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THE CHALLENGES OF CLOUD TECHNOLOGY IMPLEMENTATION IN OIL COMPANIES

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Abstract: Given that data and information have become the most valuable assets of companies that can be efficiently and economically stored in the cloud infrastructure, there is great pressure on business entities to capitalize on this business and technological opportunity. There is a particular pressure on oil companies to find new ways to create a competitive advantage by using the opportunities offered by cloud-based businesses. This is primarily a result of the fact that the reorientation of business activities to this type of storage and integration of data and applications represents a major change in the business world, and the growth trend continues in all aspects of the business. This paper deals with the possibilities and challenges of applying cloud technology in oil companies operating in turbulent conditions caused by fluctuations in oil prices in the global market..

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1. Introduction

Cloud is a technology that already affects the way information technology infrastructure is managed, by both large and small energy companies. Although the technology itself is not new, advances in mobility, internet connections, and computer hardware have contributed to the commercial offering of information technology (IT) resources tailored to the needs of businesses of all sizes. The term cloud in the IT field has a large number of definitions, but it mainly refers to hardware and software that is located in a scalable environment and, at the same time, can serve the specific needs of a large number of businesses. Although the cloud is the center of data processing, this does not mean that it must cover every activity or function of the company. (Heisterberg & Verma, 2014)

Cloud computing services can be distributed differently within business models, depending on requirements. Accordingly, the basic types of cloud services are:

1. Infrastructure as a Service - Iaas
2. Platform as a Service - PaaS
3. Software as a Service - SaaS

IaaS allows the user to develop and run the software, which includes operating systems and applications. The user does not manage or control the basic cloud infrastructure, but has control over the storage and development of applications. PaaS gives the user the ability to place an application he has created on the cloud infrastructure. The user also does not manage or control the basic cloud infrastructure but has control over the developed applications and possibly the settings for the hosting environment of those applications. SaaS provides the user with the ability to use provider applications that run in the cloud infrastructure. In other words, here the complete application is offered to the user as a service on request. (Perrons & Hems, 2013)

Depending on the level of acceptable risk of the company's management and its IT philosophy, two types of cloud infrastructure can be chosen: public cloud and private cloud. The public cloud is an IT infrastructure managed outside the company's environment, mainly by a third party or provider, while the private cloud environment is under the supervision and management of the company itself.

Fluctuations in the price of oil on the world market, with periods of sharp decline. force oil and gas companies to transform their business models, all with the aim of reducing operating costs by increasing operational efficiency. In this context, we could say that cloud technology is more sophisticated, tested, and more secure than ever. This technology offers the competitive advantage that oil and gas companies need in order to optimize production and business. (Shelton, 2013)

Whether IT infrastructure is public or private, cloud services provide companies with numerous opportunities to advance their technology and business endeavors. The adoption of cloud technology will be one of the main IT trends, in addition to the Internet of Things, drones, intelligent equipment, and software for detecting gas leaks in the oil industry (Al-Mascati & Al-Badi, 2016). The benefit of cloud technology is faster detection of project value, as well as the development of new solutions that are flexible and more accessible. This technology eliminates most of the downtime that occurs in traditional non-cloud-based information systems and unequivocally saves time.

The main aim of the paper is to analyze the possibilities and challenges of applying cloud technology in oil companies. In the following text, we will explain in more detail the advantages and motives of the transition of oil companies to cloud technology, the areas of its application in oil companies and the challenges that these companies face in the process of transition to this technology.

2. Advantages and motives of oil companies' transition to cloud technology

2.1. General advantages of applying cloud technology

Many large companies have relocated their entire IT infrastructure to the cloud. Recognizing the possibility that such a transition can improve their business in every aspect, and especially by reducing costs and risks, even the most rigid sectors see the benefits of cloud technology. The appeal of the new technology lies in the fact that it provides companies with powerful analytical solutions available at all times, thus enabling individuals to always have an insight into their business activities and the company's business. Whereas business data is increasingly available on mobile devices, this option is especially important when it comes to marketing employees who must always be ready to respond immediately to the vast amount of information. (Lim, 2021)

The cloud as a technological solution has enabled the integration of information from sales and marketing, which allows better access to potential customers and new business opportunities. In recent years, the complexity of attracting potential buyers has increased, especially if we take into account the increasing number of digital options used for this purpose. In that sense, companies are more willing to spend their resources on new ways of attracting potential customers and automating the marketing process, especially on social networks. However, options are changing and evolving, so that all businesses (small and large companies) are directing their business towards cloud technology, which is a new challenge for marketing professionals. (Debashis, 2016)

One study (Tableau 2016) listed 10 business trends that indicate that business data stored in the cloud environment has become an area of competition among companies seeking to use consumer data analytics effectively. Data sources can be numerous, from the Internet of Things to social media, all of which have a great potential for marketing professionals. The Internet of Things is a network of physical devices connected by electronics, software, and sensors, which allows them to communicate with each other and exchange data. Another important business trend is competition in cloud services, which gives large cloud providers the opportunity to create strong partnerships with users of their services. With the growing number of networked consumers and the growing importance of searching the internet and social networks when making purchasing decisions, the traditional way of shopping is now under the auspices of the cloud environment, and partnership is the most efficient way to compete in the market. (Priyanka et al., 2021)

The benefits of cloud technology are the most important factors when deciding on the application of cloud technology in a company. Of the many benefits of using cloud technology, here are ten most commonly mentioned:

1. Reducing costs is perhaps the most important benefit of cloud technology. Every company, regardless of its organization and the size, strives to keep capital and operating costs to a minimum. When using cloud technology, there is certain cost flexibility, in the sense that you only pay as much as you use it. There is no invested capital, but only the payment of a monthly fee for the use of this service, but in accordance with the scope of use. It is a common misconception that only large companies can afford to use cloud technology, when, in fact, cloud services are extremely affordable for smaller companies.

2. Reliability means that cloud technology is much more reliable and consistent than self-management of IT infrastructure. Most cloud providers offer contracts that guarantee uninterrupted availability of services (24/7/365). Thanks to cloud technology, an organization that uses cloud services can also have a fast recovery mechanism. If a server downtime occurs, hosted applications and services can be easily moved to one of the available servers without major problems.

3. Simpler management is an advantage of cloud technology that allows better and simpler management of IT resources and the ability to maintain IT capacity through centralized administration. Updating and maintaining the IT infrastructure is eliminated because all resources are maintained by the service provider. A great benefit is the use of a simple web interface to access software, applications, and services, without the need to install some additional tools.

4. Large capacities for information storage are a great advantage because the cloud infrastructure provides almost unlimited capacities for this storage.

5. Automatic software integration in the cloud infrastructure means that cloud users do not need to make additional efforts to customize and integrate their applications as desired.

6. Sharing capabilities is a convenience that allows files and documentation to be shared or forwarded at any time.

7. Easy access to information builds on the previous advantage. Once users register in the cloud infrastructure, they can access information from anywhere there is an internet connection. This convenience allows users to overcome time zone and geographic location issues.

8. Easier customization of services helps cloud service providers to easily adjust their services (reduce or increase the volume of services) according to customer needs.

9. Quick tests, or various tools available using cloud technology, allow users to test a new product, application or feature.

10. Access from multiple devices is another advantage of cloud technology. The cloud environment is accessed not only from computer systems, but also through other options, such as tablets, netbooks, laptops, and mobile and smartphones. This not only increases efficiency but also improves the services provided to users. Requested accounts, documents and valuable files are just a click away.

Before the company's transition to cloud technology, its shortcomings should not be overlooked, which are shown in Table 1 in comparison with the advantages of cloud technology. (Xu & Zhao, 2013)

Table 1. Comparison of ten advantages and disadvantages of cloud technology

Advantages of cloud technology	Disadvantages of cloud technology
Cost reduction - pay only as much as it is used. There is no capital invested	The cost of purchasing specific supplements
Reliability - Most providers offer a service contract that guarantees uninterrupted service (24/7/365) and 99% availability	Lack of support - in reality, the situation is often the opposite of what the contract stipulates

Easier management - all resources are maintained by the service provider.	Non-negotiable terms
Almost unlimited storage of information	Poor quality due to large number of users
Automatic software integration	Software incompatibility
Sharing capabilities with internet connection	Downtime, which, among other things, can be caused by an interruption in the internet connection
Easy access to information	Limited control
Easier customization of services to customer needs	Inflexibility
Instant / quick tests	Lack of hard disk
Access from multiple devices	Security

Source: Turchaninov et al. 2019, p.1096.

2.2. Motives for the transition of oil companies to cloud technology

The oil and gas industry has a rich tradition of adopting new IT solutions and models. This industry has always reacted in a timely manner, and in many situations has led to many trends in the development of IT solutions in the last thirty years. New platforms, from mainframes and supercomputers to workstations and distributed systems, were quickly adopted by oil companies. High-performance computers, virtualization, advanced visualization, etc, have found their application primarily in the oil industry. The clear benefits of seemingly unlimited data storage and processing capacities, with their fairly simple availability and reasonable cost, are irresistible to the oil industry, which has great needs for massive data processing.

In order to fully understand the rather cautious transition of the oil and gas industry to cloud technology, we need to understand the oil market. In that sense, the collapse of the oil price, in 2014, was a signal for the oil companies that they have to make certain changes in their business. Oil companies have felt pressure on two fronts, from CAPEX and OPEX costs. CAPEX (Capital Expenditure) are

funds that the company uses to acquire, improve and preserve its assets in the form of real estate, industrial plants, and equipment. OPEX (Operating Expense) covers costs that arise in the ordinary course of business and are the costs of rent, labor, equipment, inventory, marketing, salaries, insurance and research, and development funds.

In addition, oil companies are aware of the benefits offered by cloud-enabled businesses. For example, in the research of digital trends in the oil industry (Ramboll 2021), a key finding was made that companies fear that if they do not keep up with the changes, it will lead to their non-competitiveness. Nearly 40% of companies were concerned about the risk of falling behind their competitors if they did not continue to invest in digital technologies. Cloud technology is particularly suitable for oil and gas companies seeking proactive market access to meet industry challenges, including the need for better cooperation and connectivity of all operations globally, as well as with their partners.

Increasing operational efficiency, reducing costs, and approaching new projects more carefully and in a more flexible way are some of the changes that had to be made. On the other hand, the nature of the business, which includes a huge amount of sensitive information, complicates the acceptance of cloud services. However, cloud technology has evolved, data security concerns have diminished, and oil companies have become open to cloud solutions. (Feblowitz, 2011)

The Oil and Gas Council of Great Britain predicted (Slav, 2017) that this industry will significantly benefit from the application of cloud technology. Using a hybrid model, i.e. a model that combines Software as a Service - SaaS (public cloud) and Secure Infrastructure and Services - SiaS (private cloud) would not only reduce costs, but would also improve the way of doing business. According to this forecast, cloud technology would equip the oil companies with the data processing capacities they need, while facilitating the connection of facilities, geographically dislocated around the world. Since the data is stored in virtual space, and not on local servers, their security would be improved.

Another important motive for the transition of the oil sector to cloud technology is that the technology eliminates the burden of storing huge amounts of data on oil sources, data from the seismic analysis, SCADA (Supervisory Control And Data Acquisition) systems, sensors on and below the surface, etc. In addition, cloud technology is an ideal solution when you consider the fact that oil industry has a globally dispersed workforce, as well as capital projects and joint ventures of a large number of stakeholders.

The benefits of digital technology are evident in the key processes of the oil industry, from exploitation to production. Data collection and analysis are of the greatest importance in the oil and gas industry. One study (Wald, 2019) showed that current investment in data collection and analysis is the second largest in the

oil industry and that the growth trend of investment in this area will continue and will become the most valuable investment in the next five to six years.

The expected benefits of the cloud and other digital technologies today and in the next few years, among other things include faster and better decision-making, as well as reducing the time required to perform key processes in the field of oil exploitation - production. As oil companies strive to increase their digital capacity, the cloud is becoming a necessity for further change (Aliguliyev et al., 2016). At the same time, these companies are trying to redefine their operational processes, noting that value consists of:

- Agility, through digital technologies as a catalyst for greater flexibility in response to the ever-changing business environment.
- Building business partnerships and cooperation in the field of strategy, procurement and technical capacity.
- Reduction of operating costs through economies of scale that transcend the boundaries of the IT department.
- Reduction of capital costs and provision of IT resources as needed.
- Fuller utilization of resources.
- Alignment of operations with decisions concerning the overall investment portfolio.

Despite these advantages and values of cloud technology, it is clear that in the beginning it was not enthusiastically accepted in the oil industry, but it is changing, so now this technology is expanding rapidly, changing business models and enabling innovation throughout this industry.

3. Areas of application of cloud technology in the oil industry

3.1. Big data processing

Cloud technology provides energy companies with access to new, real-time data and analytical capabilities. It is the use of advanced analytics introduced by cloud technology that reveals the financial and operational value locked in big data that accumulates on a daily basis in regular business processes.

As energy demand grows and oil reserves shrink through exploitation, energy companies are expanding the scope of their business and moving toward unconventional sources of oil and gas. This trend creates the need for advanced data management in upstream operations (oil exploration and production), including preventive maintenance processes and 3D/4D modeling based on seismic data. At the same time, the global energy trade is becoming increasingly complex, increasing the demand for advanced data modeling and forecasting. Accordingly, energy companies need to manage the mass of data and draw conclusions from it.

Therefore, it is becoming increasingly important to develop a cloud strategy that is in line with the imperative of production operations, which is to reduce the duration of the production cycle. For example, Shell Oil uses its cloud services to manage and analyze vast amounts of geological data collected using super-sensitive seismic sensors installed in collaboration with Hewlett-Packard. These sensors allow the company to detect and exploit oil from sources believed to have dried up, or in locations where previous tests have shown no oil. (Boush & Seifarth, 2013)

3.2. Human Resource Management

Companies are rapidly abandoning their old systems in order to implement new Human Resources Management (HR) systems, highly integrated and based on cloud technology. Two-thirds of respondents to a study (Volini et al. 2021) conducted by Deloitte said that investments in HR technologies are considered "urgent" and "important". When it comes to oil and gas industry, one must take into account the fact that this is an industry that is facing a new wave of changing generations of employees. This wave (The Great Crew Change) occurred as a consequence of the retirement of a large number of workers (from the baby boomer generation), and there was no adequate staff to replace them (Birenbaum, 2015).

Cloud-based human resource management has been developed to address the complexity of management and communication. The main benefit of using such an HR system is the integrated platform on which many applications are based. Companies no longer have to rely on their own IT staff to create an environment that suits their employees. HR SaaS solutions are an ever-growing library of requirements and supporting documentation, where an integrated notification system can assist an employee in submitting reports, while software is updated and constantly upgraded to reflect the latest changes. Routine functions, such as timed reporting, personal information maintenance, work safety and asset management, are regulated through a cloud platform. Some cloud providers focus on a narrowly defined market, such as recruiting new staff and monitoring the performance of candidates.

3.3. Accounting and Marketing

Although desktop accounting systems are extensively used by small and medium enterprises (SMEs), large firms often require complex accounting systems. Many IT software development firms have developed cloud accounting systems to meet their clients' needs for agility and mobility. While there are still security concerns, there is no doubt that cloud accounting solutions continue to evolve. (Rong, 2009)

Users are no longer tied to a central computer or are not forced to log on to a company's computer network to approve or create orders, approve costs, or view reports. Cloud solutions will meet the accounting needs of most companies at a

reasonable cost and with a high degree of reliability. When it comes to oil companies, reducing IT infrastructure is always a desirable thing, especially when it comes to savings due to the large reduction in oil prices on the world market that occurs periodically. (Perrons, 2015)

Considering marketing, CRM cloud software is an adequate solution for companies that need mobility and access to customer data and information. Historically, CRM software has been user-oriented, so cloud CRM systems allow users to record their data and then managers to quickly access information from all the sources needed to make decisions. In addition, through cloud mobile applications and online data entry forms, sales information can be entered and corrected in real-time, and managers can react quickly and coordinate their actions.

The pressure to increase brand value and build long-term relationships and trust with its customers, as well as the growing need to differentiate from its competitors in the eyes of customers, has turned companies to cloud CRM software and social media engagement. Energy companies strive for greater representation on social networks, which have become a powerful tool for communicating with customers to get feedback and build relationships with them. For example, the Shell Oil Eco-marathon Challenge was created as a result of the company's commitment to combating climate change. With the support of the Accenture Technology Labs cloud solution, their Green Guardians team has developed a platform that has enabled students around the world to design, build and test vehicles that should cross as many roads as possible with as little energy consumption. (Crabtree & Holsman, 2020)

3.4. Managing business collaboration

With cloud technological innovation, energy companies around the world are gaining access to information anytime, anywhere, with new tools expanding from the consumer market to the corporate environment, such as social networking and online video conferencing. This allows energy companies to work together efficiently at all levels, from the corporate level to individual workers.

This innovation in the energy industry comes at a time when companies are striving to create more value through collaboration and joint ventures, to reduce risk and costs, especially when it comes to capital projects involving more stakeholders. Increased opportunities for collaboration result in a global environment, full of complex and geographically dislocated systems. Energy companies that use the cloud for strategic purposes can make their infrastructure and applications available for joint ventures, mergers, and other investment ventures, far faster than using traditional technologies. This results in saving the required time of oil exploitation and refining, and in increasing competitiveness. Cloud contributes to rapid capacity increase at lower costs to meet business growth needs. In addition, it enables the optimization of production in the exploitation

phase (upstream operations) thanks to the easy sharing of data between the company and its contractors.

Tullow Oil, one of the largest European oil and gas exploration and production companies (Tullow Oil, 2021), has successfully transferred its business to the cloud platform in all aspects. The new platform allows its workers to securely share large-scale files containing maps, oil well data, images, graphics and other critical information, all without burdening the e-mail system traditionally used for this purpose. A good example (Accenture 2019) of collaboration through the cloud is the gas field project in Australia, in which the involved users (2,350 users in 89 companies) collaborate through SaaS applications. State-controlled oil companies have also taken the necessary steps to transition to the cloud. For example, the Chinese company *Sinopec* announced in September 2011 to accelerate its development processes, and the incorporation of business processes into the cloud (Wald, 2019). All these examples show that the cooperation based on the cloud platform is becoming commonplace, taking into account all the advantages related to cost, flexibility and speed.

3.5. Management of production operations

Energy companies are constantly looking for new ways to improve control, efficiency, and effectiveness. Over the past decade, these companies have embraced the digitization of oil fields to integrate exploration and production information, saving hundreds of millions of dollars a year. Today, we have the development of new technologies, due to the fact that cloud technology gives existing digital fields flexibility and agility, especially in the integration of resources and their monitoring. Cloud technology provides great transparency and costs control through pay-per-use pricing, giving energy companies the ability to change infrastructure, platforms, applications, and business processes as needed, on-demand, and as flexibly as possible. Such needs have led to the emergence of an increasing number of software providers that base their solutions on the cloud environment. (Holsman, 2018)

As a result of striving for an advanced model of managing production operations, and especially in response to unfavorable oil prices in certain periods, a new business model called Production Operations as a Service (POaaS) was developed, based on the IoT (Internet of Things) and machine learning, using the massive capacity of cloud technology. Traditional needs include monitoring and control, diagnostics, optimization and the analysis of production operations. Given the importance of these processes, the idea of implementing cloud solutions is their integration and profit based on a complete business model.

3.6. Environmental protection

A mixture of political, regulatory, and environmental pressures, combined with rising petrol prices, as well as increasingly strict customer attitudes towards energy sources, have led to the investment in transition to a new energy mix.

Cooperation based on cloud technology can improve the impact of energy on the environment. For example, Chevron uses Locus Technologies solutions and its SaaS model to organize and manage laboratory data to address environmental challenges. Ecological cloud solutions can also be applied in the field of hydro fraction, where companies must remain within the framework of environmental regulations, especially in the field of preserving the quality of drinking water and emissions. (Pferd, 2017)

In addition to helping companies make the transition to environmentally responsible energy production, cloud technology will continue to contribute to companies' efforts to limit their environmental impact and energy consumption in conducting their business operations.

4. The process of transition to cloud technology

A successful path to cloud technology usually begins with business analysis, which is based on cost reduction goals, as significant savings are achieved in the use of IT infrastructure. On the other hand, business performance increases due to the growth of data processing capacity, such as advanced analytics that can extract business value trapped in the mass of data.

Potential savings are a strong argument on the side of cloud technology, but for all oil companies, the adoption of cloud technology is part of a much broader strategy aimed at efficient digital transformation. For companies in the oil industry, cost reduction is becoming a secondary goal, as the main focus is on harnessing the power of cloud technology that can speed up the decision-making and shorten the production time. Thus, we have an oil industry that is shifting its digital focus from reducing costs to increasing productivity and value, by building a model based on smart machines and robotics.

The transfer to cloud technology requires a clear tactical vision, strong management, perseverance and adequate methodology. If all these elements are harmonized, oil companies can significantly improve all their business functions. Cloud opens new horizons for business modeling, advanced analysis, and even the development of autonomous power plants.

The transition to cloud technology in the oil sector requires a set of fundamental principles aimed at achieving strategic goals (Perrons & Hems, 2013). We can summarize these principles as follows:

1. Use of Business Process as a Service (BPaaS) for functions that are not essential to competitive advantage. This includes the transfer of functions, such as human resource management, procurement and accounting, i.e, functions that do not create a competitive advantage, to a provider that could perform these functions more efficiently and at a lower cost.
2. Maximize the use of software as a service (SaaS), wherever possible, which reduces the need to create and maintain special applications.
3. Acceptance of public, private and hybrid cloud models. Positioning the appropriate workload in accordance with the chosen cloud solution with balancing and risk management that includes elements such as data security.
4. Migration of appropriate applications to IaaS and PaaS services using standardized platforms, which can minimize costs.
5. Reducing the complexity of the company's IT infrastructure, while increasing quality and reducing costs.
6. Reshaping the provider's ecosystem, which reduces the level of operational complexity while maintaining a competitive advantage.
7. Education of employees. Informing about the characteristics, benefits and risks involved in the use of cloud infrastructure and its applications.

Although the transition of each company to cloud technology is specific to that company, certain functions common to all oil companies can be singled out and categorized, such as: industry-specific and technology-specific functions. For example, industrial functions include underground mining, marketing and trade, while technology-specific functions include complex integration and a high-performance computing platform. Considering oil and gas companies, dividing these functions into groups helps in understanding the challenges of such a transition, as well as how cloud solutions contribute to efficiency, especially in the context of cost and time.

Before moving to a new platform, oil companies must conduct a feasibility study related to the elements that need to be transferred to the cloud. This assessment provides an answer to the question of what are the specific requirements of each business function, as well as for which parts of the business it makes sense to carry out the transition process. Certainly, the very nature of digital solutions requires a culture based on innovation, and innovation and risk-taking.

Although most discussions about the transition to the cloud start with a focus on technological solutions, the basic success factor is building an appropriate operational model, where there is a greater focus on people, processes, tools and management. It is difficult to build a universal model of transition to cloud technology as an optimal solution because the cloud option is specific to each company. Therefore, an adequately constructed operational model is the key to achieving increased agility, efficiency and reduced IT infrastructure costs.

There are many models of cloud technology that companies can use, so the most important issues to consider when choosing a solution are the following:

- Organizations must assess the state of their IT infrastructure and analyze how cloud technology can affect the dynamics of their business. In general, organizations need to make sure that contracts with their cloud providers are clear and firm, and that they are fully aware of the services they pay for.
- Resource ownership and control pose certain challenges. Organizations need a different set of skills to adequately manage the cloud environment.
- Organizations must answer questions about cost-effectiveness, data security, privacy, and performance.
- An analysis of business requirements is needed before making a decision to move to the cloud.
- •Organizations need to understand all the players in the cloud services market.

After considering these issues, companies seeking to transition their business to the cloud can adopt a management approach to guide this transition process in four steps, as shown in Table 2 (Holsman, 2018)

Table 2. The process of transition to cloud technology

Steps	Activities
Strategy and analysis	•Defining strategic vision and direction •Data collection •Analysis of the current situation •Setting financial models •Unification of organizational structure •Approval of security policy
Planning and design	•Designing and defining the ideal organizational structure •Directing people, processes and technologies in accordance with the desired situation •Gap analysis and planning •Benefits and monitoring the value of implementation •Sequencing, defining scope and planning
Transition and implementation	•Creating and purchasing cloud services that meet pre-defined expectations •Testing and evaluating cloud services •Transition and preparation of services for commissioning
Application, continuous improvement and ongoing migration	•Effective management of current operations •Management and monitoring •Initiation of new activities •Constant modernization and migration process •Feedback and optimization

Therefore, leading oil and gas companies do not see the cloud only as a tool to reduce the cost of IT resources, but consider the cloud as a key platform for

strategic growth. We are entering time when the benefits and risks of cloud solutions are clear, implementation is almost inevitable, and the cloud management strategy becomes part of the corporate strategy of companies. Many companies are already enjoying the benefits of cloud technology, such as Hess Corporation (2020) which expects to reduce its costs by approximately 40% by moving to a PaaS solution. The corporation also expects to save between 10% and 20% in labor costs, exclusively through process automation.

5. Challenges of oil companies' transition to cloud technology

The oil and gas industry has changed drastically in the last 20 years or so, primarily as a result of fluctuations in the oil market and intense competition. In addition, shareholders are putting pressure on oil companies for as much profit as possible and adequate compensation for long-term investments. Advanced and innovative technology can help eliminate uncertainty and increase performance in oil and gas exploration, exploitation and production. There is often too much complex information that needs to be processed and understood in a timely manner, in order to make a timely and correct decision. Process efficiency and the right information at the right time are key to the decision-making process and the automation of monitoring and control of oil sources. (CaoLei & Dengsheng, 2012)

Oil companies around the world now see the cloud as a powerful tool that increases the reliability of the refinery and the rest of the infrastructure, which undeniably affects profit growth. This is especially true today when companies face five critical and essentially global problems:

1. Data management,
2. Outdated infrastructure,
3. Sudden failures leading to losses, especially in the downstream segment of oil production,
4. Integration of old and new infrastructure,
5. Challenges in manpower management.

Transitioning to the cloud platform is not an easy task and the oil industry is facing specific challenges. Oil companies' executives see the cloud not only as a catalyst for higher performance in data processing, but also as a path to faster and cheaper digital transformation. They seek to discover new sources of value offered by the cloud, such as advanced analytics, artificial intelligence, internet applications and automation.

One of the biggest challenges in the transition to the cloud is storing and backing up data and recovering it from loss through recovery procedures. In many ways, data backup and recovery are very similar to the traditional procedure on a local area network. Ideally, the company determines the storage schedule of copies

of data at a precisely specified interval (daily, weekly or monthly). However, there are a few important differences compared to the classic backup and recovery procedures. The advantage over these classic procedures is the higher speed of this procedure in the cloud environment. Also, storage capacities automatically increase as needs grow, without the need to engage additional equipment. The disadvantage is in the fact that the cloud environment is organized on a pay-to-play basis, so if a company wants its data stored, it must set aside funds and pay for the service. In addition, the price list differs depending on whether the company wants the data to be available immediately or after a certain time after storage. If it is necessary to access an individual file, and not the entire block of files, the company must pay for this additional option.

Although providers claim that cloud resources are 100% available all the time, data can have an error, software and hardware can fail, and there is a possibility of user error. Although these are rare situations, there is a certain degree of risk when storing large amounts of data in the cloud. Data availability can also be a problem if the cloud provider has downtime, so it is wise to have a backup strategy in case of an undesirable scenario.

Organizations are overcoming fears about the security and privacy of data and other IT resources by investing in new technologies and solutions that would monitor and control cloud services. These solutions, no matter how expensive, are cost-effective primarily due to the economies of scale they provide. Companies must research security policies and standards offered by cloud service providers, as well as ensure that standards meet the needs of the organization, offer the possibility of revision, with compatibility with local legislation. (Lim et al. 2021)

In addition, the cloud revolution also means that deep connections with IT solution vendors such as Dell and IBM are weak as the traditional notion of computing power is abandoned. On the other hand, new connections are being created with companies that offer cloud solutions, such as Amazon, Google and Microsoft. However, the current big players in the IT industry are refusing to give up, but are already trying to establish alliances through which they are trying to renew the impact on creating value for their customers. Underestimating the business moves of these companies, which still represent the giants of the IT industry, would be a big mistake, given that these players have research centers and experts with high competencies.

One example (Boush & Seifarth, 2013) of a successful cloud technology transition process is a Texas-based oil company that uses oil fields and equipment managed by 50,000 employees worldwide for its operations. The company has outsourced most of its data management services, while the infrastructure is divided into a number of facilities owned and leased. The key shortcoming pointed out by the company's IT team was the fact that outsourcing only solved the question of who would deal with the problem, but no progress was made in

efficiency or speed of work. Thus, the company adopted a solution offered by Microsoft System Center, which would enable the right use of the company's resources. Within two weeks, the company noted an improvement in data processing and activity approval, which is one of the key processes in this highly regulated industry.

It is important to understand that the necessity of implementing cloud technology represents a change in the business paradigm of oil companies, as well as their daily business. The transition to cloud technology requires a lot of effort and time, so companies must develop a strategy in time, before investing in the technology itself. The oil and gas industry can undoubtedly benefit from cloud technology solutions, especially if we take into account the fact that it is an industry with the constant growth of infrastructure. The solution that would make the most sense for companies in this industry is a mix of private and public cloud services. With self-developed applications within a private cloud environment, additional data processing power could be gained by connecting to a public cloud. With this mechanism, the data security policy would be clearly defined due to the fact that all applications run via a private cloud system.

6. Conclusion

Recognizing the fact that oil and its derivatives are still the main sources of energy, it is concluded that the oil and gas industry is one of the main factors of global economic development. Therefore, it is paradoxical that the industry that is the engine of development and whose companies produce the most valuable resource, suffers from insufficient efficiency of production processes. Inadequate solutions in oil exploitation and refining, as well as interruptions in the supply chain, directly affect the success of oil companies. Managing tens of thousands of documents, and the ability to access and analyze data at any time, make the right decision, and then conduct adequate communication with other members of the organization, are the challenges that oil companies face every day.

The technology that has the potential to eliminate potential obstacles in the business of companies in the oil sector is precisely cloud technology. This technology shapes the future of almost all industries, while adapting to the specific requirements of each. Managing massive data with the help of cloud technology will enable energy companies to automate business processes, a higher level of collaboration and build long-term relationships with their partners. The cloud is reshaping the infrastructure of the oil industry and defining the further direction of its development.

By moving to the cloud platform, oil companies can access the necessary IT resources, without excessive investment in infrastructure, and with far greater flexibility. The work of companies is not limited by office space, but requires the

collaboration of employees in upstream and downstream processes, in the office and in the field. Cloud systems enable uninterrupted cooperation in all organizational parts, regardless of the size of the organization itself. More efficient use of servers and other infrastructure leads to lower energy consumption for the same level of work performed, which ultimately affects raising awareness of environmental protection and building "greener" technology.

Since the possibilities of cloud technology are great, considering data collection, processing and transfer as well as the synchronization of activities of all organizational units, an increasing number of oil and gas companies are in the process of transitioning existing information systems to cloud technology. In addition, it is becoming clear that cloud technology is the future of the oil sector and a condition without which it is impossible, so it is only a matter of time before companies adopt and use all the possibilities of this technological solution.

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IZAZOVI PRIMENE KLAUD TEHNOLOGIJE U NAFTNIM KOMPANIJAMA

Apstrakt. S obzirom na to da su podaci i informacije postali najvrednija imovina kompanija koja se efikasno i ekonomično može skladištiti u klaud infrastrukturi, veliki je pritisak na poslovne entitete da kapitalizuju ovu poslovnu i tehnološku mogućnost. Posebno je veliki pritisak na naftne kompanije da pronađu nove načine kreiranja konkurentske prednosti, korišćenjem šansi koje nudi poslovanje bazirano na klaud tehnologiji. To je prvenstveno rezultat činjenice da preusmeravanje poslovnih aktivnosti na ovaj vid skladištenja i integracije podataka i aplikacija predstavlja veliku promenu u poslovnom svetu, a trend rasta se nastavlja u svim aspektima poslovanja. Ovaj rad se upravo bavi mogućnostima i izazovima primene klaud tehnologije u naftnim kompanijama koje posluju u turbulentnim uslovima uzrokovanim fluktuacijama cena nafte na globalnom tržištu.

Ključne reči: Klaud tehnologija, naftne kompanije, oblasti primene, izazovi implementacije

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