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Leveraging Artificial Intelligence to Improve Sustainable Cloud Computing: A Study on the Transition from Physical to Virtual Machines

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Abstract: The aim of this study is to explores the potential of leveraging artificial intelligence (AI) to enhance the sustainability of cloud computing infrastructures. Many areas of IT are profoundly affected by the increasingly popular idea of using cloud computing to replace physical hardware like servers. There is great potential for cloud computing to enhance factory operations in terms of both efficiency and quality. According to the review of relevant literature, there is a dearth of studies examining the early phases of cloud computing implementation in Jordan's industrial sector. The use of cloud computing that may cause Jordanian firms to switch out their physical machines for virtual ones. Consequently, a framework for adoption is proposed by the study. The framework was created and tested by three Jordanian businesses working together. Qualitative data for the interpretive approach came from a variety of sources, including two focus groups, semi-structured interviews, and annual reports. Important issues that may influence cloud adoption which highlighted in the paper. Important considerations include virtualization technologies, cost, price, physical resource availability, team knowledge, and migration procedure.

Keywords: Cloud technology, Information quality, manufacturing, Virtual machines.

1 Introduction

The term "cloud" as it pertains to computer systems. According to this research, "cloud computing" is storing, processing, and managing data over the internet on virtual servers hosted by a third party rather than using one's own personal computers. When compared to conventional in-house computing, the cloud's business model is different. The core concept of this business model is the pay-per-use model [2]. So, much like other utilities like water and electricity, cloud computing services follow a billing cycle. However, the term "cloud computing" is still lacking a consensus meaning.

According to scholars like Sultan [3], the business model of cloud computing is out of date. Throughout the 1930s, IBM offered services which allowed consumers to input massive amounts of data for processing. Here, IBM processed the necessary that was based on a number of service tiers. By using distributed technologies and parallel computers, the virtualization method used in cloud computing expedites scheduling and optimizes operations [4]. Everyone agrees that cloud computing is the single most important thing that has improved IT in terms of reaction time, processing speed, payment security, and service quality [5]. Customers are guaranteed by cloud computing service providers that they will only be charged for the resources that they really utilize [34].

It is critical to reevaluate the ROI in this case because of the company's size and the application's unique qualities [7]. In the end, using cloud computing requires a fully operational internet connection. Because of this, cloud computing may not be the best option for businesses that often send huge amounts of data, particularly in underdeveloped nations with poor IT infrastructure and slow internet connections [33].

In leveraging artificial intelligence to improve sustainable cloud computing during the transition of physical to virtual, several mathematical models and equations are essential. Resource utilization prediction can be modeled using an autoregressive approach, represented by

$$\widehat{R_{t+1}} = \phi_0 + \sum_{i=1}^{p} \phi_i R_{t-i} \tag{1}$$

where $\widehat{R_{t+1}}$ is the predicted resource utilization at time$(t+1)$, and (ϕ_i) are autoregressive parameters. Energy consumption is modeled as $(E = \alpha R + \beta)$, linking energy consumption (E) with resource utilization (R) through

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coefficients(α) and (β). Load balancing optimization aims to minimize the maximum load across virtual machines, formulated as

$$\min \max_{i} L_i \tag{2}$$

subject to

$$\sum_i L_i \leq \sum_i C_i \tag{3}$$

where (L_i) *and* (C_i) represent the load and capacity of virtual machine (i).

Neural network training for predicting resource utilization minimizes the mean squared error between predicted and actual values, described by

$$(\min \theta \frac{1}{N} \sum_{t=1}^{N} \left(\widehat{R_t} - R_t\right)^2) \tag{4}$$

with (θ) representing the model parameters. A sustainability metric can be defined as

$$(S = \frac{\sum_i C_i - \sum_i L_i}{\sum_i E_i}) \tag{5}$$

combining capacity, load, and energy consumption to evaluate the overall sustainability of the cloud infrastructure. Reinforcement learning can be used to optimize resource allocation with a reward function (R) defined as

$$(R = \sum_{t=1}^{T} \left(\lambda_1 \cdot \frac{C_t - L_t}{C_t} - \lambda_2 \cdot \frac{E_t}{C_t}\right)) \tag{6}$$

where (λ_1) and (λ_2) are weighting factors. Support Vector Machines (SVM) for classification of load patterns can be modeled by

$$(\min w, b, \xi \frac{1}{2} w^T w + C \sum_{i=1}^{N} \xi_i) \tag{7}$$

subject to

$$(y_i(w^T \phi(x_i) + b) \geq 1 - \xi_i, \xi_i \geq 0) \tag{8}$$

A Markov Decision Process (MDP) can model state transitions with

$$V(s) = \max_a (R(s,a) + \gamma \sum_{s'} P(s'|s,a) V(s')) \tag{9}$$

where $(V(s))$ is the value function of state (s), $(R(s,a))$ is the reward for action (a), (γ) is the discount factor, and $(P(s'|s,a))$is the transition probability. The Long Short-Term Memory (LSTM) network can be used for resource prediction, given by

$$(\widehat{R_{t+1}} = \mathrm{LSTM}(R_t, R_{t-1}, \ldots, R_{t-n}; \theta)) \tag{10}$$

For more complex predictions, the Autoregressive Integrated Moving Average (ARIMA) model can be applied as

$$(\widehat{R_{t+1}} = \phi_0 + \sum_{i=1}^{p} \phi_i R_{t-i} + \sum_{j=1}^{q} \theta_j \epsilon_{t-j} + d\Delta R_{t-1}) \tag{11}$$

The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model can also be used, represented by

$$(\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i \epsilon_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2) \tag{12}$$

To address power consumption, the Power Usage Effectiveness (PUE) metric can be calculated as

$$(\mathrm{PUE} = \frac{\text{Total Facility Energy}}{\text{IT Equipment Energy}}) \tag{13}$$

The optimization of virtual machine allocation can use integer programming, defined by

$$(\min \sum_{i=1}^{N} \sum_{j=1}^{M} c_{ij} x_{ij}) \tag{14}$$

subject to

$$(\sum_{j=1}^{M} x_{ij} = 1) \tag{15}$$

And

$$(\sum_{i=1}^{N} x_{ij} \leq 1) \tag{16}$$

where (c_{ij}) is the cost of assigning task (i) to machine(j), and (x_{ij}) are binary variables. The queueing theory can model service rates with ($\lambda/\mu < 1$) where (λ) is the arrival rate and (μ) is the service rate. The use of Kalman filters for state estimation in dynamic systems can be represented by

$$(\widehat{x_k} = A\widehat{x_{k-1}} + Bu_k + K(z_k - H\widehat{x_{k-1}})) \quad (17)$$

The application of Bayesian networks for probabilistic inference in resource management can be modeled by

$$(P(X_i|\text{parents}(X_i)) = \prod_j P\left(X_j\middle|\text{parents}(X_j)\right)) \quad (18)$$

The use of fuzzy logic for decision-making can be represented by

$$(\mu_A(x) = \frac{1}{1+\left(\frac{x-c}{a}\right)^{2b}}) \quad (19)$$

The integration of genetic algorithms for optimization can be modeled by $(\text{Select}\left(\text{CrossOver}\left(\text{Mutate}(P)\right)\right))$ where (P) is the population. The application of principal component analysis (PCA) for dimensionality reduction can be represented by ($Z = X\,W$) where (Z) are the principal components, (X) is the data matrix, and (W) is the weight matrix. Finally, the use of deep reinforcement learning can be represented by the Bellman equation,

$$(Q(s,a) = R(s,a) + \gamma \max_{a'} Q\,(s',a')) \quad (20)$$

where ($Q(s,a)$) is the action-value function. These equations collectively support the integration of AI to enhance the efficiency and sustainability of cloud computing systems, addressing current challenges and providing a roadmap for future advancements.

This paper attempts to give a framework for the adoption of cloud computing in Jordan, while also examining the significant concerns that may impact its acceptance. The outcomes of this research indicate that the use of cloud technology in Jordanian manufacturing is not fully optimized. The consumption level may be determined by several factors. Factors such as the level of familiarity with cloud computing may have an influence.

The technical personnel may have seen cloud technology as unnecessary due to their expectation of no advantages and their prediction of increased expenditures associated with its implementation. Hence, the objectives of this study are to:

1. What are the primary benefits and limitations of using cloud computing in manufacturers located in Jordan?
2. What are the effective strategies for Jordanian manufacturers to adopt cloud computing technology?
3. What are the main procedures related in transitioning Jordanian to digital technology?
4. Which elements might potentially impact the use of cloud computing through Jordanian environment?

2 Quantifying sustainable cloud technology to improve performance

1. Resource Utilization Matrix

This three-level matrix (U) represents the utilization of various resources (CPU, memory, storage) by physical and virtual machines across different time periods.

$$[U = \begin{bmatrix} \begin{bmatrix} u_{111} & u_{112} & \cdots & u_{11n} \\ u_{121} & u_{122} & \cdots & u_{12n} \\ \vdots & \vdots & \ddots & \vdots \\ u_{1m1} & u_{1m2} & \cdots & u_{1mn} \end{bmatrix} \\ \begin{bmatrix} u_{211} & u_{212} & \cdots & u_{21n} \\ u_{221} & u_{222} & \cdots & u_{22n} \\ \vdots & \vdots & \ddots & \vdots \\ u_{2m1} & u_{2m2} & \cdots & u_{2mn} \end{bmatrix} \\ \vdots \\ \begin{bmatrix} u_{t11} & u_{t12} & \cdots & u_{t1n} \\ u_{t21} & u_{t22} & \cdots & u_{t2n} \\ \vdots & \vdots & \ddots & \vdots \\ u_{tm1} & u_{tm2} & \cdots & u_{tmn} \end{bmatrix} \end{bmatrix}] \quad (21)$$

Where $(u\_\{ijk\})$ denotes the utilization of resource (k) by machine (j) at time (i).

1. Average Utilization: To calculate the average utilization of resource (k) over all

Where total Utilization: Total utilization of all resources at time (i):

$$[\bar{u}_k = \frac{1}{t \cdot m} \sum_{i=1}^{t} \sum_{j=1}^{m} u_{ijk}][U_i = \sum_{j=1}^{m} \sum_{k=1}^{n} u_{ijk}] \quad (22)$$

2. Energy Consumption Array

This three-level array (E) captures the energy consumption of physical and virtual machines across different time periods.

$$[E = \begin{bmatrix} [e_{111} \quad e_{112} \quad \cdots \quad e_{11n}] \\ [e_{211} \quad e_{212} \quad \cdots \quad e_{21n}] \\ \vdots \\ [e_{t11} \quad e_{t12} \quad \cdots \quad e_{t1n}] \end{bmatrix}] \quad (23)$$

Where $(\mathrm{e_{ijk}})$ represents the energy consumption of machine (j) at time (i).

Total Energy Consumption: Total energy consumption over all machines and time periods:

$$[E_{\text{total}} = \sum_{i=1}^{t} \sum_{j=1}^{m} e_{ijk}][\bar{e}_j = \frac{1}{t} \sum_{i=1}^{t} e_{ijk}] \quad (24)$$

3. Performance Metrics Array

This three-level array (P) contains performance metrics (such as throughput, latency) for evaluating the efficiency of machines across different time periods.

$$[P = \begin{bmatrix} \begin{bmatrix} p_{111} & p_{112} & \cdots & p_{11k} \\ p_{121} & p_{122} & \cdots & p_{12k} \\ \vdots & \vdots & \ddots & \vdots \\ p_{1n1} & p_{1n2} & \cdots & p_{1nk} \end{bmatrix} \\ \begin{bmatrix} p_{211} & p_{212} & \cdots & p_{21k} \\ p_{221} & p_{222} & \cdots & p_{22k} \\ \vdots & \vdots & \ddots & \vdots \\ p_{2n1} & p_{2n2} & \cdots & p_{2nk} \end{bmatrix} \\ \vdots \\ \begin{bmatrix} p_{t11} & p_{t12} & \cdots & p_{t1k} \\ p_{t21} & p_{t22} & \cdots & p_{t2k} \\ \vdots & \vdots & \ddots & \vdots \\ p_{tn1} & p_{tn2} & \cdots & p_{tnk} \end{bmatrix} \end{bmatrix}] \quad (25)$$

Where $(\mathrm{p_{ijk}})$ denotes the performance metric (k) for machine (j) at time (i).

Average Performance: Average performance for metric (k) over all machines and time periods:

$$[\bar{p}_k = \frac{1}{t \cdot m} \sum_{i=1}^{t} \sum_{j=1}^{m} p_{ijk}][P_{ik} = \sum_{j=1}^{m} p_{ijk}] \quad (26)$$

4. Cost Efficiency Array

This three-level array (C) helps in assessing the cost efficiency of transitioning from physical to virtual machines across different time periods.

$$[C = \begin{bmatrix} [c_{111} & c_{112} & \cdots & c_{11n}] \\ [c_{211} & c_{212} & \cdots & c_{21n}] \\ & \vdots & & \\ [c_{t11} & c_{t12} & \cdots & c_{t1n}] \end{bmatrix}] \quad (27)$$

Where (c_{ijk}) represents the cost efficiency of machine (j) at time (i).

Total Cost Efficiency: Total cost efficiency over all machines and time periods:

$$[C_{\text{total}} = \sum_{i=1}^{t} \sum_{j=1}^{m} c_{ijk}][\bar{c}_j = \frac{1}{t} \sum_{i=1}^{t} c_{ijk}] \quad (28)$$

3 Cloud Computing Models

Looking at a cloud deployment model is crucial for understanding cloud resource aggregation. To start, there's the widely available and inexpensive public cloud computing, which offers basic features with little room for personalization. The intrinsic openness of the public cloud, which draws a varied spectrum of end users, may make it less secure than previous models. The low-priced public cloud computing is a benefit of this model. Companies in Jordan may utilize this cloud architecture for data and activities that aren't mission critical. On the other hand, there is a large trade-off between the private approach's high level of secrecy and its high price tag.

It was common for a single company to own and operate this approach, which gave them more say over the underlying infrastructure of their cloud. With a private cloud, just one company and its clients have access. This paradigm is thus being considered for very sensitive data by Jordanian industrial entities. When public and private clouds, among others, are combined, the result is the hybrid cloud model. It is possible to get additional benefits and avoid constraints in this specific situation by combining two techniques. For instance, we may tighten security for sensitive information while lowering disclosure costs for data that isn't really needed.

Organizations in fields including education, healthcare, industry, and technology may pool their resources via the community cloud. By joining a community cloud, users are able to tap into the tried-and-true infrastructure that has served other organizations well. Additionally, people in close quarters may be able to save money and feel safer if they pool their resources.

Cloud Computing Service Models

In cloud computing, the phrase "x-as-a-service" describes a popular model for reusing cloud services [11]. Many different kinds of software, hardware, and support are available from cloud service providers. These all-inclusive services are beneficial for Jordanian manufacturers. However, there are a lot of things that need to be considered when choosing a provider, so it could be difficult. In addition, there is a limit on how much customization is available with most cloud services [10]. Since the decision to replace in-house servers with cloud services will be made during the confirmation phase, it is highly suggested to keep both the present in-house technology and the new cloud computing service running simultaneously. Also, try out the demo version; it might give you a good idea of what the transfer procedure is like [6].

Cloud computing service models have been categorized as Infrastructure-as-a-Service, Platform-as-a-Service, and Application-as-a-Service, according to many research findings [12-14].

IaaS (Infrastructure-as-a-Service)

An organization must spend several thousand dollars on a physical server if it chooses the time-consuming and expensive method of managing its IT infrastructure internally. A full server room, individual servers, or even individual components may be rented or purchased via Infrastructure as a Service (IaaS) and accessible remotely from any place in the globe [15-16]. In order to move away from traditional server hardware. Infrastructure as a service also has the benefit of being scalable, which means that the quantity of cloud computing resources may be readily increased or decreased to meet particular needs. By raising the number of CPUs and RAM with a single command, this feature makes it easier to improve the overall performance of the virtual server. Users of cloud services have the option to allocate fewer CPUs and/or less memory, which reduces virtual performance [4]. But security and privacy are still IaaS's top priorities. Even when using Infrastructure as a Service (IaaS) would be the most cost-effective option, a company that requires a lot of bandwidth and data transfers would be better off buying its own physical assets.

Platform-as-a-Service (PaaS)

Platform as a Service (PaaS) offers a pre-configured framework for developing applications, enabling clients to efficiently and expeditiously build on top of a robust infrastructure [17]. Additionally, it enables users to design and develop their own customized interface and applications. Furthermore, PaaS offers the essential resources for creating and launching a web application with a very high level of security and little risk [8]. Examples of such resources include technical instruments, a code library, and recycled software [18]. PaaS offers the advantage of cost and time savings, without the need for any upfront investment [15]. The pay-as-you-go model provides small and medium-sized enterprises with a remarkable chance to rival large corporations that possess almost limitless resources [7]. Consequently, new enterprises will avoid the expensive requirements of computer equipment and software. An inherent limitation of PaaS is that developers may get strongly attached to a certain platform, hence complicating the process of transitioning to a different cloud service provider [10].

SaaS (Software-as-a-Service), Software as a Service (SaaS)

"Software as a service" (SaaS) describes applications that are made to be accessible over the web and a user's web browser [19]. Google Drive, Docs, Maps, and OneDrive are among the several popular cloud storage services that heavily use this service [20]. Software as a service has several benefits. One big benefit of SaaS is that it gets rid of software installation altogether by letting users run programs in a web browser [10]. Your SaaS account may be accessed from a wide variety of devices, including mobile phones, desktop PCs, and tablets [21]. Finally, the most attractive aspect of SaaS is its affordable price. This feature is quite useful for those who use cloud services. Only when a user makes use of an app do they incur costs under pay-as-you-go pricing [22]. Using SaaS comes with a number of negatives. When it comes to cloud computing, users are most concerned about potential security and privacy issues [23]. A further disadvantage is that clients have little control over the settings of the cloud applications, while the service provider has unlimited control. There is no need for SaaS providers to inform users in advance when sending software updates, upgrades, or replacements [11]. This is why, going forward, Jordanian companies should seriously explore SaaS. If that's the case, SaaS may not be enough to meet the specific needs of Jordan's industrial industry.

Database-as-a-Service, also known as DaaS

Customers may build, store, and administer databases on the cloud in an efficient and cost-effective manner. Strict hardware requirements are sometimes imposed by physical server-based databases [10]. Database as a service, on the other hand, lets users or administrators access to a database in the cloud from any device and anywhere [24]. The use of DaaS is not without its pros and cons, just like any other service [8]. As part of the services they provide, the providers are in charge of database upkeep, backups, recoveries, and overall administration. But one thing to think about is that a lot of bandwidth is needed when data is being transferred from one place to another. Plus, customers may become too attached to their cloud service provider, making it difficult for them to transfer. Data migration from an on-premises database to one hosted by a cloud provider may be an expensive ordeal under typical conditions [25-27].

What Is Virtualization?

The term "virtualization" refers to the method of simulating an actual system, server, or network resource in a computer. It entails decoupling hardware from software, which improves system utilization and gives administrators greater leeway when allocating and managing resources. The capabilities of computers and the programs that go along with them have grown at an exponential rate in the last several years. Several software entities may exist within a single hardware instance at the same time; this is the basic idea of virtualization [15]. Cloud computing relies on virtualization as its foundational basis [4]. Using cloud computing, Jordanian manufacturers may ditch their old hardware and switch to virtual machines. As a result, data centers may one day supersede their physical counterparts. A number of components make up virtualization; they include storage, operating systems, platforms, and networks [30-32].

4 Research Methodology

According to Zikmund [28], research methodology includes everything from the study strategy to the tools, procedures, fieldwork, and analysis that are used. A qualitative approach based on interpretation was applied in this investigation. Inductive research, of which this study is a subset, seeks to provide novel answers to real-world problems rather than evaluate existing theories. In order to arrive at their findings, the research team used a combination of primary and secondary sources, including in-depth interviews and focus groups. Nvivo was used by the researcher to analyze the data. We used Miles and Huberman's [29] recommended three-step process for qualitative analysis for the third stage. Data condensing and presentation came next, followed by validation and confirmation of results.

Using a semi-structured interview format, the researcher chose to gather data from fifteen participants. Due to many participants' absences and subsequent notifications of regret, only nine of the fifteen interviews were able to proceed as planned. In this study, nine semi-structured interviews and two focus groups were carried out at three separate Jordanian manufacturing locations to compile data for this qualitative research project using an interpretative approach. Table 1 presents the participants' code from this study. Whereas table 2 shows focus groups taking part in this study.

Table 1: Participant's codes, job description, and years of experience.

Participant code	Job description	Years of experience
A1	Senior technical support engineer	8
A2	Technical support engineer	2
A3	IT manager	11
A4	Chief technical office	14
A5	IT manager	10
A6	General manager	18
A7	Financial executive officer	14
A8	Senior technical engineer	9
A9	IT manager	13

Table 2: Focus group taking part in this study.

Group #	Department	Number of participants
1	Information system	6
2	Information system and management	7

5 Main results and suggested framework

This information was compiled using nine interviews, two focus groups, and secondary data, which were conducted across three distinct manufacturing sites. Data was collected from February 2018 to May of the same year. Owing to the participants' additional commitments, some interviews had to be postponed or canceled. The data analysis process outlined by Miles and Hagerman [29] was adhered to, which consists of three stages. This included the processes of data condensation, data display, and drawing/verifying conclusions. The primary discovery was graphically presented using Microsoft Visio.

The main factors influencing the shift from physical to virtual machines in Jordanian manufacturing facilities include the availability and cost of virtualization solutions, the existing hardware infrastructure, the responsible party for the migration process, and other related considerations. The researchers discovered that almost all of the respondents said that there was a lack of resources to support the implementation of the virtualization technique in their production facilities. Hence, it would be advantageous to provide a prospective solution that may assist in this process.

As to A2's comment, the primary challenge they are facing is initiating the Virtualization process. Therefore, it is crucial that any proposed strategy be simple and straightforward to implement. The primary objective is to streamline processes. We lack the time to dedicate to intricate structures or methodologies. We conducted a comprehensive examination of the previous solutions. Unfortunately, we had to repeatedly abandon the transfer earlier due to the challenging nature of implementing the solution.

Another writer (A7) said, "Although I lack expertise in IT, it is crucial for me to have assurance that any proposed solution can be easily calculated." As part of my job, I am responsible for evaluating the financial feasibility of new projects in all departments. Therefore, I kindly request that you and our technical team provide a concise and unambiguous response about the costs related to our information systems. In addition, I recommend using the current technology available to us.

Considering the A7 standpoint, the expenses and benefits associated with the virtualization procedure would be a significant factor to consider. Such deliberation may play a vital role in deciding the adoption of cloud computing. The determination of the return on investment (ROI) for this approach is necessary, particularly for the near and intermediate time periods. A responder (A5) pointed out that the initial expenditure in cloud computing would be minimal due to the absence of physical servers. The cost of upkeep, however, is a concern for me.

(A4) Insufficient availability of skilled technical personnel poses an additional obstacle during the transition to cloud computing. According to secondary sources, the researcher's conclusion was that the majority of technical engineers had less than three years of expertise. One member in the first focus group said, "I possess less than three years of experience and virtually no familiarity with cloud computing technologies and virtualization." I am concerned about the stability of my employment if my firm implements virtualization. I envision that relocating to another country would entail a challenging process in its entirety. The method you propose may seem theoretically simple, but its execution will be quite challenging. (Specific interest) Several factors may impact the virtualization process, as shown. Reasons for proposing a virtualization solution may include the possible cost reduction, the simplicity of deployment, and the availability of established virtualization frameworks. The main hurdles would be the current physical resources, the accessibility of professional teams, and the process of relocating.

The data was examined by the researcher, who then formulated a guideline advocating the use of cloud to virtual machines. Participants assist in formulating the proposed remedy. At one of the selected production facilities, A1, A3, and A9 played a crucial role in designing and validating this strategy. The suggested resolution has been constructed and verified inside the server room of the firm. The researcher recorded the probable solution stages on a notebook and then illustrated them using Microsoft Visio. The ultimate solution has undergone extensive testing conducted by researchers and participants, including a thorough verification process in the server room. Upon making some modifications to the proposed solution, the participants subsequently verified its effectiveness. Figure 1illustrates the recommended method for virtualization.

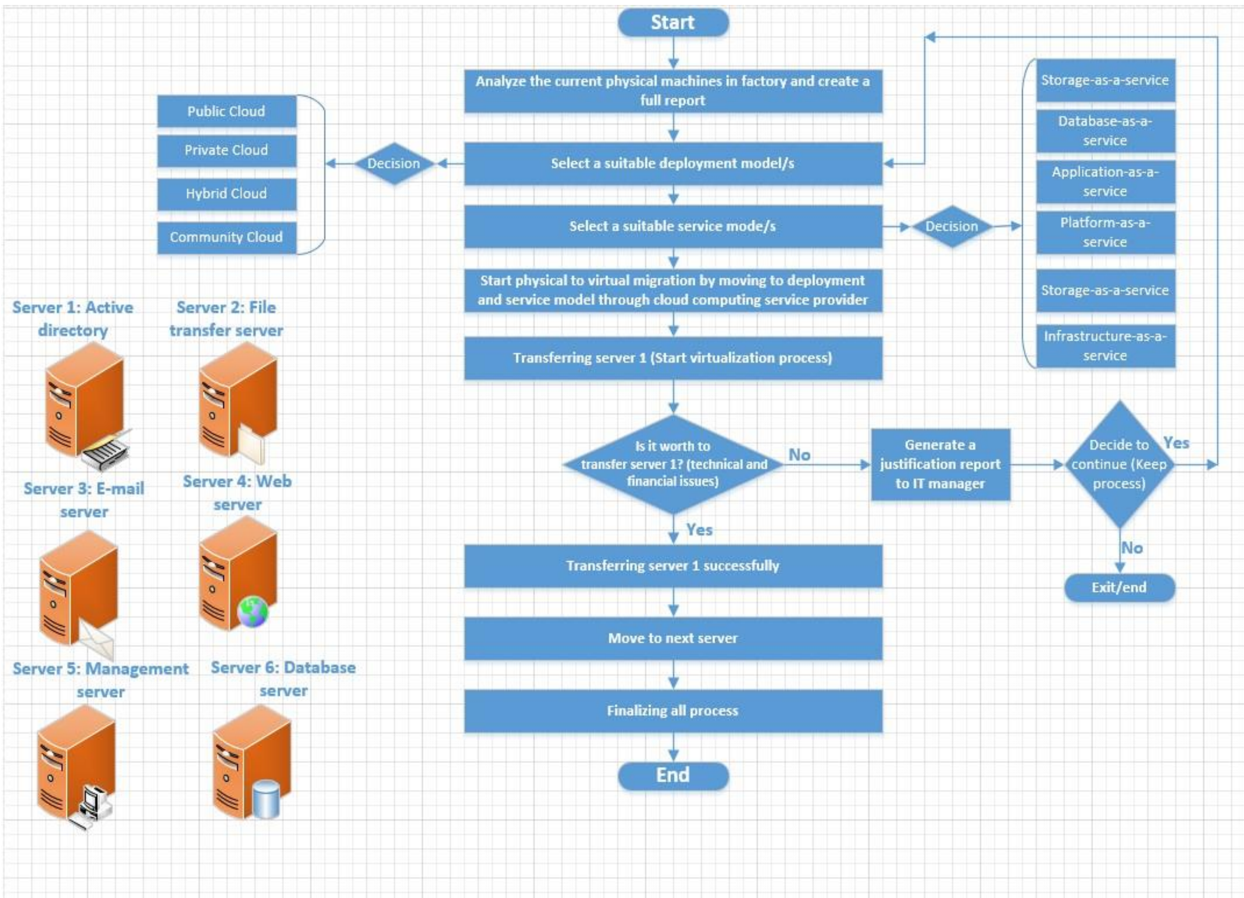

Fig. 1: Proposed framework for transferring data from physical to virtual machines

As depicted in Figure 1, the initial phase of virtualization involved examining the tangible assets such as servers. There are 6 main servers that make up the foundation of the departments, and here they are: The user accounts of the Company are stored on the active directory server. A server that facilitates the transfer and storage of large files, commonly employed for communication purposes across multiple devices. Exchange servers, commonly referred to as mail servers, primarily cater to email services and accounts. It was anticipated that the web server hosting the company website would provide support for all website visits.

SQL and the management server housed all the crucial files, documents, and databases pertaining to employees and clients. Information on each server's CPU, RAM, H.D.D., and other crucial metrics is presented in comprehensive reports. The statistics also show how much data is kept on each server and how crucial it is. The next step is to choose the optimal deployment plan and service model. After that, you'll need to use some specialist software to begin migrating the original server to a virtual cloud server. The final step is to use all of the reports, both financial and technical, for the handoff. In the last stage, the IT manager decides whether to finish the server’s conversion, start over from the second step, or cancel the deal completely.

6 Conclusion

A growing number of businesses across several sectors have begun using cloud computing services in recent years. The underutilization of cloud computing in Jordanian industrial facilities was the primary emphasis of this research. When thinking about cloud virtualization, many aspects, both good and bad, have been considered. The data collection that was used for the study was heavily influenced by four factories, participants interviewers, and focus groups, and annual reports. The procedures described by Miles and Huberman should be followed while assessing data. Data compression, data presentation, and result verification are all part of these duties. Lastly, a data-based proposal to improve virtualization was presented by the study. The author's and the subjects' technique has been verified by this investigation.

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