Despite the challenges of low oil prices, uncertain economic outlooks, and regional instability, the Middle East and North Africa (MENA) energy sector boasts many exciting investment projects. The region can anticipate almost $900 billion in energy sector investments over the next five years, according to the Arab Petroleum Investments Corporation (APICORP). The multilateral development bank APICORP recently released its 2016 MENA Energy Investment Outlook. Currently, the bank estimates $289 billion worth of investments in ongoing MENA energy projects over the next five years. APICORP reports that the oil sector has the largest share of investments with $110 billion, with the majority of funds invested in upstream projects. Total gas investments stand at $76 billion.

APICORP anticipates an additional $611 billion in planned MENA energy sector investments over the next five years. The oil and gas sector can expect investments of $190 billion and $149 billion, respectively. The high rate of investments seems surprising when one examines the global oil and gas industry outlook. Continuing conflicts in Syria, Iraq, Yemen, and Libya have made investors wary of spill-over into neighboring countries. Industry revenue is projected to decline this year. Again, global energy companies have reduced dividends, capital spending, and staffing, and made other reforms to cope with low oil prices and slowed growth. Last year, the decline in oil prices cost MENA oil exporters $360 billion, according to the IMF. Losses are expected to deepen this year. Several MENA oil exporting countries have incurred large budget deficits and face difficult choices about cutting expenditures and increasing non-oil revenues.

Nevertheless, countries in the MENA region have prioritized energy projects and international energy companies are investing billions to develop promising resources in the region. “Global investments in oil and gas fell by 20% in 2015 compared with 2014, one of the biggest drops in history,” said Dr. Raed Al-Rayes, Deputy Chief Executive and General Manager of APICORP, commenting on the report. “However, against this trend, we expect the MENA region to continue investing heavily as major energy-exporting countries expand the size of their energy sectors and strengthen their positions within global markets.”

**Egypt Increases Oil and Gas Production**

Investments in Egypt will focus on meeting the country’s growing energy needs. The Ministry of Petroleum expects the demand for oil and gas to increase by 22% over the next five years, according to Daily News Egypt. This demand is magnified by the fact that most Egyptian oil and gas wells are at maturity or declining. Given these issues, oil and gas development projects in Egypt are extremely significant. Planned investments in Egypt’s energy sector will amount to $60 billion over the next five years, with the power sector representing 75% of this total, according to APICORP. The Egyptian government is aggressively courting foreign investment. The Ministry of Petroleum aims to achieve about $8.5 billion in drilling and exploration investments by the end of the 2015-16 fiscal year. Last year, these investments reached about $7.5 billion. In January, the Ministry of Petroleum announced expected 2016 investments worth $16 billion in research, exploration, development, refinement, petrochemicals, infrastructure, pipeline expansion, and natural gas delivery, according to Daily News Egypt. The major gas finds of recent years dominate the investment outlook for Egypt. Developing these fields will help Egypt ease some of the demand for gas. Production of the offshore Zohr gas field by the Italian company Eni is anticipated at the end of 2017, with full production capacity expected by the end of 2019. Eni project production rates of 2.7 bcfd by 2020. The Zohr project has already swallowed $12 billion in investments. Eni’s Nooros field is currently producing 65,000 boe/d and the company hopes to increase that to 140,000 boe/d by the end of 2016. The Italian giant also plans to build two natural gas plants in Egypt to increase processing capacity from Zohr gas. Construction of one processing plant is already underway in Port Said.

Other significant gas fields are being developed by the British company BP. The West Nile Delta projects in Taurus and Libra gas fields will begin production next year. Facilities are about half complete. BP’s Atoll natural gas field has been fast tracked for development, making it another investment to watch. GlobalData, a global analysis firm, estimates that a $945 million investment will be necessary to develop Atoll’s first phase, which should be online by 2018. The field has estimated gas reserves of 1.5 tcf and 31 million barrels of condensates.

Another exploration project to follow is the Apache Corp. and Royal Dutch Shell Plc joint venture in the Western Desert. The two companies plan to begin producing unconventional gas by the end of June. Apache and Shell have an agreement with the Egyptian government to drill three horizontal wells and then discuss full field development by horizontal drilling and fracking. Shell is operating the project with a 52% interest, while Apache Corp. owns the remainder. Egypt’s oil and gas infrastructure will soon see major upgrades. The Egyptian company Sonker received a $341 million loan to build a bulk-liquids terminal at the Ain Sokhna port, as well as to upgrade environmental and safety standards. “The Sonker Project will ensure a constant supply of energy to our burgeoning economy and will certainly transform the Red Sea area into a regional hub for trading petroleum products, not only for the Egyptian market, but also for East Africa and Europe,” Ossama Al Sharif, Sonker’s Managing Director, told the European Bank for Reconstruction and Development in early February.

Recent investments in refineries will boost the production capacity of petroleum derivatives. The Egyptian refineries in Alexandria, Suez, Assiut, and Mostorod require investments of $7.3 billion. The most important project is the expansion of the Middle East Oil Refinery (MIDOR) processing facility in Alexandria, according to Tarek El Molla, Minister of Petroleum and Mineral Resources, in a 2015 interview with Oxford Business Group. The expansion will increase production capacity by 60% to a capacity of 160,000 b/d at an estimated cost of $1.4 billion. MIDOR is also planning to establish new hydrotreating oil units that will require $7.5 billion in investments. The Cairo Oil Refining Company is working on a new plant to refine about 4.2 million tons of crude oil annually. Other MENA countries are also sinking significant resources into oil and gas investments and hoping to meet domestic energy demands. Three countries to watch are Saudi Arabia, United Arab Emirates (UAE), and Iran. Saudi Arabia and Iran together represent nearly 30% of planned MENA investments over the next five years, according to APICORP.

**Saudi Arabia Diversifies Energy Spending**

Saudi Arabia has prioritized the development of unconventional gas resources and offshore oil and gas as it aims to move away from dependence on crude oil. In spite of low oil prices, the state-owned oil company Saudi Aramco continues to invest in oil and gas production. The country aims to increase the role of gas for its domestic power and industrial sectors, so has heavily emphasized gas exploration. Saudi Aramco’s former Chairman, Khalid al-Falih, said recently at a business conference, “Our investments in capacity of oil and gas have not slowed down - we have been able to do a lot of cuts in spending by simply driving down costs,” according to Reuters. At the same time, Riyadh is looking to diversify its economy and increase investment in renewable energy. Under the King Salman Renewable Energy Initiative, the country aims to produce 9.5 GW of renewable energy by 2023. According to APICORP, Saudi Arabia currently has $53 billion in committed investments and $102 billion in planned investments. Major projects in Saudi Arabia include the Hasbah sour gas field expansion. Saudi Aramco began producing gas from the Hasbah field in March of this year. The Hasbah expansion will eventually supply the proposed Fadhili plant with 2 bscf/d of gas, while another field, Khur-
saniyah, will add 580 mscfd to the plant. In September of last year, Aramco awarded $4.7 billion in contracts to Spain's Tecnigas Reunidas and Britain's Petrofac for the Fadhili plant, with expected completion in 2019. Other gas plants are also in the works, including the Midyan and Wasit projects. In total, the three new gas plants will be able to process more than 5 bscf/d.

The Jazan oil refinery is scheduled to begin operations in 2017 and will process 400,000 b/d of crude oil. The refinery is part of a $20 billion plan to develop an industrial city in southwestern Saudi Arabia.

Iran: Goodbye Sanctions, Hello Investments

In Iran, investments in oil and gas projects highlight the country's interest in boosting its oil and gas sectors. The removal of sanctions has allowed the Iranian government to push for foreign investments. Iran can expect to see $71 billion in planned energy sector investments over the next five years, according to APICORP, the country's investment promotion agency. The government to push for foreign investments. Iran can expect to see $71 billion in planned energy sector investments over the next five years, according to APICORP, the country's investment promotion agency. The government to push for foreign investments. Iran can expect to see $71 billion in planned energy sector investments over the next five years, according to APICORP, the country's investment promotion agency. The government to push for foreign investments. Iran can expect to see $71 billion in planned energy sector investments over the next five years, according to APICORP, the country's investment promotion agency. The government to push for foreign investments. Iran can expect to see $71 billion in planned energy sector investments over the next five years, according to APICORP, the country's investment promotion agency.

Despite these ambitious plans, several factors could hinder foreign investments. In an article on Iranian oil and gas production that appeared in the February 2016 issue of Oil and Gas Facilities, Katy Smith notes that Iran faces challenges to investment, including the potential for sanctions to be reintroduced if the country fails to meet nuclear monitoring commitments, and continued US sanctions concerning terrorism and human rights abuses. Despite some uncertainty, Smith anticipates a rise in both onshore and offshore drilling activity over the next few years, which will lead to increasing demand for rigs and impact oilfield services expenditures.

One of the highest budget energy projects in the Middle East right now is Iran's $8.5 billion IGAT Gas Trunkline expansion. The pipeline is a top priority project for the country, said Planning Director of National Iranian Gas Company, Mohammad Reza Goudsazadeh, in early April, as reported by the Iranian news agency. Iran has already commenced construction on the second part of the Iran Gas Trunkline-6, a 600 km long line, costing $2.2 billion. When completed, this pipeline will transport gas to Iraq. Further, the South Korean state-owned entity giant Korean Gas Corporation (KOGAS) recently agreed to provide engineering services for constructing two key pipelines, the Iran Gas Trunkline-7 (IGAT 7) and Iran Gas Trunkline-9 (IGAT 9). IGAT 7 will cross southern Iran, and IGAT 9 will take gas to Iran's border with Turkey. KOGAS has also signed a memorandum of understanding to develop Iran Gas Trunk-Line 11 and to lay a subsea pipeline through the Persian Gulf to bring gas to Oman. This $1 billion, 260 km long project will be completed by 2019 and supply 10 bcm/year of natural gas to Oman.

Iran also aims to boost crude oil production from its southwestern oilfields, particularly the Azadegan, Yadavaran, and Yaran fields, which are all shared with Iraq. The government is currently working with foreign investors to develop the various fields. Expansion of the Kish gas field is another significant upcoming project for the country. This mega field likely contains up to 5 bcf/d of recoverable gas, an extraction target that Iran hopes to achieve over three planned phases of development. Phase 1 involves drilling 12 production wells, laying subsea pipeline, and building multiple onshore installations, with a goal of producing 1 bcf/d of gas for domestic consumption and 11,300 barrels of gas condensate for export.

UAE's Major Investments in Gas

UAE can count on approximately $43 billion in committed energy investments and $49 billion in planned investments over the next few years, states APICORP. And approximately $20 billion of that planned investment figure is currently at the contract-bidding phase. BMI Research predicts significant growth in oil production over the next three to five years, but expects UAE to grow more dependent on imports of pipeline gas and LNG. The country is seeking a bigger gas supply to run power plants and industries. While UAE waits for the completion of four nuclear power plants, the first of which is supposed to come online in 2017, the country needs to meet a high demand for gas supplies. UAE has several major investment projects. UAE's $3.5 billion Fujairah refinery project, with an expected completion date of 2018, would process 200,000 b/d. Abu Dhabi is also targeting the Upper Zakum oilfield, currently the second largest offshore oilfield in the world, for expansion. Currently, the field produces about 500,000 b/d of oil. The Emirates are assessing bids for two projects to increase capacity of the field to 1 mbb/d by 2020. Abu Dhabi also announced a huge sour gas project in late April. The Al Hosn sour gas development project is expected to cost $10 billion and extract more than 1 bcf/d of ultra sour gas from the Shah gas field.

Challenges Ahead

Egypt's investments in the oil and gas sector should help support the country's economic rebound and meet the country's growing energy demands. Foreign investors are optimistic about exploration activities and willing to invest in the country's energy future. Other countries in the region also have major oil and gas development plans that will require significant investments in the next few years. Whether investments in the region meet expectations will be determined, at least in part, by oil prices, political and economic concerns, and regional conflicts. These unstable and unpredictable factors will likely set the tone for investments in the region for many years to come.
Investment is somehow one of the most controversial aspects in companies' lives. Through investments, companies are expanding something tangible without quite knowing what the result will be, trying to make an educated bet, with the hope of eventually collecting a payout. But how much will a company receive in return, and when?

For most, digital technology represents a quintessential mystery in terms of investments to be made. In the context of the oil and gas industry, the challenge for decision makers becomes increasingly difficult due to the pressing characteristics of this results-driven environment. Is the industry on the right path in the midst of the information revolution? Which digital technology is ripe for investments, and which one is on the way out? How can one assess what each course of action is worth? How can one measure its potential impact?

For years, investments in information technology within the oil and gas industry have lagged behind. While the delay has not be as evident as in other industries, an acute lack of investment in this segment has resulted in weak Information Technology (IT) departments, as Chief Information Executives (CIOs) are struggling to keep up with the business horizon increasingly revolutionized by the latest digital advancements. Fortune favors the bold. However, there are few industries where this classical dictum materializes. Companies that have yet to adapt to new technological advances are those that are suffering the most today, weighed down by outdated work methods. For when it comes to digital technology, one is not talking about future aspirations, but rather about urgent demands of the present.

Digital Technology Is Essential

Digital technologies – in addition to seismic imaging – have the potential to make radical changes to how energy resources are found, extracted, and used, providing opportunities for more efficient operations through unparalleled levels of data analysis. As BP stated in its Technology Outlook Report released in November 2015 regarding the oil and gas industry, sensor technologies in equipment such as pumps, wells, and appliances are increasingly being employed by leading play-ers in the field.

“When connected to data collection mechanisms, they provide real-time information on field activities. Intelligent wells – providing updates on well condition from top to bottom – are now becoming a reality, a development that reduces both non-productive time and cost,” the report stated. Together with the rapid development of data analytics and management techniques, the industry can find oil and gas resources faster and more effectively, while operating refineries and manufacturing plants more efficiently. Therefore, digital technologies provide a road to a faster and better decision-making process, boost safety, productivity, and efficiency, which ultimately means considerable savings.

Specifically, the BP study estimated that digital technologies have the potential to increase production volumes by 4% and reduce costs by 13% by 2050.

“Technology is likely to have the most impact on resources that are difficult to produce or those that are sparsely exploited today, such as ultra-deepwater and unconventional. At a time of lower prices, revenues, and capital spending, digital technologies – including sensors, data analytics, and automated systems – stand out as the leading contributors for reducing costs," according to the report.

As Jarrod Bassan, a Senior Consultant at the Computer Sciences Corporation (CSC) – a global leader in providing technology-enabled business solutions and services, with its headquarters in Tysons, Virginia, USA – explained in an email interview with Egypt Oil&Gas:

“Operational efficiency is a key driver, and every initiative needs to show a return on investment in 6-12 months or less. Companies with a longer-term focus are investing now in piloting technology and new ways of working to drive efficiencies that make them hyper-competitive – both in terms of improved labor productivity and quality of work. Even when labor costs are low, the poor-quality work execution causes massive inefficiencies, unnecessary costs, and increased operational risk. Mature companies understand this, and are working to dramatically...
“By 2050, digital technologies have the potential to increase production volumes by 4% and reduce costs by 13%.”

BP Technology Outlook Report

improve the quality of work and productivity rates so they can reduce their operating costs.”

In this context, baseline technologies, but also new areas such as Outage Management Systems, Distribution Management Systems, and a wealth of other technology platforms are aimed at providing greater levels of insight, according to the experts from the CIO Energy Summit.

Digital Oil Field

A great example of the sort of technology directly applied to the so-called digital oil field (DOF), which focuses on leveraging the benefits of modern IT, automation, and communications to enhance all the conventional aspects of oil and gas operations, from exploration and production to environmental monitoring and safety, was recently highlighted by the Offshore Technology web-site. More than just simply deploying digital and data management technologies, the DOF implies unifying disparate oil field processes into a more easily digested stream of information, making it possible to get the big picture of how production impacts the bottom line, and it is essential to select the business drivers in which IT can provide a substantial improvement. “Throughout operations, costs, particularly maintenance costs, are usually the main drivers in the oil and gas industry with product prices [being] the major uncontrollable variable,” van Staden said.

Second, it is necessary to analyze these impacts and identify opportunities—equipment opportunities and process/system opportunities—where the organization can be more efficient. “The main area where IT can deliver value is with identifying and exploiting opportunities related to business processes and systems, such as operating rounds and routine maintenance planning,” added van Staden.

And last, but not least, it is crucial to construct a portfolio of initiatives where IT plans are plotted along two axes: ease of implementation and impact.

Productivity Transformation

As Brian Richards wrote on Accenture Energy Blog, “For the oil and gas industry, the last 10 years were more about production than cost. The next 10 years will be about implementing digital technology to drive significant cost efficiencies.”

Given current oil prices, which are below $50 per barrel, energy companies are battling amongst themselves in a hard-fought price war, aiming to prove that they are capable of producing oil and gas at the best price. It is essential to analyze the operating model from top to bottom, from scheduling to training to production surveillance. “Things that used to be sacred, such as keeping ‘data within our walls,’ are now on the table, and it is time to take it to the next level,” wrote Richards on Accenture Energy Blog.

In other words, the oil and gas industry is facing a new productivity transformation, where digital technologies are the key to help companies discover new ways to move towards increased

“Things that used to be sacred, such as keeping ‘data within our walls,’ are now on the table, and it is time to take it to the next level.”

Brian Richards, Senior Manager and Energy Innovation Lead, Accenture

lay real-time information in order to make better decisions at a faster pace. In Richards’ opinion, this technology “will change how field work is done, and represents the next evolution of mobility.” Nevertheless, there is still a long way to go. One of the main challenges is that most of the devices on the market today are not intrinsically safe. Battery life is still limited, which raises even more questions.

Augmented Worker Technology

Accenture’s Senior Manager, Richards, is not alone in emphasizing the advantages of employing augmented reality (AR) that have been assessed for the mining industry, but can also apply for the oil and gas sector.

While more effective use of data combined with advanced analytics offers opportunities for im-provement, according to CSC, providing this information to the worker in the field in a real time has proven expensive, and cumbersome. New capabilities are therefore emerging, which address some of the limitations experienced to date. AR provides a means to overlay interactive digital information on top of the physical world.

“Augmented Worker technology allows video collaboration with remote experts, hands-free work instructions, and better condition monitoring of assets. For example, this allows a remote worker to set up a remote maintenance expert, who can see a problem in a live video broadcast. This can reduce fault diagnosis, shorten diagnosing time, which in many cases means that the expert does not have to actually go out in the field,” said Costantin van Staden, said for Egypt Oil&Gas.

In a white paper about the use of AR in the mining industry, Jarrod Bassan, who co-authored the piece, added that the benefits would manifest themselves through “better maintenance outcomes, more effective training, better collaboration and knowledge transfer, and enhanced situational awareness for improved safety.”

The expert states that applying AR would allow a mobile worker to ‘see’ all relevant information for a given task, as well as read the physical environment, exactly at the moment when he can make the greatest use of the data. “These methods have proven to be more effective than traditional text-based work instructions. The worker can also capture photo, video, and even thermal imaging data to more accurately describe a problem in the field, which allows planners to make more informed decisions,” he concluded.

Demonstrating the Value

The advantages of digital technology seem to be clear, however, one of the challenges that CIOs of the oil and gas sector face in this respect is to demonstrate the value of this kind of investment within such a production-driven industry. Indeed, a study conducted by the consultancy firm Ernst & Young in 2014 made it evident to see that the energy industry leaders feel that their suggestions are less respected, in the oil and gas sector in particular. They have revealed that they were dissatisfied with their remit, ability to influence broader company strategy, and with prevalent perceptions about the role of the CIO within different companies.

In addition to this, the reputation of IT departments has been damaged in recent years because of their inability to deliver on the monetary gains promised in business case documents for IT pro-jects, according to Marco van Staden, an operations subject matter expert, oil, gas, and energy at Aijon, an Australian consulting firm, cited by CIO.com. “This is especially apparent