)	49 (38.9%)	54 (42.9%)	18 (14.3%)	5 (4.0%)	3.17
Existing capacity building programmes are	41	62	16	7	3.09

handled by data management Administrator	(32.5%)	(49.2%)	(12.7%)	(5.6%)	
Weighted Mean					**3.13**
Data application	**Very High**	**High**	**Low**	**Very Low**	**Mean**
I am satisfied with the quality of service in data transfer	42 (33.3%)	49 (38.9%)	23 (18.3%)	12 (9.5%)	2.96
I am satisfied with the support data when completing my task	49 (38.9%)	51 (40.5%)	23 (18.3%)	3 (2.4%)	3.16
I satisfied with the quality of service in the connection available	46 (36.5%)	52 (41.3%)	23 (18.3%)	5 (4.0%)	3.10
Weighted Mean					**3.07**
Overall Weighted Mean					**3.13**

Decision rule for mean: < 2.5 = low; 2.5 = moderate; > 2.5 = high
Note: Very High (4), High (3), Low (2), Very Low (1)
Source: Field Survey, 2023

According to Table 4.5, for data collection, 45.2% of respondents reported that existing policies aid in ensuring the collection of institutional research output to a high extent, 31.0% of respondents to a very high extent, 17.5% of respondents to a low extent, and 6.3% of respondents reported very low extent. On average, the responses on this item have a mean of 3.01. For the next item, 40.5% of respondents reported that management provided guidance on files organization, for example, creating system to instantly access administrative records to a high extent, 39.7% of respondents to a very high extent, 16.7% of respondents to a low extent, and 3.2% responded to a very low extent. On average, the responses on this item have a mean of 3.17. More so, 45.2% of respondents reported that analysis of retrieved data were done by administrators to a high extent, 38.9% of respondents to a very high extent, 10.3% of respondents to a low extent, and 5.6% of respondents to a very low extent. On average, the responses on this item have a mean of 3.17. As shown in Table 4.5, the mean values for all items on data collection are high. Also, the weighted mean for data collection is 3.12. This result suggests that,

overall, the level of data collection by administrators in ICT Polytechnic, Ogun State, Nigeria is high.

For data evaluation, 46.8% of respondents reported no data was missing because it was necessary to have overview of students/academic needs to high extent, 39.7% of respondents to a very high extent, 9.5% of respondents to a low extent, and 4.0% of respondents reported very low extent. On average, the responses on this item have a mean of 3.22. Also, 42.9% of respondents reported that data were structured to achieve the administrative objectives of the management to a very high extent, 41.3% of respondents to a high extent, 12.7% of respondents to a low extent, and 3.2% of respondents to a very low extent. On average, the responses on this item have a mean of 3.24.

In addition, 46.0% of respondents reported that data was easily accessed due to availability of i-Cloud to a high extent, 34.9% of respondents to a very high extent, 11.9% of respondents to a low extent, and 7.1% of respondents to a very low extent. On average, the responses on this item have a mean of 3.09. As shown in Table 4.5, the mean values for all items on data evaluation are high. Also, the weighted mean for data evaluation is 3.18. This result suggests that, overall, the level of data evaluation by administrators in ICT Polytechnic, Ogun State, Nigeria is high.

For data management, Table 4.5 reveals that 49.2% of respondents reported that existing capacity building programmes helped to develop skills to handle data management to a high extent, 34.1% of respondents to a very high extent, 13.5% of respondents to a low extent, and 3.2% of respondents reported very low extent. On average, the responses on this item have a mean of 3.14. For the next item, 42.9% of respondents accepted there was data management plans (for example: providing templates or examples) to a high

extent, 38.9% of respondents to a very high extent, 14.3% of respondents to a low extent, and 4.0% of respondents reported very low extent. On average, the responses on this item have a mean of 3.17.

In addition, 49.2% of respondents reported that existing capacity building programmes were handled by data management Administrator to a high extent, 32.5% of respondents to a very high extent, 12.7% of respondents to a low extent, and 5.6% of respondents to a very low extent. On average, the responses on this item have a mean of 3.09. As observed from Table 4.5, the mean values for all items on data management are high. More so, the weighted mean for data management is 3.13. This result suggests that level of data management by administrators in ICT Polytechnic, Ogun State, Nigeria is high.

For data application, Table 4.5 indicates that 38.9% of respondents accepted, to a high extent, that they were satisfied with the quality of service in data transfer, 33.3% of respondents to a very high extent, 18.3% of respondents to a low extent, and 9.5% of respondents to very low extent. On average, the responses on this item have a mean of 2.96. Likewise, 40.5% of respondents were satisfied with the support data when completing their task to a high extent, 38.9% of respondents to a very high extent, 18.3% of respondents to a low extent, and 2.4% of respondents reported very low extent. On average, the responses on this item have a mean of 3.16.

Also, 41.3% of respondents indicated that they were satisfied with the quality of service in the connection available to a high extent, 36.5% of respondents to a very high extent, 18.3% of respondents to a low extent, and 4.0% of respondents reported very low extent. On the average, the responses on this item have a mean of 3.10. As shown in Table 4.5,

the mean values for all items on data application are high. In addition, the weighted mean for data application is 3.07 which suggests that level of data application by administrators in ICT Polytechnic, Ogun State, Nigeria is high. The overall weighted mean for level of data literacy skills used by administrators in ICT Polytechnic, Ogun State, Nigeria is 3.13. This suggests that, based on this study, there is high level of data literacy skills used by administrators in ICT Polytechnic, Ogun State, Nigeria.

4.3 Test of Hypotheses

This section presents the regression analyses carried out on hypotheses one to three. The study adopted the linear regression analysis. The acceptable level of significance for all regression analyses carried out in this study is 0.05.

$H_0$1: There is no significant influence of human capital development on quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria.

To test the above null hypothesis, data on quality of cloud computing services were regressed on the data on human capital development using simple linear regression analysis. Tables 4.6 a, b and c present the results of the regression analysis.

Table 4.6: Regression analysis for influence of human capital development on quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria

a. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.587[a]	.344	.339	.49578

a. Predictors: (Constant), Human capital development

b. ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.001	1	16.001	65.099	.000[a]
	Residual	30.479	124	.246		
	Total	46.479	125			

a. Predictors: (Constant), Human capital development
b. Dependent Variable: Quality of cloud computing services

c. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.764	.288		2.650	.009
	Human capital development	.727	.090	.587	8.068	.000

a. Dependent Variable: Quality of cloud computing services
Source: Field Survey, 2023

Tables 4.6a shows that human capital development has a moderate and positive correlation (R = 0.587) with quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria. Also, the coefficient of determination (Adj. R^2 = 0.339) indicates that human capital development explains 33.9% of the total variance in quality of cloud computing services provided by

administrators in ICT Polytechnic, Ogun State, Nigeria. The other 66.1% variation in quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria are explained by other factors not considered in this study.

Table 4.6b shows that for the overall significance of the model, human capital development has a significant influence on quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria ($F(1, 124) = 65.099$, $p < 0.05$). Table 4.6c also shows that, if all other factor are constant, a unit change in human capital development will lead to 0.727 increase in the quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria at 95% level of confidence ($B = 0.727$, $p < 0.05$). Therefore, based on the result of the regression analysis, the null hypothesis one, which states that there is no significant influence of human capital development on quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria is rejected.

$H_0$2: There is no significant influence of data literacy skills on quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria.

To test the second null hypothesis, data on quality of cloud computing services were regressed on the data on data literacy skills using simple linear regression analysis. Tables 4.7 a, b and c present the results of the regression analysis.

Table 4.7: Regression analysis for influence of data literacy skills on quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria

a. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.694[a]	.482	.478	.44072

a. Predictors: (Constant), Data literacy skills

b. ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.395	1	22.395	115.298	.000[a]
	Residual	24.085	124	.194		
	Total	46.479	125			

a. Predictors: (Constant), Data literacy skills
b. Dependent Variable: Quality of cloud computing services

c. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.821	.213		3.859	.000
	Data literacy skills	.718	.067	.694	10.738	.000

a. Dependent Variable: Quality of cloud computing services
Source: Field Survey, 2023

According to Table 4.7a, data literacy skill has a high and positive correlation (R = 0.694) with quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria. In addition, the coefficient of determination (Adj. R^2 = 0.478) reveals that data literacy skill explains 47.8% of the total variance in quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria. Other factors not included in this study explained the other 52.2% variation in quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria. Also, Table 4.7b presents the overall significance of the model which indicates that data literacy skill has a significant influence on quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria ($F(1, 124) = 115.298$, $p < 0.05$).

More so, Table 4.7c shows that, at 95% level of confidence, given all other factor remain constant, a unit change in data literacy skills will lead to 0.718 increase in the quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria ($B = 0.718$, $p < 0.05$). Hence, considering the result of the regression analysis, the null hypothesis two, which states that there is no significant influence of data literacy skills on quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria is also rejected.

$H_0$3: There is no significant combined influence of human capital development and data literacy skills on quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria.

To test the third null hypothesis, data on quality of cloud computing services were regressed on the data on human capital development and data literacy skills using multiple linear regression analysis. Tables 4.8 a, b and c present the results of the regression analysis.

Table 4.8: Regression analysis for influence of human capital development and data literacy skills on quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria

a. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.753[a]	.567	.560	.40427

a. Predictors: (Constant), Data literacy skills, Human capital development

b. ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	26.377	2	13.188	80.694	.000[a]

	Residual	20.103	123	.163
	Total	46.479	125	

a. Predictors: (Constant), Data literacy skills, Human capital development
b. Dependent Variable: Quality of cloud computing services

c. Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.027	.253		.106	.916
	Human capital development	.412	.083	.332	4.936	.000
	Data literacy skills	.555	.070	.537	7.968	.000

a. Dependent Variable: Quality of cloud computing services

Source: Field Survey, 2023

The results of the third null hypothesis are presented in Table 4.8. As shown in Table 4.8a, human capital development and data literacy skills have high and positive correlation (R = 0.753) with quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria. Also, human capital development and data literacy skills explain 56.0% (Adj. $R^2 = 0.560$) of the total variance in quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria. Factors not investigated in this study explained the other 44% variation in quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria. In addition, Table 4.8b presents the overall significance of the model which indicate that human capital development and data literacy skills have significant influence on quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria ($F(2, 123) = 80.694$, $p < 0.05$).

Also, Table 4.8c shows that for the combined influence on the quality of cloud computing services provided, at 95% level of confidence, if all other factor are constant, a unit

change in human capital development will lead to 0.412 increase in the quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria (B = 0.412, $p < 0.05$). Likewise, for the combined influence on the quality of cloud computing services provided, given that all other factors remain constant at 95% level of confidence, a unit change in data literacy skills will lead to 0.555 increase in the quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria (B = 0.555, $p < 0.05$). Therefore, on the strength of the results of the regression analysis, we reject the null hypothesis three which states that there is no combined significant influence of human capital development and data literacy skills on quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria.

4.4 Discussion of Findings

This section discusses the findings of this study in relation to past studies. Research findings are discussed and organized according to earlier stated hypothesis and in relation with past studies.

Hypothesis one examined the influence of human capital development on quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria revealed that human capital development has a significant influence on quality of cloud computing services provided by administrators under investigation. Conceptually, scholars pointed out that Human capital development presupposes investments, activities and processes that produce cloud computing knowledge, skills, and abilities[1]. Any effort

to increase human knowledge, enhance skills, productivity and stimulate resourcefulness of individuals is an effort on human capital development. Human capital development is a process of increasing human skill, ability and knowledge in the use of cloud computing applications for increase in productivity and stimulate resourcefulness of trainees. The process should be systematic to the extent that there should be a plan for which previous activities will provide support for upcoming activities while facilitating the attainment of set goals. The process should be sustainable since the product (human capital) must make desired and enduring impact on the organization or society.

Studies have attempted to explore the "6+1" HRMS structure in conjunction with cloud computing technology to build the HRM cloud service platform2. The "6" structure of HRM implementation involves six layers, including Page Layer (which collects data), Page Control (which controls the standardization and integrity of the collected data), Professional Algorithm Layer (which processes data), Logic Layer (which controls adding, inquiring, deleting, and modifying of data), Data Table Definition Layer (which specifies the fields, field control conditions, and field properties for each data table of the database), and Database Layer (which establishes the connection between the database and the professional algorithm layer The "+1" stands for the sub-working platform to implement the cloud-based HRM service characteristics. All aspects of HRM company are covered by the cloud service platform, which offers services to manage everyday tasks as well as job management, recruitment, HR planning, training, salary, careers, and labor relations. The research showed that the proposed platform is highly extensible, efficient, and Pay-as-you-go with no regional restrictions. The study revealed that the

difficulties facing the HRMS cloud service platform are cloud security, network issues, and a lack of platform developers.

An empirical a study to identify the Taiwanese cloud development's impact on human resources needs was presented[3]. With the help of 20 companies, they conducted the analysis using quantitative and qualitative approaches in order to offer a thorough picture of the evolution of cloud HR. The results showed that (1) employers prefer to hire people with experience rather than recent graduates due to the high cost of HR development, and (2) the turnover rate of cloud-related professionals has increased among competitive firms, thus increasing the cost required for retaining experienced personnel and educating new hires, (3) the HR industry is lacking talent for creating cloud computing-related software architecture. (4) most businesses lack middle managers with knowledge of cloud services and emerging application trends. (5) Businesses want HR professionals with experience in evaluating big data and cloud applications.

A scholar By polling 96 students at a Romanian institution, researchers examined the TAM framework-based elements that influence the adoption of cloud computing in higher education4. Findings showed that the elements are important for improving faculty members' and students' awareness of cloud computing adoption. There is, however, little explanation and no practical benefit. Another exploratory study using the Technology Organization Environment (TOE) paradigm was done to determine the elements that influence Saudi Arabia's higher education institutions' adoption of cloud computing[5]. Complexity, relative advantage, and data problems were assessed by statistical analysis, and the findings demonstrated their importance. Although the study's authors improved

our understanding of the elements influencing cloud computing adoption, they left out the effects of bandwidth and reliability.

A scholar conducted a survey to examine the data demonstrating the use of cloud computing in the educational sector 6. The literature review contained a total of 27 studies. The study's findings showed that there isn't much research on cloud computing's use in educational settings. Providing IT assistance for instructional activities is difficult for higher education institutions. Therefore, institutions of higher learning must take into account the opportunities provided by cloud computing. A researcher came up with a cloud computing architecture for institutions of higher learning that includes cloud computing deployment models, services models, and user domains as a solution. A plan for switching from the conventional system to cloud computing was also outlined. Although the suggested architecture boosts efficiency and agility, it hasn't yet been tested. Software as a Service (SaaS) is the most popular cloud computing service model that affects the educational industry[7]. So, a researcher investigated if SaaS is a practical choice for South African higher education institutions. Undergraduate students were questioned about utilizing Office 365 as a SaaS. Findings showed that utilizing Office 365 has various benefits, including program installation, updating, and maintenance. Office 365 also helps universities save money and have easier access to resources, which is helpful. But there are alternative options besides Office 365 that offer all the same functionality but at a lower price[8].

The findings of hypothesis two found support in prior empirical studies. Examining Quality of cloud computing service to optimize their services, cloud providers must use

specific criteria of service[9]. In order to achieve different trade-offs, the paper applied two optimization techniques on a few Quality of cloud computing service objectives. Q-aware, or quality of service-based cloud resource provisioning, is suggested. In the project, Quality of cloud computing service was thought to be a crucial component in the supply of resources by cloud providers, who therefore presented a Quality of cloud computing service metric-based approach for workload analysis. A comprehensive mapping analysis of quality of service methodologies in cloud computing is suggested. To increase trust in the cloud, it is important to appropriately handle the issue of service quality in cloud computing. The report examined various Quality of cloud computing service methodologies to identify areas that should receive greater attention and made recommendations for the way forward. Quality of service approaches in cloud computing: A systematic mapping study is proposed. Quality of cloud computing service is an issue that must be addressed properly to enhance trust in the cloud. The paper analyzed several Quality of cloud computing service approaches to determine the area of more focus and suggested the way forward.

Quality of cloud computing service survey in Software Defined Networking (SDN) is proposed[10]. Numerous options were put out in terms of Quality of cloud computing service. Relevant surveys were conducted at a variety of locations for Quality of cloud computing service, showcasing difficulties and insights. A proposed service-oriented architecture for the mobile cloud handoff procedure is safe and supports quality of service. The paper's main subject: Regarding concerns with energy and handoff, the quality of cloud computing services. The study suggests a four-layer paradigm for cloud computing service quality and energy efficiency in mobile Cloud computing while a

researcher concentrated on virtual machine provisioning based on analytical performance and Quality of cloud computing service in cloud computing environments, virtualization on the cloud is examined. It was concluded that among other factors, workload, virtualization, and application monitoring have the most effects on cloud performance. Lastly, a technique for assessing workload adjustments in applications to improve Quality of cloud computing service was presented.

The following was highlighted as the impact of ICT on students: the use of ICT had equipped them with skills to search for information and this had helped them gain more knowledge of some of the things they study in many subjects, increasing their confidence in making contributions during class discussions, helped in understanding abstract ideas and concepts[11]. As ICT is used as a tool for students to discover learning topics, solve problems, and provide solutions to the problems in the learning process. ICT makes knowledge acquisition more accessible, and concepts in learning areas are understood while engaging students in the application of ICT. Students are now more frequently engaged in the meaningful use of computers.

A scholar explored the use of Information and Communication Technology used by medical students. They found 77% of the respondents were of the opinion that ICT should be included in their syllabus[12]. Nearly all respondents expressed their desire to have a computer lab in their college. One hundred respondents out of 128 opined that medical education is not effective without ICT based resources and services. ICT has also enabled learning through multiple intelligence as ICT has introduced learning through simulation games; this enables active learning through all senses. Effective use of

different information communication technologies has become imperative for students in learning environments. The utilization of modern ICT facilities can make students, teachers' and administrators retrieve their required information within a short period. They can access and disseminate electronic information like e-books, news, e-journals which can advance teaching and learning process at all levels of education. Effective utilization of ICT resources can help facilitate good communication within and outside any organization. There must be a good communication mechanism among teachers', students' and school administrators' within and outside the school for goals achievement at all levels of education.

The findings of hypothesis three found support in prior empirical studies. A study investigated Data literacy for improving governmental performance: A competence-based approach and multidimensional operationalization[13]. The findings indicate that data literacy has a direct positive impact on internal performance. Making employees data literate thus improves the effectiveness of governmental bodies. This is in line with previous studies which found similar results in the private sector[14]. In addition, a scholar has noted that human capital is a source not only to motivate workers and boost up their commitment but also to create expenditure and eventually pave a way for the generation of new knowledge for the economy and society in general[15]. A scholar states that digital competency clearly involves more than knowing how to use devices and applications which is intricately connected with skills to communicate with ICT, as well as information skills[16]. Sensible and healthy use of ICT requires particular knowledge and attitudes regarding legal and ethical aspects, privacy and security, as well as understanding the role of ICT in society and a balanced attitude towards technology. In

this educational landscape, extending and improving digital competence of the workforce is an area that needs to be given more attention. Digital tools are merely tools that can be used in a variety of ways. What matters more is how these digital tools are applied and utilized. Therefore, it is a given fact that ability of knowing how to find reliable information or the so-called information skills, over the tons of digital contents on-hand is one important competency that workforce need to acquire.

The findings of this study equally aligned with the Human Capital Theory. According to the generally accepted value of human capital theory, improving organizational performance depends on employees' skill, knowledge, and aptitude as a fundamental principle of value creation. Employees are viewed as an asset and should be developed and integrated with multidimensional technology, according to the human capital idea. However, the paradigm for human capital has changed from one that was activity-based (focusing on a particular measurement, input emphasis, preparation for routine tasks, etc.). By putting more emphasis on the bottom line than top-down management, the shift to a result-based paradigm (focus on result and total performance such as business impact, cost-benefit analysis, output focus, and performance effectiveness) has an impact on human capital policy and practice. Therefore, on the strength of the support found in prior conceptual, empirical and theoretical studies with this present study's result, the study can conclude that human capital development and data literacy skills have significant influence on quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria.

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Chapter five

Conclusion

This chapter presents and discusses the summary of findings, conclusions and provides useful recommendations, contributions to knowledge and suggestions for further studies.

5.1 Summary of Findings

The study has reviewed various literature on human capital development, data literacy skills and cloud computing services provided by administrators. The study has five chapters so as to achieve its main objective. The chapter one presented the background to the study which confirms that in higher education, cloud computing services are commonly used to provide the means for students to collaborate and interact in a distributed learning space. It has the potential to support advanced teaching and learning processes in the sense of developing one's collaborative social interaction during the problem-solving activities, reflections, knowledge sharing, and idea generation.

Literature review of existing relevant studies to the concept of human capital development, data literacy skills and cloud computing services was done. Human capital development was measured by personal talent of administrators, Behaviour of administrators, Effort of administrators and Time used by administrators. Data literacy skills was measured by data application, data collection, data evaluation, data management and conceptual framework of data. Cloud computing services was measured with reliability, tangibility, responsiveness, assurance and empathy of the services.

The study reviewed three different theories which are of specific relevance to the study. These are; Human capital theory, data literacy skills and competency model and

SERVQUAL theory. This study is anchored on Human Capital Theory. According to the generally accepted value of human capital theory, improving organizational performance depends on employees' skill, knowledge, and aptitude as a fundamental principle of value creation. Employees are viewed as an asset and should be developed and integrated with multidimensional technology, according to the human capital idea. However, the paradigm shift in human capital from an activity-based (focus on a particular measurement, input focus, preparing for routine tasks, etc.) to a result-based (focus on result and total performance such as business impact, cost-benefit analysis, output focus, and performance effectiveness) paradigm has an impact on human capital policy and practice by focusing more on the bottom line than top-down management.

A descriptive survey research design was employed to determine the influence of human capital development and data literacy skills on quality of cloud computing services among administrators in ICT polytechnic in Ogun State, Nigeria. The population was one hundred and eighty-six (186) administrative Staff in ICT polytechnic, Ogun State, Nigeria. The population sample consists of Gateway (ICT) Polytechnic, Saapade, Abraham Adesanya (ICT) Polytechnic, Ijebu – Igbo, D.S. Adegbenro (ICT) Polytechnic, Itori and Gateway (ICT) Polytechnic, Igbesa. Total enumeration was adopted due to the population size. Self-developed questionnaires were used to elicit response from 186 respondents of the sampled polytechnics who returned the questionnaires. Statistical Package for the Social Sciences version 25 was used to test the hypotheses at 0.05 level of significance to determine the rejection or acceptance of the null hypotheses. The results were extensively discussed in the context of the current research as well as extant literature.

The findings of the study can be summarized as follows:

1. Quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria is high, however, there is room for improvement.
2. Human capital development among administrators of ICT Polytechnics, Ogun State, Nigeria is high. Hence, administrators should not relent in continuous development as it leads to increases in innovation, social well-being, equality, increased productivity, improved rates of participation, all of which contribute to economic growth.
3. The level of data literacy skills used by administrators in ICT Polytechnic, Ogun State, Nigeria is moderately high.
4. Human capital development has a moderate and positive correlation with quality of cloud computing services provided by administrators in ICT Polytechnic, Ogun State, Nigeria.
5. Data literacy skill has a significant influence on quality of cloud computing services used by administrators in ICT Polytechnic, Ogun State, Nigeria
6. Human capital development and data literacy skills have significant influence on quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria.

5.2 Conclusion

The study examined the influence of human capital development and data literacy skills on quality of cloud computing service provided by administrators in ICT Polytechnics, Ogun State, Nigeria. Cloud computing is a distributed computing technology that provides dynamically scalable computing resources including storage, computation power, and applications delivered as a service over the Internet. Cloud computing

practices may also provide easier and quicker information retrieval and discovery, allow students to store and share documents, offer a more flexible environment by enabling ubiquitous access to materials, and facilitate interaction among students and instructors. Human capital development is a process of increasing human skill, ability and knowledge in the use of cloud computing applications for increase in productivity and stimulate resourcefulness of trainees. The process should be systematic to the extent that there should be a plan for which previous activities will provide support for upcoming activities while facilitating the attainment of set goals. Also, in addition to specific abilities, data literacy is characterized by habits of mind such as curiosity, resiliency, and ethical decision making. Data literacy is becoming more commonplace in formal and informal and is addressed in various efforts to reform undergraduate science education. Data literacy is the ability to collect, manage, evaluate and apply data, in a critical manner. Based on the empirical findings, this study concluded that there is statistically significant influence of human capital development and data literacy skills on quality of cloud computing service provided by administrators in ICT Polytechnic, Ogun State, Nigeria.

5.3 Recommendations

Every research endeavor aims to expand existing knowledge and advance society as a whole by generating new knowledge that will either enhance the present situation or offer fresh approaches to problem-solving. Based on the findings in this study, the following recommendations were made:

1. Administrators in ICT Polytechnic should continually improve on the quality of cloud computing services provided.

2. The management should ensure that human capital development plans should be SMART that is: been specific, measurable, achievable, realistic and timely.

3. The management should ensure that systematic training be adopted. Identification of training needs should be done more professionally.

4. Administrators in ICT Polytechnics under study should improve on their data literacy skills.

5.4 Contribution to Knowledge

This study offers significant contribution to literature conceptually, theoretically and empirically.

Conceptually, the study focused on identifying gaps in literature pertaining Human capital development, data literacy skills and quality of cloud computing service. The conceptual framework of this study equally offers conceptual contribution as it was constructed by the researcher to analyze the gaps identified in literature. The model also can be adapted to suite future studies.

From the theoretical stand point the Human Capital Theory was strengthened. The value of human capital theory is widely accepted in order to increase organizational performance, so an organization relies on employees' skill, knowledge, ability as a key concept of value creation. Human capital concept is seen that employees are an asset and should be developed, and integrated with multi-dimensional technology. This study results are in concomitance with these theoretical perspectives.

Empirically, the study is able to add to recent literature on the interaction between human capital development, data literacy skills and quality of cloud computing service. Though, studies on Human capital development, data literacy skills and cloud computing abound in developed economy context, however, empirical study from developing countries like Nigeria seems to be few in this regard. By the findings of the three null hypotheses examined, the study becomes a basis for reference for future study. Moreover, the study provides findings which scholars can use to buttress the empirical submissions in their study. Overall, these above-mentioned points lay emphasis on the fact that this study offers significant contribution to knowledge and has practical implication for the management and administrators in ICT Polytechnics, Ogun State, Nigeria that were investigated.

5.5 Suggestion for Further Research

The researcher makes the following suggestions for further or future research:

1. Future researchers interested in the dependent variable (quality of cloud computing services) is advised to look at other measures from another theory aside SERVQUAL.
2. The inclusion of larger sample size is necessary to give room for more generalization and conclusion.
3. Samples sizes involving administrators in public polytechnics of other geographical regions in Nigeria can be used for better generalization of findings.

4. Further studies in the area of Human Capital Development, Data literacy skills and cloud computing services can as well be carried out in Private tertiary institutions so as to be able to extend the knowledge gained from this work to other institutions in the State.
5. A comparative study with Private and Federal Universities in Nigeria may be considered in the nearest future.
6. A cross-sectional survey design was used in the course of this study, and this means evidence of causality cannot be established hence, further study may consider longitudinal survey design to explain causality over a long period of time.
7. This study employed primary data for collection of information from the selected public universities, same study may be carried out in the nearest future using secondary data for collection of information.

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APPENDICES

Appendix I

QUESTIONNAIRE

Lead City University, Ibadan
Faculty of Communication and Information Sciences (FCIS)
Department of Information Management

Human Capital Development and Data Literacy Skills and Cloud Computing Service among Administrators in ICT Polytechnics in Ogun State, Nigeria'

Dear Respondent,

I am a Master's Student of the above institution and department, carrying out research on the above topic. The study is purely an academic exercise and your assistance is needed for the completion of the work by filling the questionnaire. All information given will be treated with strict confidence.

Kindly return the questionnaire at your earliest convienient time after the answering the below listed questions by ticking the one you consider most appropriate among the alternatives.

Thank you for your cooperation

AKAH OLUSEYI AUGUSTINA
LCU/PG/00181

Appendix II

Study Population , Sample Size and Location

Population of the Study

S/N	Name of Institution	Number in each Institution
1.	Gateway (ICT) Polytechnic, Saapade	47
2.	Abraham Adesanya (ICT) Polytechnics, Ijebu - Igbo	43
3.	D.S. Adegbenro (ICT) Polytechnics, Itori	40
4.	Gateway (ICT) Polytechnics, Igbesa	56
	Total	**186**

Source: Ogun State Ministry of Education (2022).

SECTION A: Demographic Information

1. Gender: Male ( ), Female ( )
2. Age: 20 – 25 ( ), 26 – 30 ( ), 31 – 35 ( ), 36 – 40 ( ), 41-45 ( ), 46 and above ( )
3. Educational Level: ND ( ) Bachelor's degree/HND ( ) Master's degree ( ) Ph.D ( )
4. Years of experience: 5 – 10 ( ), 11 – 15 ( ), 16 – 20 ( ), 21 – 25 ( ), 26 - 30 (

SECTION B: Quality of Cloud Computing Service among Administrators of ICT Polytechnic in Ogun State.

The statement in this section concerns cloud computing service among administrators in ICT Polytechnic, Ogun State. Using the four-point Likert scale provided below: Please tick the appropriate choice that indicates your opinion on level of use of cloud computing practices

Very High (VH) =4, High (H) = 3, Low (L) = 2, Very Low (VL) = 1

S/N	**To what extent are these factors exhibited in the school administration?**	**VH 4**	**H 3**	**L 2**	**VL 1**
	Reliability				
1	The school administrators ensure accuracy of students' information at all times	4	3	2	1
2	Students receive services required whenever they visit / seek the attention of the administrators	4	3	2	1
3	Students depend on administrators' service on their information at all times	4	3	2	1
	Tangibility				
1	There is facility put in place for proper storage of students' record	4	3	2	1
2	There are no instances of records misplacement	4	3	2	1
3	There are computers put in place to enhance easy retrieval of students' records	4	3	2	1
	Responsiveness				

1	The students feel satisfied whenever they have encounter with the school administrators	4	3	2	1
2	The students are given prompt attention by the administrators and they are willing to attend to them at all time	4	3	2	1
3	The students are always willing to meet the administrators whenever they have complaint about their results	4	3	2	1
	Assurance				
1	Students' records are secured in the custody of the school administrators				
2	Students do not have reasons to complain about any missing records in their file				
3	Students records are always intact and accessible on request				
	Empathy				
1	Students receive prompt attention any time they need the services of the administrators				
2	Students are not delayed on the queue				
3	Students are impressed with the services of the administrators				

SECTION C: Human Capital Development

The statement in this section is concerned with human capital development as observed in among administrators in ICT Polytechnic, Ogun State. Using the four-point Likert scale provided below: Please tick the appropriate choice that indicates your opinion on human capital development.

S/N		VH 4	H 3	L 2	VL 1
	Personal Talent				
1	My career are originated throu8gh my skills and talent	4	3	2	1
2	I prefer my career choice to be in – demand	4	3	2	1
3	The job in the future affects my career preference	4	3	2	1
	Behaviour of Administrators				
1	The students are involved in establishing the rules and procedures	4	3	2	1
2	I protect the school information technology equipment	4	3	2	1
3	I always arrive at work early	4	3	2	1
	Effort of Administrators				
1	Test reports are reported in a reasonable amount of time	4	3	2	1
2	There is effectiveness of administrative effort on academic decision	4	3	2	1
3	My progress report is always encouraging	4	3	2	1
	Time				

1	I am always on point thinking about improvement and setting long range goals				
2	I do not dodge relatively complex tasks				
3	I do not procrastinate since I work better under pressure				

SECTION D: Data Literacy Skills

The statement in this section is concerned with data literacy skills as observed in among administrators in ICT Polytechnic, Ogun State. Using the four-point Likert scale provided below: Please tick the appropriate choice that indicates your opinion on data literacy skills.

S/N	**In what way has the data literacy skills influence your work?**	**VH 4**	**H 3**	**L 2**	**VL 1**
	Data Collection				
1	Existing policies ensuring the collection of institutional research output	4	3	2	1
2	The management provide guidance on files organization e.g. creating system to instantly access administrative records	4	3	2	1
3	Analysis of retrieved data are done by administrators	4	3	2	1
	Data Evaluation				
1	No data is miss because it is necessary to have overview of students/academic needs	4	3	2	1

2	Data are structured to achieve the administrative objectives of the management	4	3	2	1
3	Data is easily accessed due to availability of database	4	3	2	1
	Data Management				
1	Existing capacity building programmes to develop skills to handle data management	4	3	2	1
2	There is data management plans (e.g. providing templates or examples)	4	3	2	1
3	Existing capacity building programmes to develop skills to handle data management	4	3	2	1
	Data Application				
1	I am satisfied with the quality of service in data transfer				
2	I am satisfied with the support data when completing my task				
3	I am satisfied with the quality of service in the connection available				

Bio – data

A. Personal Data

Name: Oluseyi Augustina AKAH

Address: House 3, Comfort Pure Water Lane, By RSS Opposite Power, Transmission Station, Sagamu, Ogun State

Status:	Married
Telephone numbers:	08029195781, 08035800853
Date/ Place of Birth:	13th November, 1972 / Lagos Mainland
Email:	seyiakah@gmail.com

B. Educational Background

Lead City University, Ibadan (Msc. OIM)	2021 - 2023
Lead City University, Ibadan (PGD OIM)	2017 - 2020
Lagos state Polytechnic, Isolo, Lagos.(HND, Sec. Admin)	1999 - 2002
IBR Computer School, Maryland, Lagos (Cert. Data)	1998
Federal Polytechnic, Ado-Ekiti (ND, Sec. Admin)	1993 - 1996
Marywood Grammar School, Lagos (SSCE)	1986 - 1991

C. Qualification Obtained with Dates

Post Graduate Degree (OIM)	2023
Post Graduate Diploma (OIM)	2020
Higher National Diploma (Secretarial Studies)	2002
Certificate in Data Processing	1998
National Diploma (Secretarial Studies)	1993
Senior Secondary School Certificate	1986
First School Leaving Certificate	

D. Work Experience

Gateway (ICT) Polytechnic, Saapade	2015 till Date
Chosen Generation Books Limited	2004 - 2011
Havilah Datacomms Limited	2003 - 2004
Soyebo & Company	1999 - 2000
Pinnacle Commercial Bank Ltd	1997 – 1999
Lasaco Assurance Plc (Industrial Attachment)	1996 – 1997

E. Conference/Papers Presented With Dates

- Gateway (ICT) Polytechnic Saapade 1st National Conference (2015)
- Academic Staff Union of Polytechnics (ASUP) Zone, Oluyole (2016)
- Gateway (ICT) Polytechnic Saapade, Centre for Applied Research, Technology and Innovation. (2017)
- Advanced Digital Appreciation Programme for Tertiary Institutions

(ADAPTI) (2017)

- Gateway (ICT) Polytechnic, (Entrepreneurship Education for Self-Employment: The Role of Facilitators (2018)
- SMBS - SPSS and Management Science: The Roadmap to Data Integrity in the 21st Century (2019)
- Gateway (ICT) Polytechnics, (United Arab Emirate) (2019)
- Women in STEM Revamping TVET for Economic Growth and sustainable Development. 1st National Conference of WITED, Ilaro Chapter (2019)
- Gateway (ICT) Polytechnic (Conflicts Management and Resolution in the Administration of Tertiary Education System) (2019)
- Gateway (ICT) Polytechnic (Functional Security Training) (2020)
- Gateway (ICT) Polytechnic, (Keeping Financial Records and Resolution in the Administrative of Tertiary Education system) (2021)
- Gateway (ICT) Polytechnic, (Building Nigeria Skills and Innovations) Liprorich Consult (2021)
- National Institute of Office Administrators and Information Managers (NIOAIM) Repositioning Office Administrator and Information Management for Innovation, Sustainable Development And Global Competitiveness. (2022)
- Gateway (ICT) Polytechnic Saapade 1st SMBS Combined International Conference for Digital Business Innovation and Financial Inclusion (2023)

F. Publications

- Akah O. A. (2016) People's Communication Skills *(Textbook) Vol 1*
- Adekunle O. A., Salami O. A., Akah O. A., Idowu-Agida E.O., (2017) Empirical Investigation of Strategic Planning as A Predicate Corporate Growth And Survival *International Journal Of Economics, Commerce nd Management Vol V. Issue 9*
- Salami O. A., Akah O. A., (2019) Application of Public relation Skills: Tools For Enhancing Secretarial Practice in Ogun State. *1st National Conference of WITED, Ilaro Chapter Journal*
- Salami O. A., Akah O. A., Ogunyemi A. A. (2020) Communication as an Indispensable Tool for Effective Administration in an Organisation. A Study of Gateway (ICT) Polytechnic, Saapade. *African Scholar Journal of Humanities and Social Sciences (JHSS-6)*
- Adenekan T. E., Akah O. A., (2023) Human Capital Development and Electronic Records Management on Information Security Capability of ICT.*Vol 3., Issue 2. International Journal of Office Administration and Information Management (IJOAIM)*
- Tunmibi S., Akah O. A., (2023) Human Capital Development and Data Literacy Skills of Cloud computing Services among Administrators in (ICT)

Polytechnics in Ogun State. *International Journal of Academic Research and Innovation (IJARI)Vol 3, Issue 1 Pg11-16*

G. Membership Of Professional Bodies

- Member: Chartered Institute of Local Government and Public Administration
- Professional Member: National Institutes of Office Administrators and Information Managers (NIOAIM)

H. References

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Mrs. Abosede Alabi bosealabi11@gmail.com +234 802 316 5915

Signature _____ Date _____

The University Compliance Certification

This is to certify that this Thesis written by **Oluseyi Augustina AKAH** with Matriculation No. **LCU/PG/001812** in the Department of Office Information Management of the Faculty of Communication and Information Sciences, Lead City University, Ibadan is in full compliance with the approved University format and style.

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Signature **Date**