

# Mapping the Future of Work in MENAT



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# CONTENTS

<b>Executive Summary</b>	<b>2</b>
<b>The Future of Work</b>	<b>4</b>
Examining the three disruptive forces of innovation: Industrial Internet, Advanced Manufacturing, and the Global Brain	
<b>What the Future of Work Means for MENAT</b>	<b>6</b>
a. The importance of supply chains	
b. Shifting attitudes to win	
c. Diverse challenges and opportunities	
A closer analysis of three groups of countries across MENAT in the context of Future of Work	
i. Next frontiers: Democratization of manufacturing	
ii. New growth models: Collaborative innovation and the Industrial Internet	
iii. Growth in volatile environments: Enabling local progress	
<b>Sustainable and Inclusive Growth</b>	<b>20</b>
How Future of Work innovations will improve social cohesion and living conditions	
<b>The Macroeconomic Impact in MENAT</b>	<b>22</b>
<b>Concluding Remarks</b>	<b>23</b>
<b>Authors' Bios</b>	<b>26</b>



# EXECUTIVE SUMMARY

The pace of innovation is accelerating, driven by three hugely disruptive forces: the Industrial Internet, Advanced Manufacturing, and the Global Brain. At GE, we see these three forces as the interdependent elements of a new technological revolution, that we call **the Future of Work**. The Future of Work is about speed and collaboration; it accelerates innovation and change; it redefines economies of scale, enabling micro-factories and new artisanal activities; it reshapes supply chains and distribution networks; it redefines the relationship between employers, who get access to a wider pool of talent, and workers, who gain greater entrepreneurial control over their skills and careers.

**The Future of Work provides enormous opportunities for the Middle East, North Africa and Turkey (MENAT) region.** MENAT countries have great potential, but struggle with formidable challenges and a status quo that is not good enough. The creative disruption of the Future of Work is a unique opportunity for the region; it will increase productivity and efficiency of organizations, ultimately transforming economies.

Business leaders in the region realize that we are facing a true technological revolution—the results of GE's Innovation Barometer show this very clearly. And they have begun to embrace it: countries like Turkey and Algeria are among those that have already reaped the greatest gains from collaborative innovation.

The disruptive power of the Future of Work can help oil importers broaden their manufacturing base: the greater flexibility and speed of Advanced Manufacturing processes, and the ability to tap the Global Brain to complement local talent will lower barriers to entry and redefine the concept of scale, allowing new producers to break into markets with smaller initial investments. In Turkey, for example, the "Maker Movement" and 3D printing are making rapid inroads. Oil exporters can use the same opportunity to diversify their economies, reducing their dependence on oil exports and the consequent vulnerability to oil price fluctuations.

**This process would ideally result in the gradual creation of local supply chains and ecosystems.** Large established industries within the region, like oil and gas, aviation, and transportation, can act as a magnet, with smaller companies emerging as new and more competitive suppliers. More dense and cohesive supply chains would have a number of advantages: lower transportation costs, lower inventories, the acceleration of innovation through a closer relationship between suppliers and manufacturers, and the creation of human capital. Advanced Manufacturing, which connects design, manufacturing, supply chains, and distribution networks via a digital thread, would be a powerful enabler. For countries still contending with significant instability, a stronger local supply chain would also limit the risk of supply distortions while greater stability is achieved.

**Sectors like oil and gas, aviation, transportation, and healthcare will benefit quickly and directly from Future of Work innovations.** The Industrial Internet and Advanced Manufacturing can already provide solutions that raise productivity and efficiency in all these sectors. **But as local supply chains become stronger, we would expect to see the rise of robust mechanical components and electronics industries, feeding into the cycle of the larger established industries.** This would help MENAT economies shift towards more knowledge intensive, higher value-added exports. The IMF estimates that the region's exports are only about one third of their potential, with less integration in global supply chains than any other emerging region.

**This will help countries throughout the region meet one of their toughest challenges: creating good jobs for a young and growing population.** There is a concern that innovation will lead to higher unemployment and greater income inequality; and GE's Innovation Barometer shows that this fear is especially pronounced in MENAT—unsurprising, given the burden of high unemployment, particularly among the young. But Future of Work innovations can augment the abilities and productivity of workers at all levels



of the skills distribution, via better access to information and collaboration tools. And greater productivity means higher incomes. They can also give workers new and more flexible ways of participating in the workforce, via crowdsourcing and open source networks. We strongly believe that Future of Work innovations will strengthen social cohesion.

**This new wave of innovation can improve living standards of all sectors of the region's population, not just by creating better job opportunities, but also by improving the performance of healthcare.** Industrial Internet solutions can improve the efficiency of hospitals, enabling them to deliver better health outcomes at lower costs; they can also extend the geographical reach of healthcare services via portable and personalized medicine solutions.

**Future of Work innovations will also bring substantial benefits in terms of sustainability.** The Industrial Internet and Advanced Manufacturing will help improve efficiency in energy consumption in aviation, transportation, and industry, as well as in power distribution, reducing transmission and distribution losses (a substantial problem for local utilities in some countries such as Jordan). This will help MENAT countries reduce consumption and cut energy subsidies—a major drain on public budgets—without imposing an undue burden on the population. In addition, the shift to micro-factories allows for a more efficient use of productive capacity; and new manufacturing techniques and the development of

new materials help economize on the use of traditional raw materials.

**Achieving all this will require a shift in attitudes on the part of governments and private sectors.** Governments will have to turn from being producers and employers to being consumers and enablers. They will need to bolster the necessary infrastructure, notably in terms of communication and data networks, transportation, and energy distribution. And they will have to strengthen education systems, with an emphasis on science and engineering, as well as flexibility and problem solving—a close partnership between schools and industry could play a fundamental role in this regard. Companies will also need to become ever more aware of the importance of attracting, retaining, and fostering talent in order to succeed—in some countries, such as Turkey, awareness is already rising rapidly. Together, governments and private sectors should work in synchrony and close cooperation across the region, and globally, to enable the creation of robust ecosystems.

**The Innovation wave of the Future of Work is powerfully disruptive, and the MENAT region is ripe for a creative disruption that can improve living standards and opportunities for all segments of the population. The potential benefits ahead are huge.** MENAT is already one of the world's fastest growing regions. The Future of Work can make growth more broad-based, sustainable, and equitable. It is an opportunity the region cannot afford to miss. ■





# THE FUTURE OF WORK

**The pace of innovation is accelerating, driving a powerful and far-reaching transformation of industry.** This transformation affects design and manufacturing processes, supply chains and distribution networks, and the way that work is performed and organized. It is redefining the competitive landscape across industrial sectors, and will impact international trade patterns and the distribution of global growth. It will reshape the labor market and affect the level and distribution of incomes across countries.

**At GE, we call this transformation the Future of Work.<sup>1</sup>**

It is driven by three fundamental forces: the Industrial Internet, Advanced Manufacturing, and the Global Brain. These three forces are interdependent and mutually reinforcing.

**The Industrial Internet is the merger of software and hardware, of big data and big iron, with the integration of cloud-based analytics and industrial machinery.** The rapid decline in the price of electronic sensors today makes it cost-effective to equip industrial machines with a large number of these sensors that make them increasingly able to analyze their environment, react, and interact with each other and with us. At the same time, lower costs of storing and processing data are enabling us to harvest massive amounts of data from industrial equipment and to process it with increasingly advanced analytics, generating insights that allow us to operate the equipment more efficiently. The Industrial Internet allows us to shift from reactive to preventive maintenance, fixing machines before they break, dramatically reducing unplanned downtime, and raising the efficiency of individual machines as well as entire systems: reducing delays in hospitals or air traffic, increasing the efficiency of power distribution.<sup>2</sup>

**The second driving force is Advanced Manufacturing. At the core of Advanced Manufacturing is a digital thread that links together design, product engineering, manufacturing, supply chain, distribution, and remanufacturing (or servicing) into one cohesive and intelligent system.** This encompasses new production techniques like additive

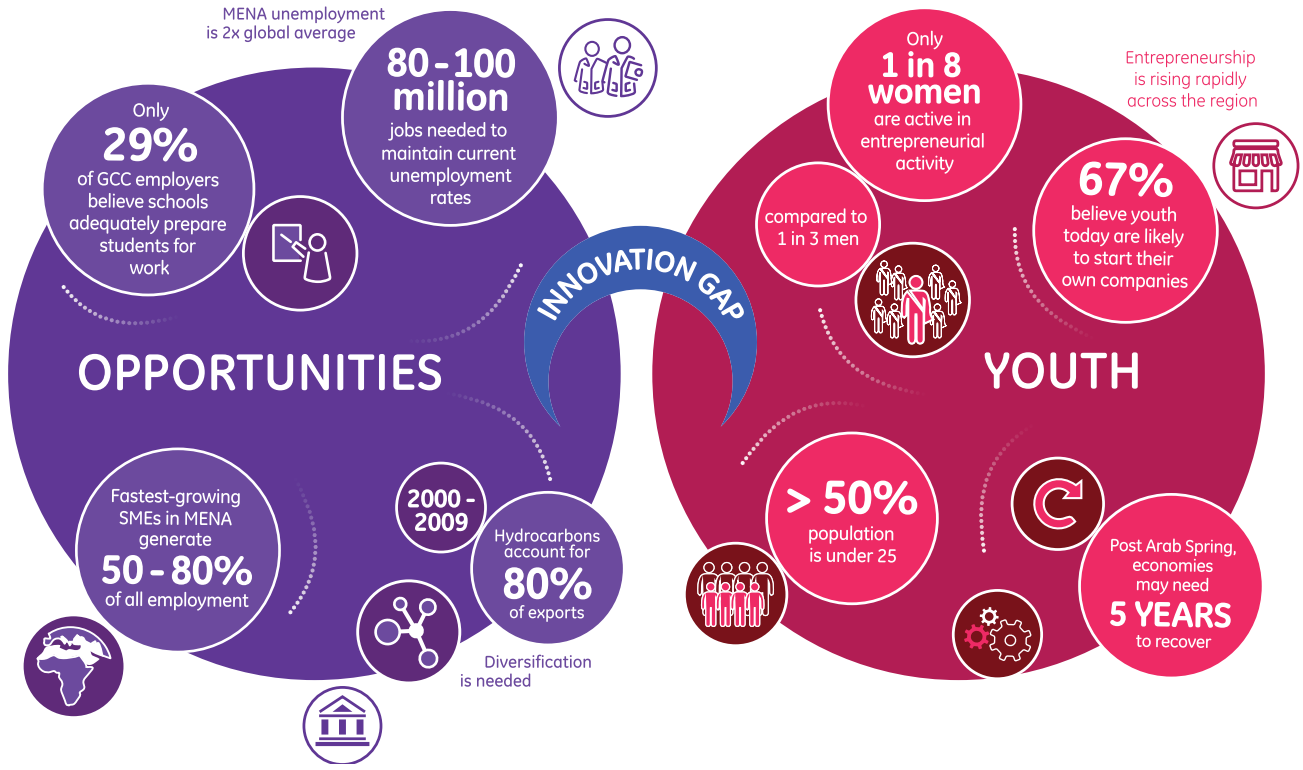
manufacturing, or “3D printing”, which allow us not only to create completely new parts and products with new properties, but also to accelerate the cycle of design, prototyping, and production. Engineers today can “print” a prototype, test it, adjust the digital design as needed, and reprint an improved version—all using the same additive manufacturing machines. This translates to increased speed and flexibility of production, at lower costs. Moreover, the digital thread connecting all aspects of the manufacturing process also allows real-time adjustments to the production process and to supply and distribution logistics.

**The third driving force is the Global Brain. This is essentially the collective intelligence of human beings across the globe, integrated by digital communication networks.** Many of us take for granted the ability to cooperate seamlessly with colleagues in different locations via email, cloud-based file sharing platforms, and tele- and video-conferencing. Today, open-source platforms and crowd-sourcing are quickly emerging as the most effective ways to unleash the creativity and entrepreneurship potential of the Global Brain. Individual companies are starting to gain expertise that extends well beyond their four walls, accessing a larger pool of talent which can vary depending on the problem at hand. Companies gain flexibility. Workers, on the other side, gain greater entrepreneurial control over their skills and talents. The Global Brain will gradually redefine the relationship between employers and employees, to the benefit of both. The process will be magnified as global economic growth brings to millions more people both connectivity to the Internet and the time to take advantage of it. Better access to clean water, food, and healthcare will free up precious hours, while improving health and longevity.

**The Future of Work is shaping up to be a powerful accelerator for the traditional innovation process.** The digital world has long enjoyed the benefits of Moore’s Law, manifested in exponential growth of cost-adjusted performance. As digital and physical become intertwined,

<sup>1</sup> Annunziata, Marco and Stephan Biller, “The Future of Work”, GE White Paper, April 2014.

<sup>2</sup> See Annunziata, Marco and Peter Evans “The Industrial Internet: Pushing the boundaries of minds and machines”, GE White Paper, 2012; and “The Industrial Internet @ Work”, GE White Paper, 2013.



some of these benefits will accrue to the world of industrial equipment. Of course, physical machines are still subject to physical laws that impose more binding constraints than in the world of software—but as they become increasingly digitized, the pace at which their performance improves will experience a significant acceleration. The Global Brain will accelerate new discoveries through at least two channels. First, by a sheer increase in the number of people able to participate in the innovation process; second, through the increased scope for collaboration, which makes the Global Brain the human equivalent of High Performance Computing.<sup>3</sup> At the same time, the greater flexibility and speed introduced by Advanced Manufacturing will allow the industrial system to quickly adapt and translate new innovations into new technologies deployed across sectors.

**Innovation is disruptive, and faster-paced innovation will be even more so. It will present new challenges for individual companies.** And it will have painful short-term costs in segments of the labor market, as some jobs will be displaced and some skills made obsolete. **But for companies and individuals alike, innovation will also be a major source of opportunities,** opening up new markets and careers. At a time of persistently low economic growth and high unemployment, it is natural to feel threatened by the added challenges that innovation brings. But today, innovation is the primary force that can ensure sustainably higher growth in jobs and incomes. And in an increasingly globalized economy, embracing the disruptive forces shaping the Future of Work will be essential to remain competitive and take advantage of the rapid growth of global markets. ■

<sup>3</sup> High Performance Computing leverages the power of “clusters” of interconnected computers, referred to as “nodes”. The coordinated computing power of the nodes delivers much higher performance, enabling it to solve large-scale high-complexity problems in business, science, and engineering.

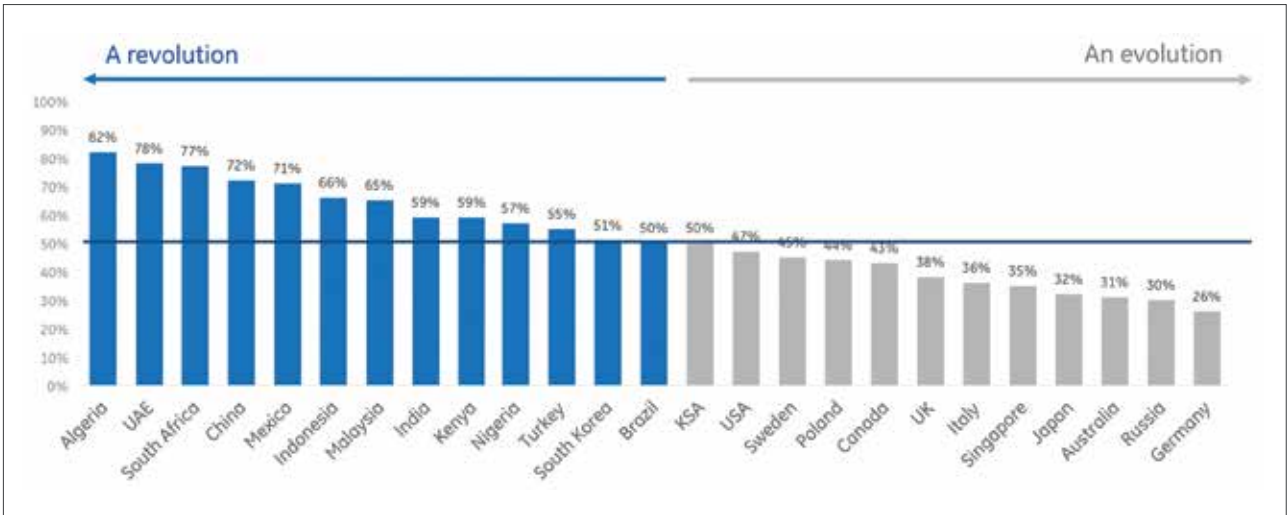


# WHAT THE FUTURE OF WORK MEANS FOR MENAT

A number of business leaders in MENAT countries are well aware of how powerful this transformation is. The 2014 GE Global Innovation Barometer surveyed senior executives actively involved in their companies' innovation strategy. In the survey, which spanned 26 countries, Algeria and the

United Arab Emirates (UAE) ranked at the very top of those who consider this new wave of innovation a true revolution, rather than just a gradual evolution. Turkey also ranked above the median, with the Kingdom of Saudi Arabia (KSA) taking a more balanced view.

Figure 1: Are we facing a new technological revolution or an evolution?



Innovation is always disruptive, and the waves of innovation brought forth by the Future of Work could be the most disruptive we have seen in a long time, for a number of reasons: they are pervasive and broad-ranging, affecting a wide range of economic sectors. They will profoundly change the way we work, transforming job scopes and the skills required. In the process, they will change job opportunities, with a powerful impact on employment and income levels, on equality, and on sustainability.

MENAT countries should embrace these innovations as an unprecedented opportunity—more so than most other regions. The countries in the MENAT region have enormous potential, but they are contending with very significant challenges, some of which have proved arduous to

surmount for an extended period of time. **The status quo is not good enough for MENAT; disruption of the status quo should be leveraged as the opportunity to boost productivity, establish a new competitive advantage, and lay the basis for stronger and more sustainable growth.**

The region has already begun to embrace these new trends. GE's Innovation Barometer shows that Algeria, Turkey, the UAE, and the Kingdom of Saudi Arabia rank among the top eight countries that have seen **an increase in revenues and profits generated by collaborative innovation activities—and the share of respondents acknowledging such an increase was extremely high, 70-80% in each country.**



## GE Innovation Centers, the 'Industrial Incubators'

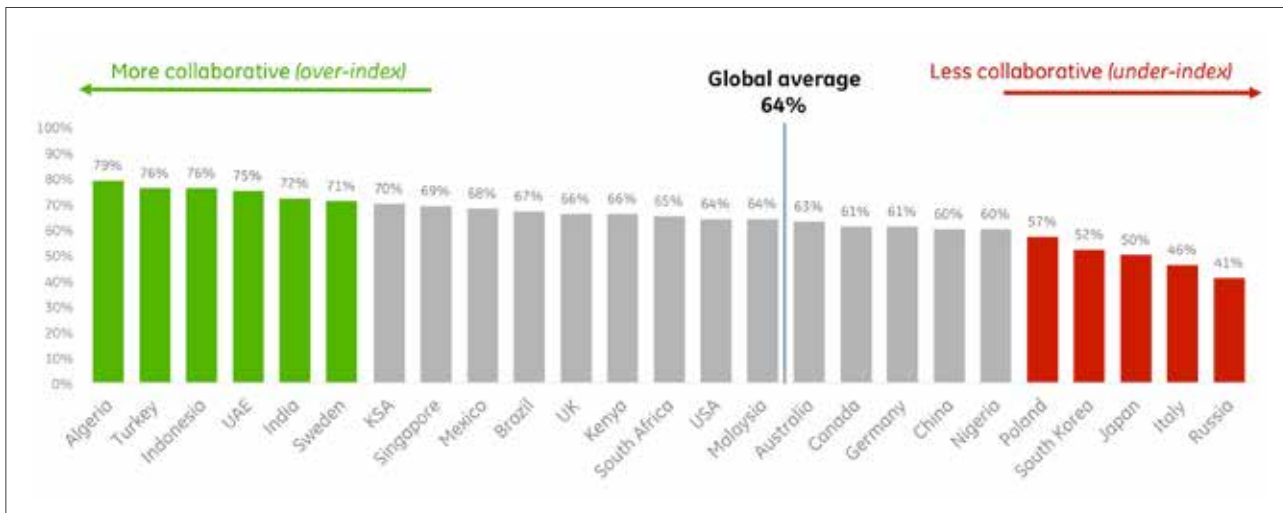
Something new and exciting is happening that is slowly but undeniably changing the innovation landscape across the world, and MENAT is a part of that change. Collaboration is replacing go-it-alone strategies. Open sourcing is phasing out isolated efforts. No more is a solution designed in a remote lab in one part of the world pushed as the answer for a different environment with vastly different needs. An increasing number of organizations and individuals are realizing the value of partnerships to foster localized innovation, diversify, expand, and spur growth. GE's Ecomagination Innovation Center in Masdar City, Abu Dhabi, and the Saudi GE Innovation Center in Dhahran, Saudi Arabia, epitomize this transition.

The Saudi GE Innovation Center follows a strategic agreement signed by GE and King Fahd University of Petroleum & Minerals (KFUPM) to build a full-fledged GE customer innovation center and office in Dhahran Techno-Valley. It focuses on co-creating local solutions, with customers, universities, and industry organizations, to address the Kingdom's priorities in driving cleaner and more efficient energy solutions, as well as sustainable and affordable healthcare solutions.

It features laboratories, training rooms, and an interactive customer experience. In Abu Dhabi, the Ecomagination Innovation Center is part of a strategic cooperation agreement between GE and the Mubadala Development Company. It combines GE's legacy of innovation with Masdar's pioneering efforts to create a collaborative environment to advance efficiency and productivity in various sectors.

More than 1,100 people, including entrepreneurs, scientists, academics, policy makers, and others have visited the Centers and 370+ people have been trained on state-of-the-art products and services related to sectors of prime importance to the region. By providing a space for multiple actors to work together, share knowledge, collaborate, and co-create, the Centers act as *industrial incubators*, promoting localized solutions to regional challenges. In doing so, they contribute towards building the region's collaborative innovation ecosystem, support the shift to manufacturing and knowledge-based economies, fast track the growth of SMEs and entrepreneurship, and develop the local talent pipeline.

Figure 2: Percentage of companies that have seen an increase in revenues and profits driven by collaborative innovation activities





GLOBAL BRAIN

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BUILD

مع المملكة لتعزيز  
القاعة في  
العربية السعودية

GE works with the Kingdom  
development of lead

تقنية إنتاج الكهرباء

Powering infrastructure

تقنية إنتاج الكهرباء  
Powering infrastructure



AQUIFERS

200 YOU KNOW  
45%  
17%  
85%  
GENERATE YOU KNOW



## The importance of supply chains

As highlighted in the previous section, a fundamental characteristic of Advanced Manufacturing is the digital thread connecting design, production, supply chains, and distribution networks. And together with the Industrial Internet and the Global Brain, the innovation wave of the Future of Work is centered on collaboration and ecosystems.

Supply chains have become increasingly global, in line with the globalization of the world economy. At face value, this makes sense: manufacturers should look for the best quality/cost ratio with as few constraints as possible. However, geographically dispersed supply chains are vulnerable to geopolitical, environmental, and operational risks that can often be difficult to monitor; moreover, they can imply significant transportation costs. **A more localized supply chain** can lower costs and reduce delivery times; additionally, it can create a closer dialogue between the different elements of the supply chain, guaranteeing faster reaction and adaptation to changing conditions, and can help innovation accelerate, as suppliers gain a better understanding of their customers' needs and priorities, and companies gain a better understanding of their suppliers' abilities, strengths, and weaknesses. Last but not least, the growth of a local supply chain helps build human capital and create jobs.

**Within the MENAT region, fostering the creation of more articulated and cohesive supply chains and ecosystems could be especially beneficial.** MENAT countries have different comparative advantages: while some benefit from a rich endowment of natural resources, others have already developed more diversified economies. Existing large industries in the region can act like a magnet: oil & gas, aviation, and transportation require high-quality inputs

and Advanced Manufacturing can allow new producers to begin providing some of these inputs by establishing micro-factories, leveraging the Global Brain to complement the available supply of local talent. Over time, this would foster the buildup of local human capital, allowing the local supply chain to grow further. Localized supply chains can function as ecosystems, facilitating the exchange of information and know-how, including as workers rotate through different companies in their career progression.

In addition, **local supply chains can serve as incubators of innovation:** successful innovation cannot happen in a vacuum, it relies crucially on the cycle of design, prototyping, testing, and customer feedback. In Gulf states such as the UAE and Qatar, significant investments have already been made in terms of building the foundations of an environment that encourages innovation. The Global Innovation Index 2014 ranks Qatar and the UAE first and second respectively (out of 143 countries) on the creation of innovation linkages. Looking forward, this foundation promises to translate into an acceleration of innovation and entrepreneurial activity, boosting the prospects of the region's technology sectors. The same index ranks Qatar and the UAE 114 and 127 respectively, on the innovation efficiency ratio, suggesting the scope for further improvement.

The new possibilities presented by the Future of Work, such as small-scale experimentation without the need for large initial investments, micro-manufacturing to meet the demands of local industries, and the open sourcing of ideas, could help these economies make the most of this foundation by presenting faster avenues for the creation of new high-tech products and exports.



## Shifting attitudes to win

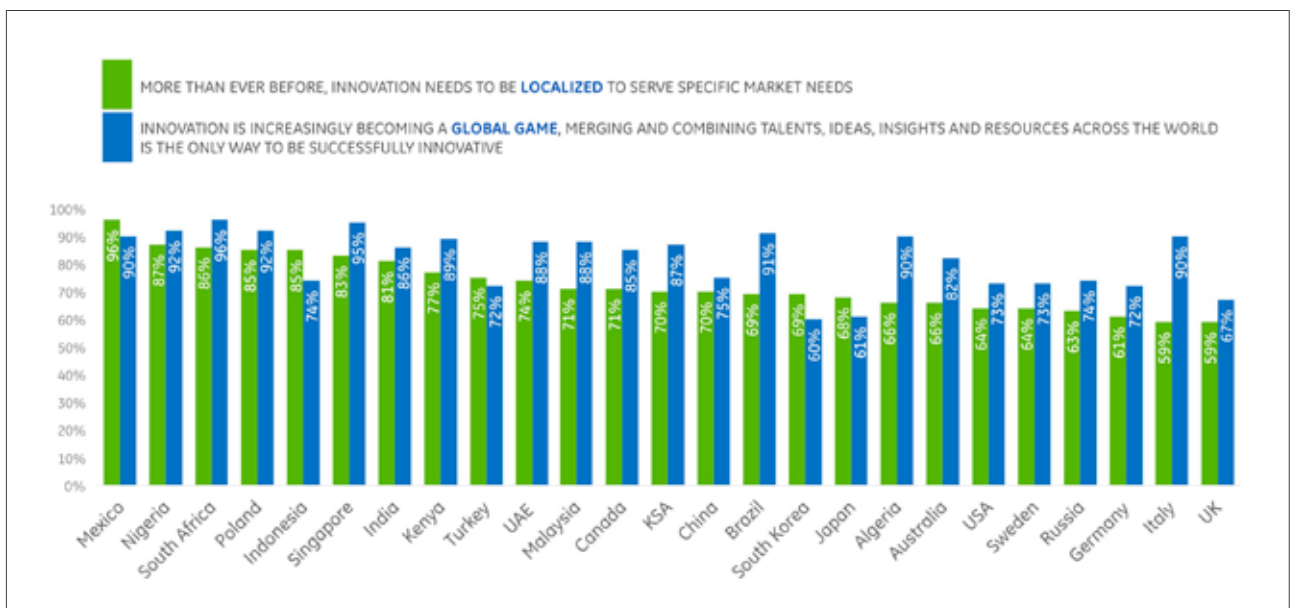
This, however, will also require a change of strategy on the part of governments: they will have to shift from being primarily producers and employers to being customers and enablers. To gain the benefits of the Future of Work, the most important role for governments will be to create the conditions that facilitate the rapid expansion of these new capabilities and technologies. This is especially true in oil-rich Arab states where the manufacturing and industrial sectors are driven by large public sector organizations. Some of that transformation can be accomplished through innovation within state owned enterprises, but it must also include creating an economic structure within which small private companies can be launched and turn into suppliers for various products and services. This requires simplified processes for starting a business, clear commercial law, and the protection of intellectual property to promote innovation and the deployment of new technologies.

**Fostering greater regional (and global) trade integration would also be highly beneficial, and would accelerate progress in shifting towards more knowledge intensive, higher value-added economies. Recent IMF studies**

**indicate that MENA exports are only about one third of their potential, with less integration in global supply chains than any other emerging region; and that raising the region's trade openness to Asia's levels could add about 1pp to growth. Actions to achieve this change should include fundamental trade facilitation measures-such as more transparent, efficient and predictable customs procedures-as called for in a recent WTO agreement on the subject. It should also include active trade barrier elimination between countries of the region, so that the business community is incentivized to make greater overall investments in the region, including greenfield investment. It would also help to drive entrepreneurs to the highest levels of competitiveness.**

Businesses in the MENAT region understand the power of globalization: in GE's Innovation Barometer, MENAT countries have some of the strongest percentages of respondents who believe innovation has become a global game - at about 90% in Algeria, the UAE, and the Kingdom of Saudi Arabia. Trade, the Global Brain, and Advanced Manufacturing are powerful engines of globalized innovation.

Figure 3: Innovation as a global game



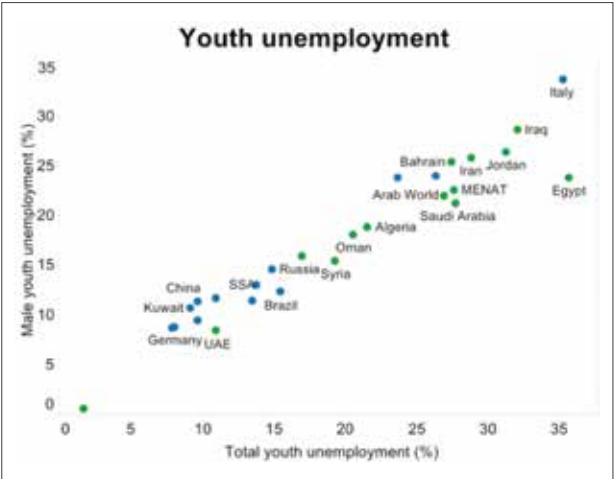


With innovation becoming both increasingly local and global, we must address its impact on job creation and localization. Every government's priority is job creation. In an effort to achieve this goal, governments are increasingly conditioning market participation through fixed levels of local content. The end result of such measures, widely implemented, is a set of Balkanized, rather than integrated, markets. A recent study by the Peterson Institute in the US highlights this fact, and suggests a number of alternative pro-market approaches by which governments can increase investment, GDP growth, and job-creation. The three forces behind the Future of Work require global and regional cooperation in the flow of ideas, services, and goods.

Future of Work innovations can also be instrumental in what is probably the most important and pressing challenge in the MENAT region: to provide rewarding career opportunities for a young and fast-growing population. Today, many MENAT countries have high rates of unemployment and, more importantly, very high rates of youth unemployment. As Figure 4 shows, youth unemployment rates in the MENAT region are well above those prevailing in other regions such as Asia, Latin America, and Sub-Saharan Africa—though, to put things in perspective, they are still below the rates in Italy and even more so in Spain, which is literally off the chart.



Figure 4: Youth unemployment rates (%)



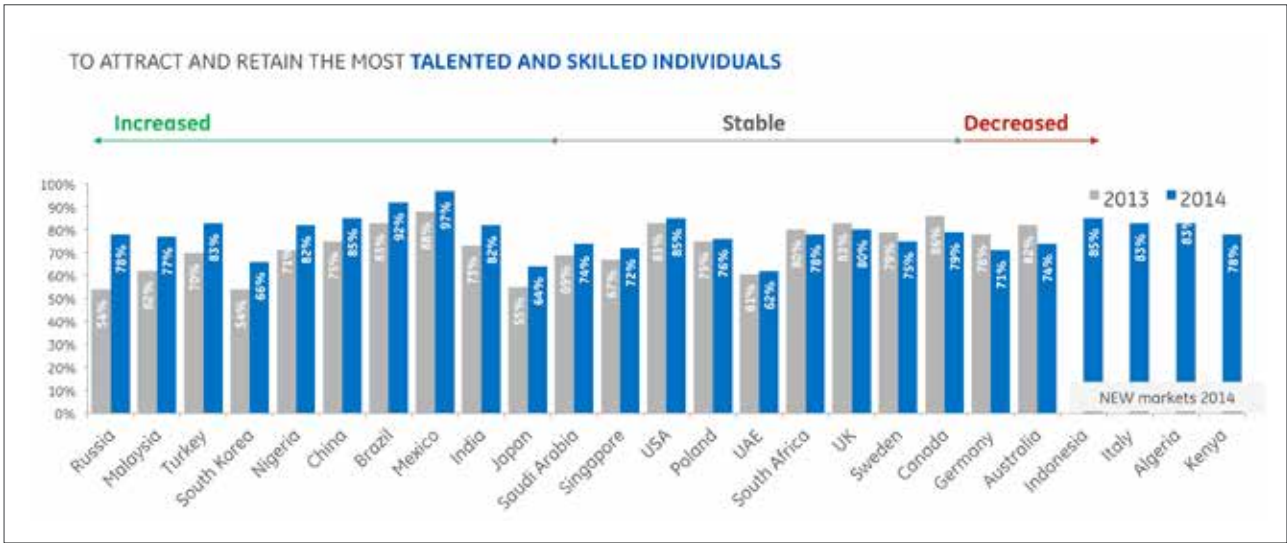
Youth unemployment is not just a potential source of social instability; it is, first and foremost, a terrible waste of resources. Unemployed youth are missing the opportunity to build up skills and experience, and to bring their contribution to the growth of the economy. Today, it is still governments that step in and try to fill the gap, providing jobs. The public sector is a large employer in many of the region's countries, accounting for a greater share of total employment than in other regions. This creates a self-feeding spiral: with governments often acting as employers of first resort, many young people have tended to prefer public employment to private sector employment, and the education system often tended to favor skills that enable entry into the public sector. There is no doubt that having smart, well-qualified young people in the public sector



can have a very positive impact, especially if they work in a sector of the public administration that has a powerful effect over the entire country. The picture is different, however, when this comes at the expense of private sector job growth. In a recent cross-country study, the IMF has found that higher levels of public sector employment are correlated to lower levels of private sector employment and not with higher levels of total employment. In other words, public sector employment often just displaces private sector job growth. **However, it is interesting and encouraging to note that recently this trend is shifting, as seen in the Sixth Annual ASDA/A Burson-Marsteller Arab Youth Survey. Entrepreneurship is rapidly rising across the region with more Arab youth-67%-likely to start a business than in the previous generation.**

Finally, governments will have to strengthen the education system, with an emphasis on science and engineering, as well as flexibility and problem solving—a close partnership between schools and industry could play a fundamental role in this regard. **Companies will also need to become ever more aware of the importance of attracting, retaining, and fostering talent in order to succeed.** In some MENAT countries, awareness is rising already: in GE’s Innovation Barometer, Turkey saw one of the largest increases year-over-year in the percent of respondents that feel successful innovation is driven by the ability to attract and retain the most talented and skilled individuals.

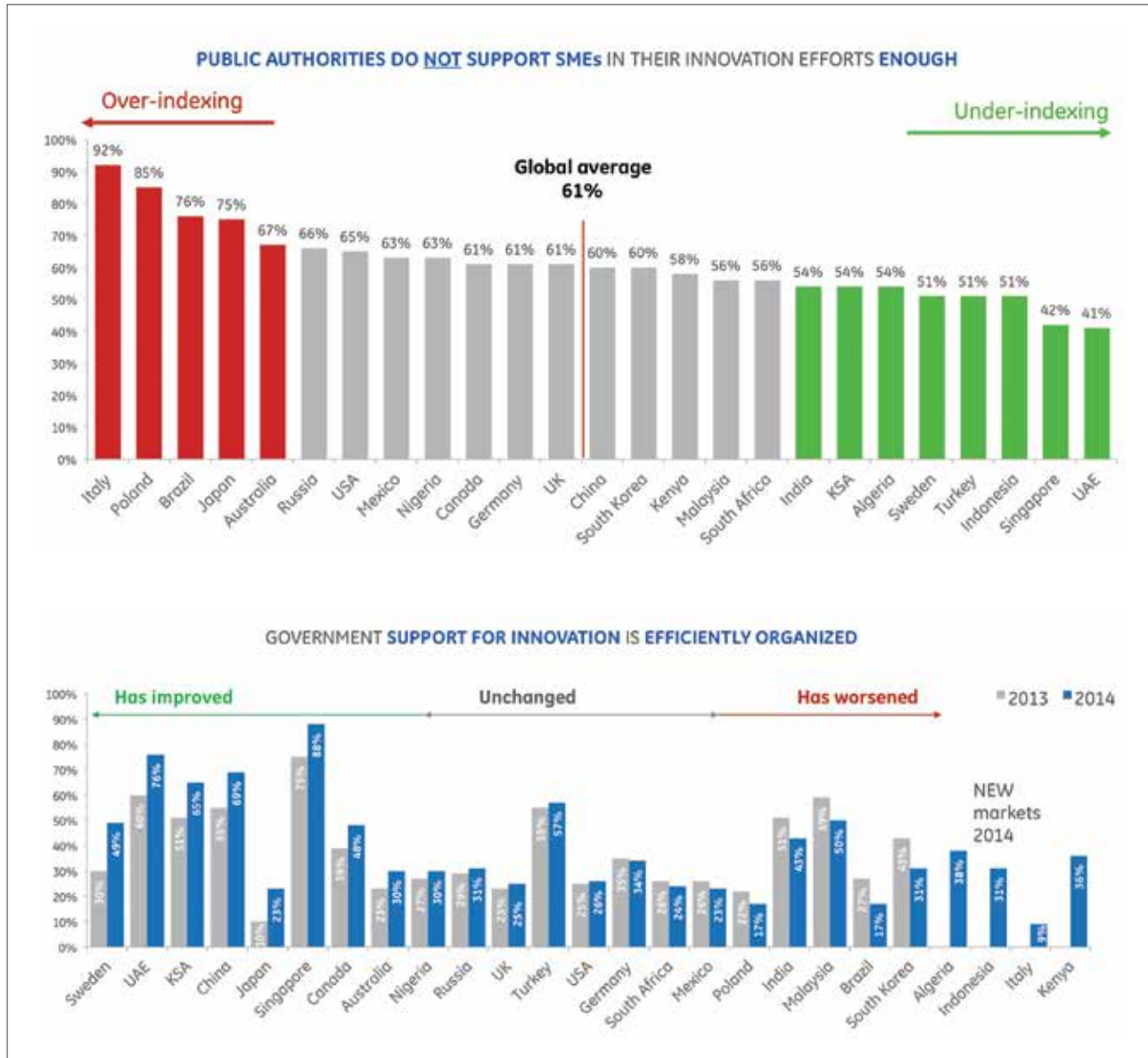
Figure 5: **The importance of talent**



Governments will need to do a lot more, but they have already started: in KSA, Turkey, Algeria, and the UAE, respondents to our Innovation Barometer rank the government highly in terms of public support of innovation efforts of SMEs; moreover, KSA and the UAE saw a rise in the share of respondents who believe government support for innovation is effectively organized.



Figure 6: Government support to SMEs and innovation

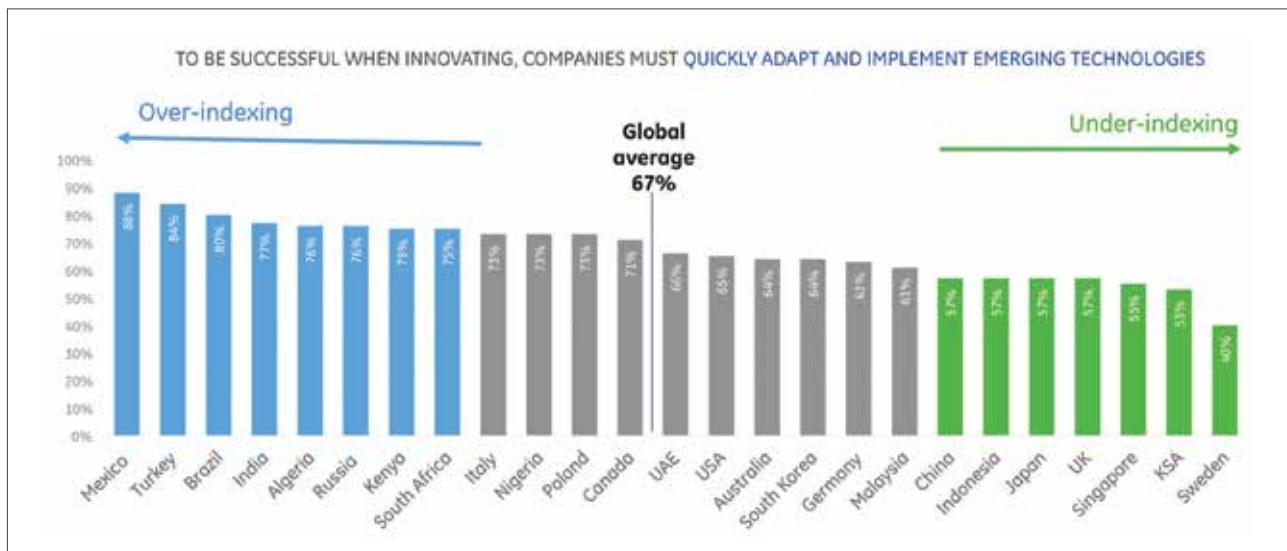


In some countries, the transformation to enable the Future of Work will also require a change of attitude in the private sector: GE's Innovation Barometer shows that some MENAT countries are already very attuned to the power of creativity and innovation, and to the fact that Future of Work innovations will open important opportunities for domestic players; in other countries, however, the attitude is much more cautious. Turkey and Algeria stand out as among the most innovation-ready countries in the region, based on the Innovation Barometer's results: both rank among the top five countries measured (80%+ respondents), stating that countries must encourage

creative behaviors and disruptive processes in business. They are also among the top five groups of respondents stating that countries must quickly adopt emerging technologies to succeed, with 84% and 76% of respondents respectively. Moreover, executives in both Turkey and Algeria believe that large national companies can play as important a role as multinationals in driving the innovation process. By contrast, executives in KSA and the UAE see multinationals as playing a much stronger role in innovation; also, KSA ranked second to last in believing that fast adoption of emerging technologies is essential to a country's success.



Figure 7: **Quick adoption of new technologies as key to success**



Governments also need to bolster the necessary infrastructure, notably in terms of communication and data networks, transportation, and energy distribution. One example is the widespread adoption of 3G services and the introduction of 4G services in a growing number of countries across the region (Algeria and Pakistan, for example, will introduce the technology in 2015). By allowing

state-of-the-art communications services, these nations have opened up access to the benefits of the Industrial Internet and big data through mobile apps which enhance efficiencies in factories and plants in unprecedented ways. Today, we can intelligently transform vast amounts of operational data into actionable information – accessible anywhere, anytime.

## Diverse challenges and opportunities

The region is very diverse; some challenges are common to most or all countries, others differ from one set of countries to another. The most important dividing lines run across two dimensions: whether countries are energy exporters or importers, and the degree of political, social, and institutional stability. Based on this, we can identify three broad groups of countries; in the remainder of this paper we will discuss how the Future of Work can help each group.

### Next frontiers: Democratization of manufacturing

A first group includes countries where oil production is either small or non-existent, but where significant progress has been made in improving the business environment and strengthening policy frameworks, fostering a more diversified economy. This group includes countries such as Turkey, Morocco, Tunisia, Egypt, Pakistan, and Jordan. For these countries, further diversifying and strengthening the growth base is a long-standing challenge, particularly in cases where oil imports are a significant burden on external and fiscal accounts. Turkey is a case in point: large energy imports make the country's external current account very sensitive to swings in crude oil prices; in some cases this has

triggered investors' concern and weakened foreign direct investment flows.

Furthermore, the Arab Spring brought to the fore the need for broader economic opportunities and advancement, especially for the region's youth. Today, young people in MENAT are coming up with new business models and are increasingly willing to take on the role of entrepreneurs in the private sector. In Tunisia, for example, the World Bank Group's Doing Business dataset shows that 11,307 new limited liability firms were set up in 2011. For governments in the region, job creation has become the top priority, tied



intricately to maintaining socio-political stability. Adopting technological advancements that can spur economic diversification, build capabilities, and strengthen the manufacturing sector will be key to meeting this goal.

In a situation like this, Advanced Manufacturing techniques can play an integral role in helping entrepreneurs and innovators shift towards an industrial-based economy, diversify, penetrate export markets, create jobs and incomes, as well as ensure financial stability.

**Advanced Manufacturing opens the scope for the “democratization of manufacturing:”** manufacturing at smaller scale, which lowers barriers to entry, allowing small firms and even individuals to launch production of products, or parts and components, with a relatively limited initial investment and in smaller quantities. These new possibilities can be leveraged to identify and fill a niche in a specific supply chain, exploiting proximity to a large producer or the local availability of know-how. Moreover, it can fuel the growth of a new artisanal class, empowered by these higher-technology Advanced Manufacturing tools.

In some parts of the region, most noticeably **Turkey**, the Maker Movement and 3D printing have already taken off. There is tremendous interest in Advanced Manufacturing processes and materials and the expectation that they will foster innovation, and the production and export of hi-tech, higher value-added industrial goods.

**Morocco** has already made important progress in sectors such as automobiles, aeronautics, and electronics; these

are all high-value added sectors where the introduction of Advanced Manufacturing techniques could make production more efficient; in addition, by enabling the creation of distributed micro-factories, Advanced Manufacturing could help create a wider supply chain within Morocco, allowing a broader geographic distribution of the growth benefits accruing in these three sectors. Strengthening the local supply chain would have a number of advantages: it would reduce import requirements, foster the development of local human capital, and accelerate innovation through a network of more flexible local suppliers attuned to the needs of Morocco’s industry. Aviation and automobiles are also two sectors where the potential benefits of Industrial Internet innovations have already become obvious: GE has developed a number of Industrial Internet solutions for aviation, and cars are becoming increasingly intelligent. Adopting Industrial Internet solutions could boost productivity and competitiveness in these sectors, allowing Morocco to increase exports within the MENAT region and beyond.

**Tunisia’s** manufacturing industry already encompasses a number of areas, including electrical and mechanical equipment, electronics, and chemicals. A large number of Tunisia’s manufacturers (close to 2,000) are partially or totally foreign-owned and strongly export-oriented. The make-up of its manufacturing sector makes Tunisia a natural hub for supply-chain excellence; Advanced Manufacturing techniques could give Tunisian enterprises the flexibility and speed needed to be an indispensable and value-added partner to industries globally, and to benefit disproportionately from an acceleration in the region’s industrial growth.

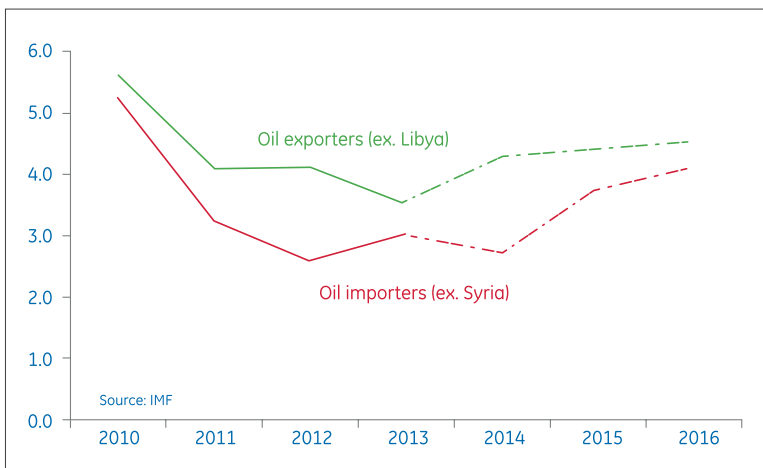
## New growth models: Collaborative innovation and the Industrial Internet

A second group includes countries that are heavily dependent on oil, but have achieved a high level of institutional and political stability: the Kingdom of Saudi Arabia, Algeria, the UAE, Oman, Qatar, and Kuwait. These countries face a different set of challenges.

Commodities will remain a very important driver of growth. Projections of sustained robust growth in large emerging markets, from China to India, imply that

demand for commodities will be well-supported over the longer term. But commodities alone are not enough to generate sustained increases in living standards—indeed, commodities can crowd out investment in other areas, reduce incentives to build human capital, and shift the focus to rent-seeking, subsidies, and redistribution. While MENAT oil exporters are expected to grow significantly faster than oil importers in 2014, the IMF projects that the difference will narrow substantially in the years ahead.

Figure 8: Oil exporters and importers: divergence, then convergence



Oil exporting countries have over time become increasingly dependent on high oil prices. The “fiscal break-even price,” that is the crude oil price needed to balance the budget, has increased significantly in many countries in the aftermath of the global financial crisis, and most countries now need crude oil prices to be in excess of \$90 per barrel. While this is not an unreasonable price level, the volatility mentioned above leaves little room to maneuver in case of sudden price declines; it also leaves very limited room for additional expansionary measures to cushion slow-growth periods or to accelerate

infrastructure investment. This is particularly problematic in cases where the rise in the fiscal break-even price is linked to increases in entitlements and other recurring expenditures.





Figure 9: Change in fiscal break-even price

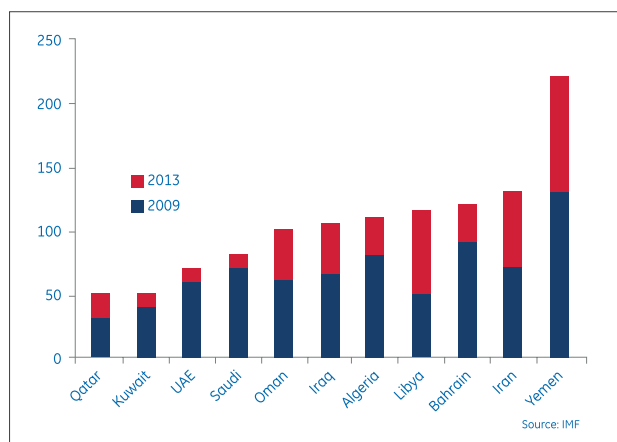
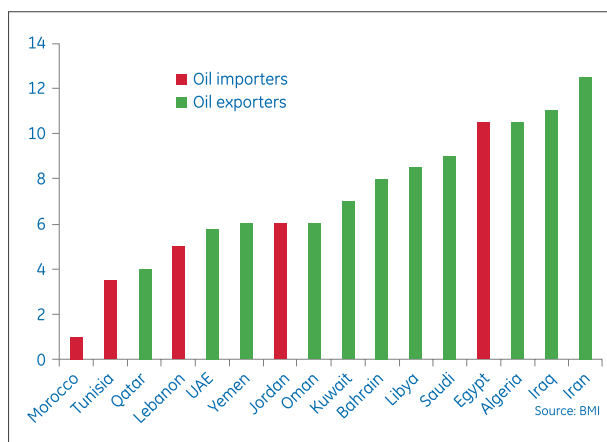


Figure 10: Energy subsidies (% GDP)



Fiscal reform should be a high priority in oil exporters and importers alike, in order to rationalize public expenditures and make sure that government budgets can deploy sufficient resources for infrastructure investment as well as for targeted support to the poorer sections of the population. Energy subsidies are a big part of the picture. Many countries in the region have very generous levels of energy subsidies, aimed at providing income support to the general population. They range from as little as 1% of the GDP in Morocco to as much as over 12% of the GDP in Iran. According to IMF data, the region as a whole spent \$240 billion on generalized price subsidies alone in 2011, largely on energy; this amounts to 9% of the region's GDP, and about one half of total global spending on such subsidies. Besides being a significant burden on public budgets, these subsidies are a very inefficient way of helping the more disadvantaged sections of the population. Generalized subsidies are regressive: since richer people consume more energy than the poor, they benefit more from the subsidies.

While energy subsidies are used across the region, they have become an especially important burden in oil exporters (see Figure 10). The sustainability benefits of Future of Work innovations can be extremely helpful on this front: improving efficiency in energy consumption in transport and industry, and in power distribution, would reduce the domestic consumption of fuel and cut subsidies without imposing an undue burden on consumers.

Industrial Internet solutions can bolster the efficiency

and resilience of oil and gas extraction facilities, and can facilitate and accelerate the exploitation of unconventional resources. This is possible through smart monitoring solutions, advanced data mining, fleet benchmarking, and comprehensive analytics, which enable assisted decision making that extends beyond individual pieces of machinery to cover the full facility.

However, strong mechanisms will have to be in place to address cyber security and intellectual property (IP) concerns before companies, especially state owned enterprises (SOEs) that tend to dominate the oil and gas sector, will be willing to adopt Industrial Internet solutions and share the data that is necessary to do so. GE's 2014 Global Innovation Barometer showed that 73% of respondents in the UAE and 78% in Saudi Arabia thought that it was necessary to reinforce IP to encourage stronger collaboration between companies and efficiently support innovation.

**The employment challenge underscores the need for governments in the region to shift from being producers and employers to being customers and enablers. Governments can help leverage two huge potential benefits of the Future of Work in this respect:**

**First, Advanced Manufacturing techniques can help accelerate the growth of a broader non-energy manufacturing and services sector.** Incubating a Maker Movement along the lines of the one emerging in Turkey could be a way to kick-start the process and generate



enthusiasm. Some micro-factories could serve the oil and gas industry, forming a stronger local supply chain. This would have a number of advantages. Supply chains have become increasingly global, in line with globalization. At face value, this makes sense: manufacturers should look for the best quality/cost ratio with as few constraints as possible. However, geographically dispersed supply chains are vulnerable to geopolitical, environmental, and operational risks that can often be difficult to monitor; moreover, they can imply significant transportation costs. A more localized supply chain can lower costs and reduce delivery times; additionally, it can

create a closer dialogue between the different elements of the supply chain, guaranteeing faster reaction and adaptation to changing conditions, and can help innovation accelerate. Last but not least, the growth of local supply chains helps build human capital and create jobs.

**Second, governments and state owned companies looking to big data to drive productivity and cost efficiencies are gradually embracing the Industrial Internet, for example, in the energy and aviation sectors in the UAE.**

## Intelligent operations for smarter skies

The International Air Transport Association (IATA) predicts that the Middle East will be home to the highest annual international passenger growth during 2013-2017 of any region globally. For commercial airlines in the region, such as Etihad, meeting this growth and reaping the benefits it offers entails not just investments in new aircraft but just as importantly, better flight planning, the optimization of assets, and improvements in aircraft maintenance.

Estimates suggest that a 1% cost reduction from better flight planning and operational changes, 1% cost reduction in capital expenditures through better utilization of existing assets, and 1% improvement in engine maintenance efficiency can help the global commercial airline business achieve annual savings of \$2 billion, \$1.3 billion, and \$250 million, respectively.

To help Etihad reap such benefits, Taleris, a joint venture between Accenture and GE Aviation, is leveraging the Industrial Internet to increase the airline's overall operational efficiency. It is providing web-based prognostics technology to predict potential aircraft maintenance faults and recommend preventative action for Etihad's fleet of 100+ aircraft. The results include reduction of unscheduled maintenance, fewer delays and cancellations, increased aircraft availability, enhanced on-time performance, increased maintenance efficiency, reduction in maintenance costs, and higher revenues.

As Etihad continues to expand its services, these results will be instrumental in helping it meet its goals of turning Abu Dhabi into a global aviation hub, and lowering the costs of connecting and carrying people and cargo throughout the region and beyond.

**For this to materialize and achieve scale, governments will need to shift gears.** They will need to be willing to reduce the role of state owned enterprises, which today often play a dominant role in industry and manufacturing. They will have to further improve the business environment, to make it easier for start-ups to launch and break into

consolidated sectors, where they will play a disruptive role. Regulations will also need to be adapted. Advanced Manufacturing techniques can deliver parts and products of the highest quality; and micro-factories can operate at the same quality standards as established larger companies. Smaller enterprises, however, will always struggle more to



mobilize resources to cut through red tape. Governments could help by simplifying regulation so that quality and compliance can be verified rapidly and with minimum interference on operations.

**Education and training is another priority area, and one where oil-exporting MENAT countries start at a disadvantage.** While traditional education metrics can be relatively high, the education system is not focused on the skills demanded by industry. As governments have long acted as the main and preferred employer, the education system has responded by focusing on skills most likely to secure a public sector job. **Strengthening the education system should focus on three pillars:**

- **First, a greater emphasis on science, technology, engineering, and mathematics (STEM).** Rapid innovation and the merger of the digital and physical worlds are creating a reality where a higher level of basic “scientific literacy” should be considered as essential as reading and writing skills.
- **Second, a closer dialogue and coordination between schools and industry.** The growth of manufacturing in

the region will create valuable job opportunities at all levels of the skills distribution—for university graduates, but also (in some cases especially) for people with lower-level degrees and readily applicable skills. A closer dialogue will give schools and students a better sense of the job opportunities available and it will give firms the possibility to help shape education and attract the right talent. This would result in a better alignment of skills supply and demand.

- **Third, flexibility and a focus on problem-solving abilities.** The rapid pace of innovation of the Industrial Internet and Advanced Manufacturing will quickly change the workplace, and this change will be ongoing. It is very difficult now to fully anticipate all the new job opportunities that will be created by innovation in the years ahead. The education system should therefore maintain sufficient flexibility to adapt, and students should acquire the flexibility necessary to evolve as the workplace does. And problem-solving abilities and creativity will increasingly be at a premium as innovation broadens the range of tasks that can be more efficiently performed by machines.

## Growth in volatile environments: Enabling local progress

The third group includes oil producers that are still struggling with a very volatile political situation, notably Libya and Iraq. The top priority for these countries is to achieve political stability and strengthen political and social institutions, so as to be able to focus on economic progress in a more peaceful and stable environment.

It is however important to fully think through an economic development strategy already at this stage, because political and social stability and economic development are mutually reinforcing. As political stability is achieved, rapid economic progress will be instrumental in fostering social cohesion, creating jobs, reducing unemployment, and fueling a fast-paced increase in living standards; this would help the growth of a middle class, which in turn is extremely helpful in ensuring that social stability becomes self-sustaining.

**Even while the situation remains volatile, making increased recourse to Advanced Manufacturing techniques could**

**introduce a higher degree of flexibility useful to bypass the current challenges.** For example, the ability to produce locally, on a small scale, specific critical components for industry would limit vulnerability to import disruptions—today, most supplies have to be flown into these regions, which is associated with high transportation costs as well as considerable bureaucratic red tape. Moreover, large inventories often have to be maintained to ensure the timely delivery of critical products. The greatest scope lies in the supply of relatively simple products (such as fuel nozzles, valves, etc.) in the energy and healthcare sectors. However, the acceptability of locally manufactured products as a viable alternative to imports will have to be built by educating the bureaucracy and customers on these new production processes and establishing strong systems of quality assurance, certification, and manufacturing audits.

**For these countries, oil and gas will be the first pillars of growth, and the first order of business should be to**



**adopt those Industrial Internet technologies that can improve efficiency, productivity, and reliability in energy production. At the same time, there will need to be a strong focus on rebuilding infrastructure, notably on energy distribution, transport, and communication.**

**To quickly improve living conditions, governments may want to prioritize healthcare. Here again, Industrial Internet solutions can be instrumental** to improve the efficiency of the healthcare system, allowing it to deliver better health outcomes at lower cost. In addition, Industrial Internet-enabled portable medicine solutions would allow the healthcare system to more rapidly reach a wider share of the population, including in rural areas.

In a second phase, these countries could follow the example of already stable oil producers, and move to diversify their economies beyond the energy sector. Establishing

a role in local (and global) supply chains should again be a key element of the strategy. In their case, an additional consideration should be that they will likely face a larger number of already established regional players; it will therefore be more important to identify the right niches and develop value propositions that can be complementary to the existing regional ecosystem, or where local national presence is more important.

In this respect, efforts to strengthen the domestic provision of healthcare services would be a way to simultaneously create good jobs and accelerate the improvement in living standards. Advanced Manufacturing techniques could be helpful to establishing local micro-factories that could begin supplying some key components, even if in a first stage the bulk of medical equipment would still need to be imported, given priority to quick delivery of healthcare services. ■

# SUSTAINABLE AND INCLUSIVE GROWTH

**Beyond fostering economic success for individual sectors and countries, Future of Work innovations can help improve living conditions and social cohesion.**

One important element which we have highlighted in previous sections is the role of healthcare. The provision of high quality healthcare services to as broad as possible a share of the population is one of the most important steps to improving living standards. And in turn, better health outcomes have an economic benefit, as they are reflected in a more productive and motivated workforce. Healthcare is one of the sectors where the Industrial Internet can quickly bring substantial benefits. Industrial Internet solutions allow hospitals to better manage their operations, from the admission of patients to the scheduling of medical procedures to the most efficient and safest use of medical equipment. Cloud-based collaborative platforms allow different specialists assisting the same patient to work together in real time, immediately sharing the results of tests and exams and exchanging views. The same technologies allow for the secure storing and rapid accessibility of patient information, regardless of location. All this translates into greater speed and better quality of health outcomes.

**Another important element is social cohesion, which can be undermined by unemployment, lack of opportunities, and excessive inequality in income distributions.** There is a concern that innovation will exacerbate these problems. One fear is that innovation will simply result in more automation, with machines displacing workers from a larger number of tasks. Another is that innovation will prove to be, in economics-jargon, “skill-biased:” the adoption of more sophisticated equipment in industry would raise the value of the highest skills, while reducing that of low and medium skills. If this were the case, it would cause a significant increase in income inequalities. GE’s Innovation Barometer shows that this fear is especially pronounced in the MENAT region, with the UAE and KSA as the second and third most concerned country, and 70% of respondents believing that innovation will increase inequality. Turkey stands out as considerably more optimistic, with just 41% of respondents expressing fear.

**Future of Work innovations, however, can push in exactly the opposite direction, for several reasons.**

**First, by increasing productivity and economic growth,**



**Future of Work innovations will fuel faster income growth, which in turn will support growing demand for a greater range of goods and services.** In a context of rising incomes, it will be significantly easier for entrepreneurial workers to launch new services and products, giving rise to a new range of professional activities—much like many of the services and manufacturing activities that exist today in many advanced economies would have been difficult to imagine twenty years ago.

**Second, as we showed in *The Industrial Internet @ Work*, this new wave of innovation can significantly augment the capabilities of workers at all levels of the skills distribution** by giving them better access to information and more powerful collaboration tools. For example, maintenance technicians will be equipped with portable devices that will allow them to access a database of information, including how-to videos and the documented experience of their colleagues across the company; the same portable devices would allow them to interact via audio and video with colleagues in other locations. This will increase their productivity, and higher productivity would then translate into higher incomes.

**Third, as the Global Brain takes hold, it will give workers much greater entrepreneurial control over their skills and talents.** A young engineer in Tunisia, for example, would be able to test her skills in open source initiatives launched by companies anywhere in the world (like the Indonesian winner of GE’s jet engine bracket challenge). Thanks to the Global Brain, MENAT citizens will have access to more and increasingly flexible options to participate in the labor market. Rather than just having the traditional option of securing a job with a specific employer, they will have the ability to participate in different projects launched by different employers, based on their interests and skills. This will also provide more flexibility both in terms of working hours and in terms of location. This will make it easier for younger workers to enter the labor market, build skills, and gradually build a career.

All this will facilitate the creation of jobs across a wide range of skill levels; and with rising productivity, these jobs will be able to attract rising remunerations. The greater flexibility of the workplace engendered by the Global Brain will create more opportunities, increasing income mobility. More jobs, better incomes, and greater income mobility in turn will alleviate income disparities, and bolster social stability and cohesion.

Reaping these benefits of the Future of Work, however, will require governments to put in place key enabling conditions. First is education: without a strong base, it will be that much harder for young workers to succeed. The second is infrastructure, starting with communication infrastructure: data-driven innovations and collaboration platforms will require a robust and secure data infrastructure. The third is more flexibility in labor markets, to help the creation of job opportunities. And the fourth is the facilitation of the establishment and operation of new private SME businesses.

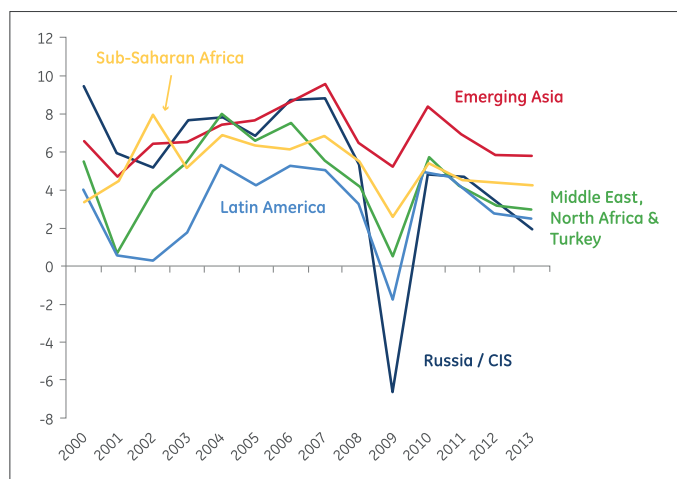
**Sustainability** is another area where Future of Work innovations can be immensely beneficial. The Industrial Internet and Advanced Manufacturing are all about increasing efficiency and productivity: in aviation and transportation, this translates into substantial fuel savings; in power distribution, it will enable a substantial reduction in transmission and distribution losses (an important financial issue that undermines the profitability of utilities, notably in Jordan); the shift to micro-factories allows for a more efficient use of productive capacity; and new manufacturing techniques and the development of new materials help economize on the use of traditional raw materials. This has global implications, as it will lessen the resource and environmental pressures of global growth; for MENAT countries that are importers of oil and other commodities, it will reduce costs of production, improving the profitability of local companies, and reduce the pressure on national external accounts. ■



# THE MACROECONOMIC IMPACT IN MENAT

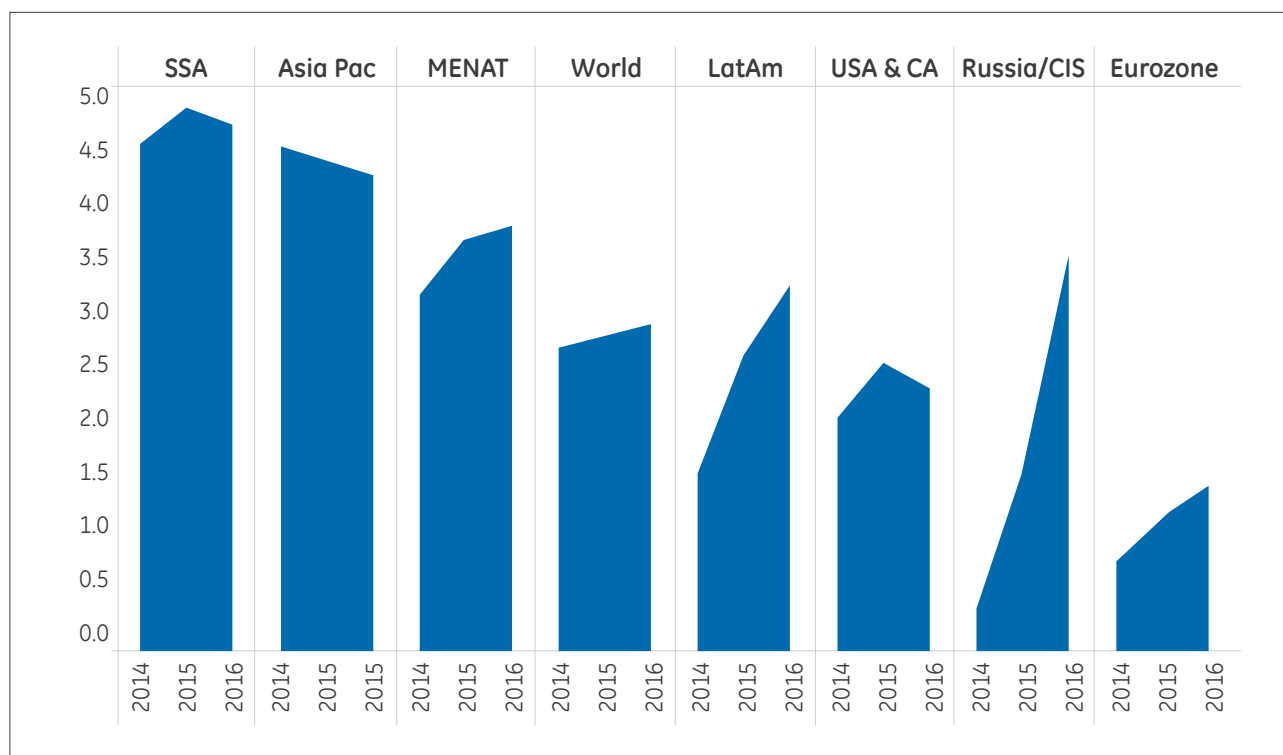
Future of Work innovations could bring a powerful economic dividend—and the region is ripe for it. The Middle East and North Africa region is already among the fastest growing in the global economy, just behind emerging Asia and Sub-Saharan Africa. While MENAT's growth slowed in 2013, in line with other regions, the IMF expects it to rebound to just over 3% this year, accelerating further to about 4.5 % in 2015.

Figure 11: MENAT growth slowed, in line with others



While oil plays a very important role, non-oil sectors are already a significant growth driver also in oil exporting countries. Construction and retail trade have particularly strong prospects, and public infrastructure investment plays a very important role both directly and indirectly, establishing more favorable conditions for additional investment and activity expansion. The Future of Work can enable a further diversification, together with a shift to higher technological content production, which will make growth performance stronger and more resilient. ■

Figure 12: But MENAT remains one of the strongest performers





## CONCLUDING REMARKS

The MENAT region, perhaps more than any other, embodies and exemplifies both the enormous potential of Future of Work innovations, and the hard work needed to turn this potential into reality. Throughout the region, countries face the pressing imperative to provide jobs and rewarding career prospects to their youth, and a sustained rise in living standards to the wider population. Oil-rich countries need to diversify their economies' growth base; oil importers need to accelerate the development of high-tech, high-value added sectors, including to bolster their export capacity; and the few oil-rich countries racked by significant instability, such as Libya and Iraq, need to limit the impact of periodic import supply disruptions while laying the basis for rapid growth once stability is re-established.

The wave of innovation brought forth by the Future of Work seems tailor-made to help MENAT achieve these objectives: the Industrial Internet can boost productivity; Advanced Manufacturing techniques can bring greater speed and flexibility, enabling micro-factories and distributed

manufacturing; and the Global Brain can give workers more and better entries into the labor market, while providing companies with more flexible access to a wider pool of talent. All this can foster the gradual creation of local supply chains and ecosystems, where the larger, more established industries like oil and gas, aviation, and transportation will act as a catalyst for the emergence of smaller, competitive suppliers.

Executives across the region are well aware of the opportunity. In GE's 2014 Global Innovation Barometer, MENAT countries are among those most convinced that we are on the brink of a new technological revolution, rather than just an evolution; and they rank among those that have seen the greatest increase in revenues and profits thanks to collaborative innovation activities. There are many success stories: Morocco has made great progress in developing high-tech, high-value added industrial activities; in Turkey's vibrant economy, the Maker Movement and 3D printing are making rapid inroads.





## I.D.E.A. to build Algerian entrepreneurship and supply chains through open innovation and Advanced Manufacturing

In Algeria, Future of Work innovations are changing the entrepreneurship, innovation, and industrial production landscapes. I.D.E.A. (Industrie et Développement de l'Entreprenariat en Algérie), a path-breaking entrepreneurship and innovation initiative, is helping to find potential suppliers for a recent venture signed between Sonelgaz and GE to develop a new production facility that will produce more than 2 GW of power generation equipment per year. In doing so, the initiative will build a domestic supply chain, nurture a talent pool of Algerian professionals, accelerate job creation, and build capabilities.

What makes the initiative interesting, though, is not just *what* it is doing, but rather, *how* it is going about it. I.D.E.A is an online open innovation challenge, which asks suppliers, start-ups, and entrepreneurs to explore how Advanced Manufacturing techniques such as 3D printing, injection molding, and laser cutting can help them find new ways to manufacture stainless steel parts used in gas turbine combustion systems.

By allowing localized micro-manufacturing, as opposed to traditional industrial production, which required large scale production (and associated large scale initial investments) to achieve economies of scale, Advanced Manufacturing techniques are giving an increasing number of Algerians the opportunity to become part of a changing, localized production ecosystem. Moreover, open access to talent across the country, facilitated by digital communications and the Internet, is allowing organizations such as Sonelgaz and GE to receive a spate of ideas at a fraction of the costs and time that would have been involved under traditional means to explore new solutions.

Together, Advanced Manufacturing and the open sourcing of innovative solutions provide an accelerated route to address today's most pressing technological, economic and social challenges, energize local entrepreneurship, build domestic supply chains, create employment, and improve the standard of living in MENAT countries.

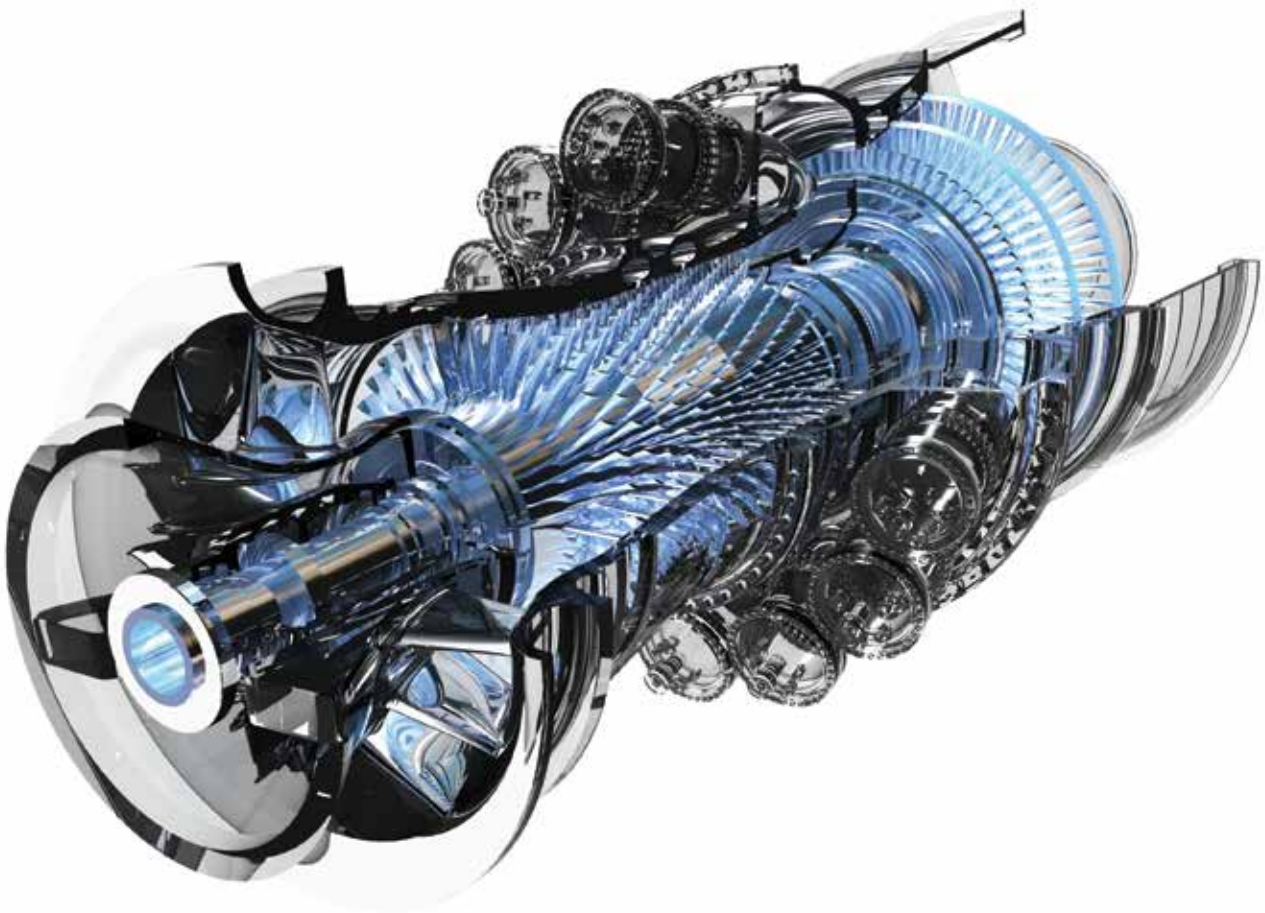




In order to scale these successful examples, public and private actors throughout the region need to do more, starting with stronger investment in education and infrastructure, with particular focus on energy distribution, transport, and communication. Industrial Internet solutions can boost efficiency and productivity both in the healthcare sector and in the oil and gas industry. Most importantly, governments will need to shift from being the primary producers and employers to being consumers and enablers. Private companies, for their part, will need to invest more

in attracting and nurturing talent and, in partnership with the government and other key entities, pave the way for the creation of robust ecosystems.

MENAT has the resources, the enthusiasm, and the right mindset to embrace this new wave of innovation, and turn its disruptive power into rewarding jobs and rising living standards for all segments of the population. The Future of MENAT can begin here. ■



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