Educational Administration: Theory and Practice
2023, 29(2), 539-546
ISSN: 2148-2403
https://kuey.net/

Research Article

Leverage Ai To Improve Cloud Modernization

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Citation: Ramasankar Molleti, (2023) Leverage Ai To Improve Cloud Modernization, *Educational Administration: Theory and Practice*, 29*(2)* 539-546
Doi: 10.53555/kuey.v29i2.7212

ARTICLE INFO

ABSTRACT

Cloud modernization is critical to any organization planning to increase IT agility as well as optimization of costs in the current technological disruption. This paper discusses AI as a service in the context of cloud modernization, specifically of infrastructure, capacity, and operation. AI technologies used in industries include predictive analytics, resource allocation, and secure connectivity reducing potential problems before they occur and therefore cutting instances of production interruptions. Nonetheless, there are some barriers when it comes to implementing AI in the process of cloud modernization. This work splits cloud modernization into approaches such as replatforming, refactoring, and containerization depending on apps' requirements and business goals. It also presents and analyzes the place of AI in strengthening the safety of clusters, data stock, and automatization benefits in numerous fields such as healthcare, retail, finance, and manufacturing. Certain hindrances such as data elaborate and the dearth of experts in the field of AI should not deter organizations from incorporating AI in cloud strategies because of the advantages such as cost reduction, flexibility, and even increased efficiency. With proper negation of challenges by accurate model governance, adequate data management, and proper security, organizations can promote competitive benefits and excellent operation in the fully developed digital economy through artificial intelligence's cloud modernization.

Keywords: Cloud modernization, Artificial Intelligence, Multi-cloud, Leveraging AI

1. Introduction

1.1. Background

Cloud modernization plays a crucial role in any organization that seeks to develop a flexible, efficient, and cost-optimizing structure for their IT environment in today's digital context. Organizations today are shifting their IT environments from purchasing software, hardware, and infrastructure to having cloud solutions, and hence managing these new environments gets complicated. AI reveals itself as an enabler in this regard as it involves features like predictive analytics, favorable resource control, and secure connection in the current setting [1]. AI makes it possible to make decisions before problems occur or when the problems are at early stages, hence reducing chances of production delays. There are some issues that arise during the integration of AI into cloud modernization such as ethical issues, technical difficulties and legal issues.

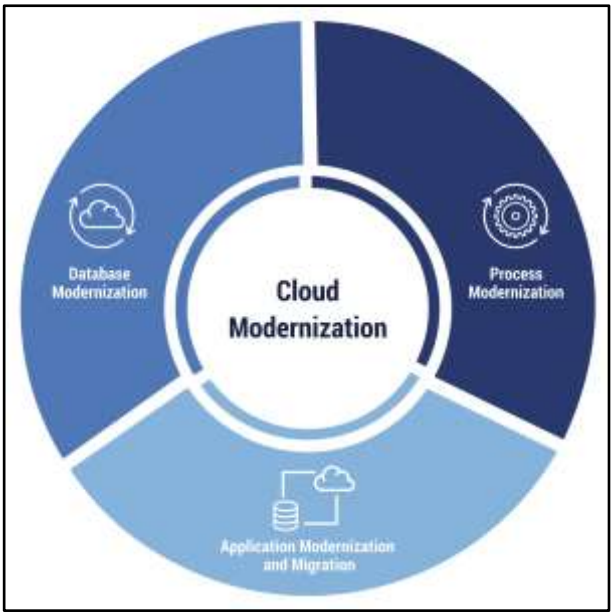

Figure 1: Cloud modernization
(Source: https://www.tierpoint.com)

1.2. Aim and scope

This research study primarily aims to discuss the insights about AI into modernization strategies of cloud to identify advantages that this technology has on infrastructure optimization, scalability and improvement. It will look into the different AI solutions and how they can be useful in improving the cloud structures, as well as examples of real-life adoption across industries. This issue is also elucidated in the paper in the forms of ethical issues, as well as technical issues in an attempt to explain concrete solutions to the question of adoption barriers.

2. Understanding of Cloud Modernization

2.1. Types of cloud modernization

Replatforming: Replatforming is the process of migrating an application from one platform to a new platform of the cloud with little changes. It fits apps that require simple values of the cloud without being resource intensive or complex.

Refactoring: Refactoring in this case entails restructuring applications to leverage characteristics such as containers and serverless architecture [2]. It transforms on-premises applications to the cloud so as to give them exposure to cloud's great scale and effectiveness.

Rearchitecting: The Re-architecture strategy is designed to rebuild the application from the ground up and make the applications cloud first. They feature heavily in organizations with many old and large applications that need optimization for cloud properties and elasticity.

Containerization: Containerization packs applications and their dependencies into deployable units, optimizes resource utilization, and is more flexible in terms of deployment on the clouds compared to Virtual Machines and generally has less overhead.

Serverless Computing: Serverless computing allows working with applications requiring IT capacities on a daily basis but not requiring constant occupancy of the servers [3]. It is efficient in the use of resources and cheaper making it most preferable for applications that are simple, used only during an event and do not frequently run.

Multi-cloud: Multi-cloud is a practice that involves using an application or multiple applications on different cloud service providers or different cloud models. It guarantees high availability, helps avoid vendor lock-in, and correctly distribute the resources for the applications with high performance priorities

2.2. Strategies of Cloud modernization

Assessing workloads: Documenting applications and data inventory is important in determining the current state and business value of the organization's application and data assets. When an organization is modernizing its system, through stratification of the workloads, the organization is able to properly deploy resources required in the business processes [4]. This means that not only is it important to look at technical characteristics and specificities of dependencies between deliverables, which contribute to the complexity of integration, but also to evaluate the project's strategic objectives and user requirements.

Choosing right cloud strategy: It is very crucial to choose appropriate and right cloud strategy that would be best suited in order to prioritizing the workloads and efficiency of functions of cloud computing. Replatforming, refactoring, or rearchitecting may be chosen if an application has certain characteristics and

business requirements the assessment has indicated. Examples from practice show how the discussed strategies are implemented in practice and for what objectives: reaching large-scale capacities, reducing costs, increasing performance.

Developing governance model for cloud: Cloud governance is a critical component in the cloud as it pertains to the management of the resources that are already hosted on cloud. This includes developing guidelines and standards for resource allocation and security, user permissions and the organization's adherence to legal standards. Thus, clear assignment of duties within the organizational structure avails accountability among the different organizational units, and applying security measures helps to protect valuable information from such threats.

Automate deployment and management: Embracing the DevOps model, as well as using deployment automation tools make the management and deployment of the cloud applications efficient [5]. Incorporation of DevOps facilitates communication between the development and operations departments, to enhance the speed of application provision as well as updates. Automation also helps minimize human mistakes when working on cloud resources and also increases the capability in terms of capacity, among other benefits of operations on cloud resources.

Continuously monitoring: Cloud infrastructures on the other hand are dynamic, that is there is need to constantly monitor and tune up for efficiency and most importantly cost. Effective use of Monitoring tools can give the real-time Performance of Applications and Resources along with the proper security status of the cloud assets [6]. Therefore, any chance of evaluating and adjusting the cloud resources range based on the usage frequency or other business trends will lead to improved return on investment and organizational flexibility.

2.3. Difference between Cloud modernization and Cloud migration

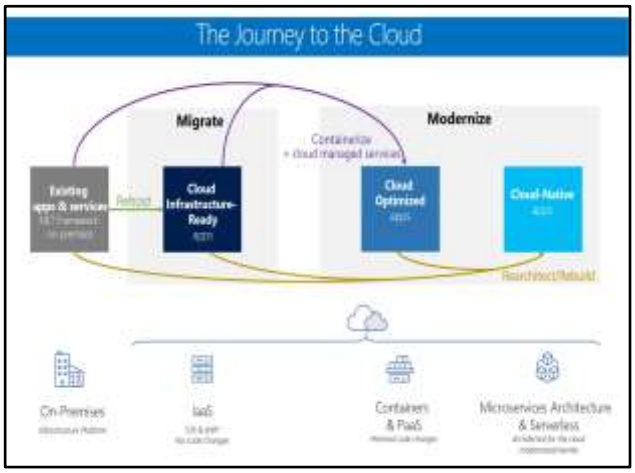

Figure 2: Cloud modernization and Cloud migration
(Source: https://intelequia.com)

Table 1: Cloud modernization vs. migration

Aspect	Cloud Migration	Cloud Modernization
Scope	Lower levels of turning applications to cloud	Rewriting and refactoring of the applications for cloud heterogeneity and cloud features
Effort	Requires less effort centered mostly on having applications running in the cloud	Substantial work concerning redeployment and recasting of applications to align with the necessary cloud paradigms
Timeframe	Shorter timeframe for completion	It takes a longer time due to the breakdown and layout of the extensive modifications that need to be done and the time spent in testing if needed.
Resources	Uses less resource and skills	Requires much more resources than the regular models, including skilled employees for creation and quality assurance.
Cost	Lower initial cost	Higher initial cost predominantly due to the high degree of re-work that needs to be done
Benefits	The new offerings' costs will be lower and the difference in value-per-what-you-pay will provide a sense of what is available in the cloud and prompt investigation of further opportunities [7].	Long-term advantages such as better optimal tissue for large amounts of data, and the possibility of new features.

Complexity	Lower complexity due to minimal changes	Greater cost due to restructuring of application architecture and utilizing application functions
Risk	Reduced vulnerability to inter-group conflict at the time of migration.	Higher risk since it is associated with changes involving multiple issues that demand alterations in the application's behavior.

3. The Role of fusion AI in Cloud Modernization

3.1. AI and Cloud integrating in business

With the application of AI and cloud computing, the two basically changed the way companies adapt the data and make their entertainment to grow. Cloud platforms offer the physical resources required for data processing and AI models training and learning while freeing the customers from the physical hardware management. It also makes it possible for businesses to address different forms of artificial intelligence workloads that may range from a pilot to a scale form adequately and affordably [8]. With AI services available at affordable prices, every organization could easily create powerful tools for themselves and work with others across the globe without having to worry about building complex private systems, but rather, concentrating on creating perfect AI applications.

3.2. AI and ML

Most cloud providers offer AI, ML as services that have leveled the playing field in making advanced technologies that are the domain of some organizations' data science specialists. Enterprises can incorporate intelligent functionalities through using in-build AI models and AI development tools. This accessibility does not only boost the rate of innovation but it also helps to increase the rates of automation and customization in handling the clients [9]. They facilitate the management of the organization hence enabling the business to act against competition, control and improve its products and services continually.

Figure 3: Fusion AI in Cloud Modernization
(Source: https://www.zucisystems.com)

3.3. Self-Management Cloud with AI

The integration of AI in IT infrastructure also makes it easier to handle workloads and at the same time addresses automation of tasks that are repetitive. It is believed that as the advances of artificial intelligence technologies shift towards the future, the importance of AI in private and public Cloud will increase. This evolution involves AI in monitoring and handling cases, making it possible for systems to self-diagnose and self-correct and routine work [10]. In many cases, when analytical capabilities are well developed, AI can develop significantly self-sufficient processes. In addition, with the aid of AI, IT departments effectively manage other restraining factors of cloud computing, while at the same time being able to work on more value-added processes.

3.4. Elevating Security

Machine learning also contributes to cloud security by correlating the cloud data behaviors and detecting threats in real-time. Techniques of machine learning enhance the capability of threat detection and response, enhancing cloud security against new cyber threats. The providers of clouds employ the help of AI in implementing security updates, patch management and enforcing multiple layers of security to provide optimal protection for the data and meet the strict international standards [11]. This timely approach in cybersecurity enhances the defenses of cloud structures and data from cyber-attacks and return.

3.5. Enhanced Data Management

Self-service tools in the cloud optimize the handling of the information flow by themselves classifying, ingesting and analyzing big data. These tools facilitate the extraction of insights from large volumes of data quickly and efficiently, thus improving the decision-making processes in organizations' value chain. From financial services to detect fraud patterns or in the retail sector for developing distinctive marketing strategies,

data management in cloud through artificial intelligence helps the organizations to take the data advantage and achieve operational excellence and far better customer satisfaction.

4. Benefits of AI in Cloud Computing

4.1. Cost Efficiency

In the PCI DSS or payment card industry, when deploying the AI capabilities, a pay-as-you-go model of cloud computing relieves businesses the burden of huge up-front investments in an on premise according to the infrastructure's utilization. With regards to AI customized services, the cloud enables one to provision on-demand fully managed computing resources such as the GPUs used in machine learning model training and scalable storage for big data [12]. Furthermore, the incorporation of AI also fast tracks many of the repetitive and time-consuming processes which, in turn, would decrease the operational costs significantly and the human efforts are better utilized for more constructive works.

4.2. Scalability and agility

At first, cloud computing resources are available on demand and combine it with the learning ability of AI, which results in extreme suitability. The enterprises can quickly scale up and scale down the cloud resources to accommodate the varying AI workloads without worrying about large investments. This flexibility is critical in responding to changes in the organization's requirements for capability [13]. Moreover, cloud supported AI applications are easily upgradable that means the advancement can be done on the go without affecting the main business line so as to keep the operation continuity and quickness.

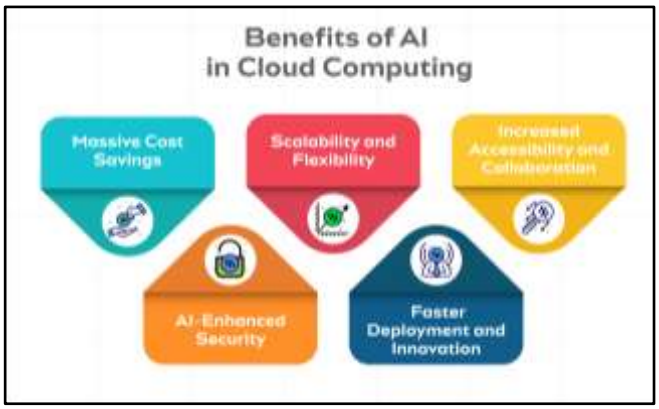

Figure 4: Benefits of AI in Cloud Computing
(Source: https://insights.daffodilsw.com)

4.3. Increased Productivity

AI technologies help to automate those processes that take a lot of time and do not require human skills, therefore letting employees concentrate on the crucial activities that positively influence the organization's performance. For example, customer questions are handled by chatbots, business intelligence is generated from data by AI systems, and RPA controls business processes [14]. It fosters the conditions for innovation and business growth where AI's effectiveness increases the level of output and efficiency of the operations.

4.4. Robust data management

Cloud has near limitless processing abilities and storage rooms and when backed with sophisticated artificial intelligence these make for a good reference architecture for making effective use of data. Thus, using natural language processing AI can analyze text, audio, or video and derive critical information from it. Such information enables the right forecasting and right guidance since it reveals patterns and relationships not easily recognizable in datasets or big data.

4.5. Accessibility

Cloud computing technologies enable the AI deployment for every company and accessing the hardware resources for computing and storage, ready-made AI applications, or AI development platforms. Thus, employees can securely use required data and tools for building and running AI applications as well as for collaboration without requiring specialized premises on their site [14]. And also, due to the high availability, the simplicity of the interface and interfaces, the presence of elements of conversational search and tools for visual data analysis, the use of AI in the cloud is also present in technical consultants, not only data analysts.

4.6. Intelligent Automation

They help in improving Cloud business by automating various functions or tasks, processes, and definitive Work Flows, whereas human interferences are thoroughly reduced or eliminated. The automatism frees up

employees' time to perform tasks that require their strategic, creative, and high-level skills, improving the efficiency and creativity of the organization [15]. Moreover, programs in cloud based on Artificial Intelligence also have self-correction and self-improvement characteristics that improve operational performance daily with minimal supervision.

5. Industries leveraging AI in Cloud Computing

Figure 5: Industries leveraging AI in Cloud Computing
(Source: https://www.researchgate.net)

5.1. Healthcare

AI in the cloud helps improve accuracy in disease detection and bring this radical change in medical imaging at a very fast pace. Sophisticated programs enable the detection of abnormalities undetectable by the human eye, which improves diagnostic accuracy and patients' overall well-being. In the same way, the self-serve and virtual healthcare assistant use cloud solutions to deliver diagnosis and treatment advice depending on a client's history of illnesses. It seems to guarantee access to quality health practices to anyone by providing timely inputs and help not tied to health facilities.

5.2. Retail Industry

In the retail sector, the technology of cloud-based artificial intelligence is developing innovations in customer relations and the number of processes. Round the clock clients' support services by intelligent chatbot based on Artificial intelligence guaranties accessibility and satisfaction of the services. Adapting cloud AI for recommendation engines advances sales since it initially evaluates the customer's wants and then offers products to match the customer's expectations [16]. Also, computer vision that involves the use of Artificial Intelligence results in the use of automatic checkouts and the management of stock, increasing the performance as well as strengthening security systems.

5.3. Financial Services

Through better customer services and business analytics cloud computing and AI are reshaping financial services. The application of NLP and sentiment analysis in the cloud helps in real-time fraud detection and more personalized examination of the customers' quality of services. Robo-advisory is also enabled and empowered by AI, cloud services to provide customized investment consultancy and portfolio management without the need of human intervention. Additionally, cloud analytics enable fin-tech firms to build credit risk models based on big data to provide financial services to more individuals.

5.4. Manufacturing

Converging AI solutions with cloud in manufacturing are enhancing quality assurance, predictive maintenance, and supply chain. Automated control of quality is critical in the production process since it means that fewer goods have to be rejected, and more importantly they fit the required quality standard. Smart maintenance which is driven by Artificial Intelligence foresees the breakdown of equipment and prevents their failures hence enhancing efficiency [16]. In the same way, when machine learning is used in supply chain analytics, supply chain, logistics, warehousing, and demand forecasting are improved hence giving manufacturers a competitive edge through efficiency.

6. Challenges and recommendation

6.1. Model Governance

One of the main issues that many organizations encounter is the difficulty in establishing the relevant know-how for the application of AI and ML solutions from within their own organizations, which takes a considerable amount of time and money. To this end, engaging cloud service providers and AI consulting firms who offer end-to- end AIaaS are strategic [17]. These partners include selecting what the AI strategies should be, training and implementation of models, and the continual running of models, all of which addresses the expertise issue and puts AI into operation at a fast pace and without detail of in-house resources.

6.2. Data Complexity

The importance of obtaining big data of good quality and free from noise, which is a constant process of data gathering, cleansing, and annotation, is crucial to develop accurate models of Artificial Intelligence. Processing is much easier with cloud-based data services since they present the data in one package and pre-process it for model building. Also, AutoML entails the automation of data preprocessing steps, and it optimizes the AI model development and deployment cycle.

6.3. Lack of AI expertise

Certainly, when enterprises try to expand their use of Artificial Intelligence, model management or model governance as it is also called becomes vital: it implies versioning, tracking, monitoring, identification of biases, and understanding. MLOps (Machine Learning Operations) frameworks in the cloud fulfill these demands at every stage of the model's lifetime [18]. This includes registry of models, metadata management, and CI/CD pipelines, monitoring tools, wherever it's feasible to maintain transparency, compliance, and operational readiness in AI.

6.4. Security Risks

Citing the AI models in the cloud brings with it risks such as loss of data, and manipulation of the trained models. Alleviating these risks calls for best security measures such as data encryption, rigid identity and access controls, validated code and perpetual security vigilance throughout AI business processes. Such measures enhance data credibility and security minimizing risks such as hacking, vandalism on AI models, and the database.

Conclusion

Therefore, AI-driven cloud modernization stands as a revolutionary process for today's organizations which seek to improve business capabilities of their IT environments in terms of flexibility, efficiency, and costs. Despite the challenges that include; data complexity, security risks, and difficulty in attaining expertise in AI, the use of AI in cloud strategies has made it easy to scale the business, improve productivity, and also develop appropriate approaches to handle data. With the help of AI solutions and cloud native technologies, it is possible to reach the efficiency and gain competitive advantage in business for organizations of various industries. Hence, directional improvements in AI technologies and partnerships with CSPs will catalyze the continued evolution of contemporary enterprises in terms of enhanced resilience and innovation capacity.

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