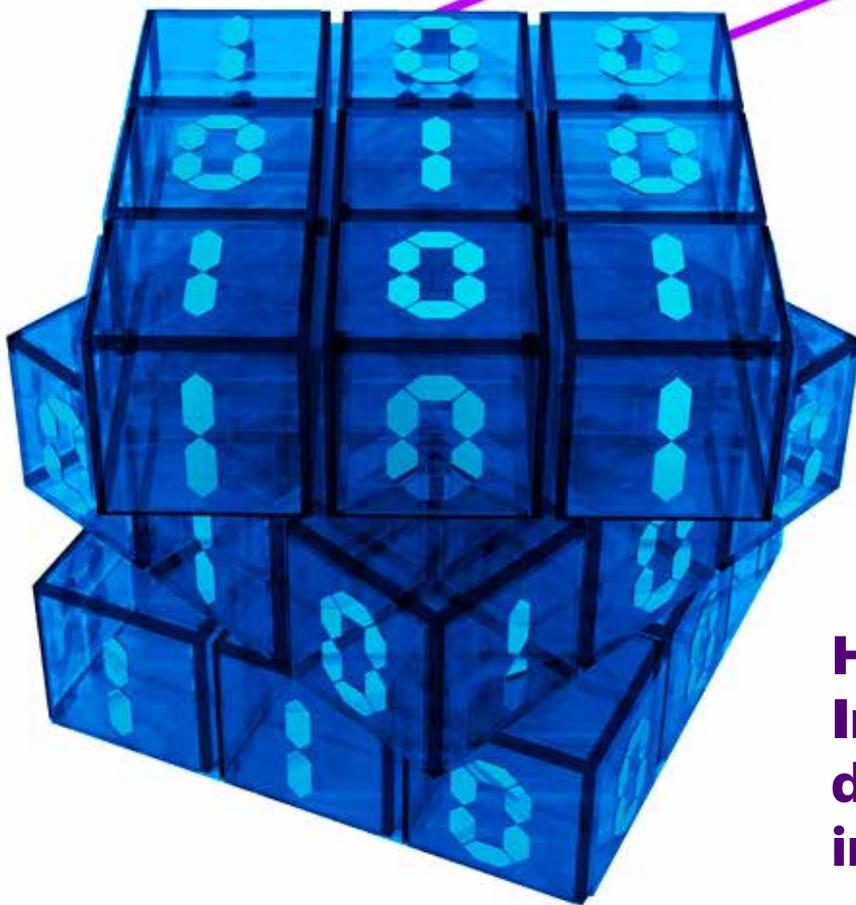


# PIVOTING WITH AI



**How Artificial  
Intelligence can  
drive diversification  
in the Middle East**

Amr Elsaadani, Mark Purdy  
and Elizabeth Hakutangwi

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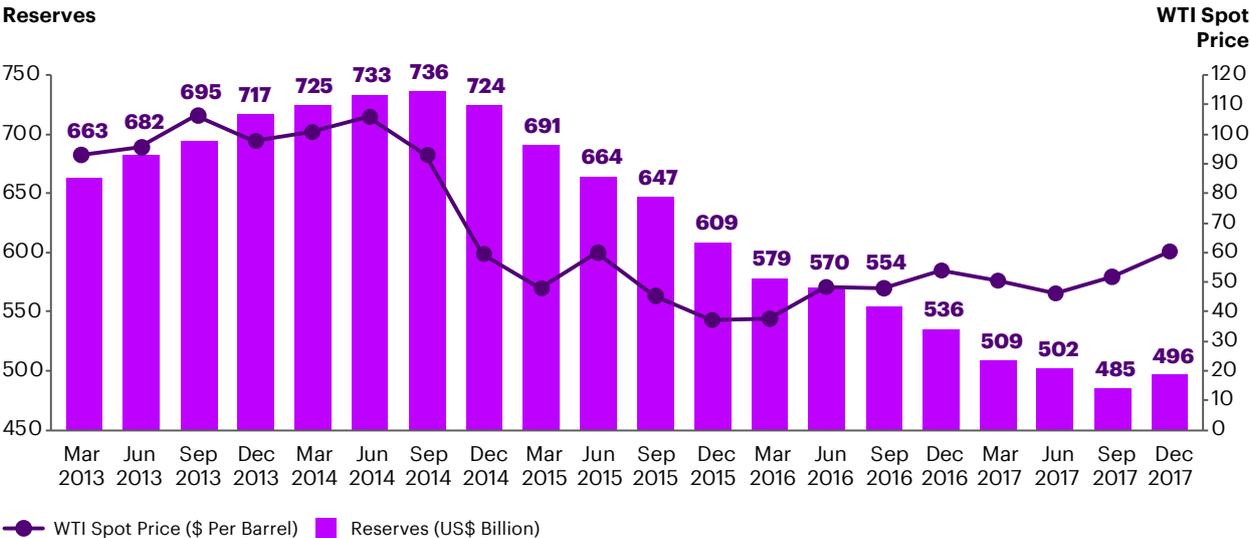


# Saudi Crown Prince Mohammed bin Salman did not mince words: “We have developed a case of oil addiction.”<sup>1</sup>

This was the prince’s terse summation of the central economic dilemma facing the oil-producing countries of the Middle East – their dependence on the energy sector to drive growth – in a 2016 interview with al-Arabiya television.

In Saudi Arabia, for example, the petroleum sector accounts for roughly 43 percent of gross domestic product (GDP), according to an International Monetary Fund (IMF) report prepared for the annual meeting of the Arab Ministers of Finance in 2016, and 80 percent of its export earnings.<sup>2</sup> The kingdom is not alone. The IMF pegged oil’s contribution to GDP growth in the United Arab Emirates (UAE) at 34 percent. The recent steep, sustained fall in oil prices only makes the situation more precarious.

Figure 1: Saudi Arabia economic fortunes closely mirror the oil cycle



Source: Accenture analysis based on Saudi Arabian Monetary Authority (SAMA)

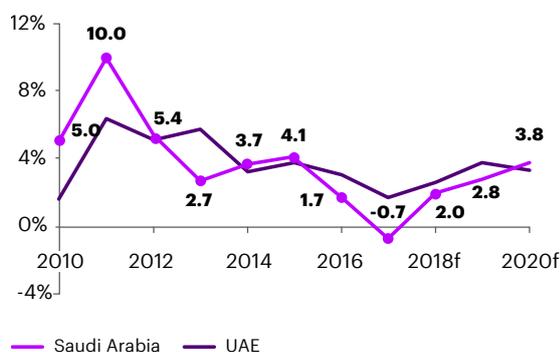
The energy sector will be no more successful at meeting the other critical challenge facing these countries: high rates of unemployment and underemployment, particularly among the region’s youth. A 2017 World Economic Forum study on the future of jobs and skills in the Middle East and North Africa projects that the region’s population, already among the world’s youngest, will grow by a quarter by 2030, a significant proportion of which will be of “prime working age.” Youth unemployment today stands at 31 percent, cautions the study.<sup>3</sup>

## Saudi Arabia: the 4.3 percent solution

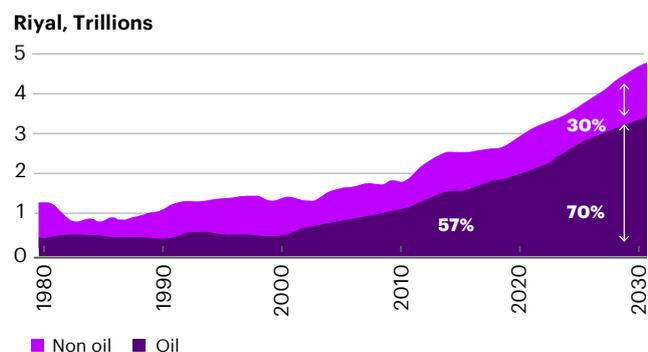
Since the 1990s, the contribution of the energy sector to the Saudi economy has fallen significantly, from almost two thirds of GDP to 43 percent by 2015. But despite recent success in reducing oil dependence, Saudi Arabia’s economic and financial fortunes remain strongly tied to international energy markets—both GDP growth and reserves still closely mirror oil price movements.

The step-by-step deterioration of the kingdom’s position is charted in Figure 1 – beginning in mid-2014 with the slump in oil prices, which created both current account and fiscal deficits. This forced the Saudi Arabian Monetary Authority, hobbled by the country’s fixed exchange rate regime, to draw on the country’s reserves and to issue debt to finance the dual shortfall. Meanwhile, annual real GDP growth has fallen from 10 percent in 2010 to a forecast 2.7 percent this year.

**Real GDP Growth (year-on-year)**



**GDP Composition (oil and non-oil)**



Source: Accenture Research based on SAMA and Oxford Economics

The way out of this bind: diversifying the economy. To achieve this goal, how much should oil ultimately contribute to GDP?

Using a regression equation and GDP time series data from 1980, Accenture Research calculated optimal real GDP, divided between oil and non-oil sectors, to 2030. This modelling reveals that for the kingdom to achieve faster growth and to reduce the strain on public finances, oil’s contribution to GDP must continue to drop – to around 30 percent by 2030. The model further suggests that to do this, the oil industry will need to grow at a compound annual growth rate (CAGR) of just under two percent, while non-oil related industries need to grow at more than twice that rate, a CAGR of 5.8 percent – for a combined GDP (oil plus non-oil) CAGR of 4.3 percent to 2030.

If diversification does not take place at the anticipated rate, and oil prices remain low, the kingdom’s economy will grow at a CAGR of 2.6 percent to 2030, thus missing its ambitious Vision 2030 national development plan targets.

Many of the region's governments have responded with a number of interconnected strategies – chiefly, economic diversification aimed at developing non-oil sectors to provide sustainable growth and employment and reduce reliance on the public sector for jobs; significant upgrades in education and training to prepare the next generation for the jobs of the future; and the streamlining and modernization of regulation and governance.

What all these strategies have in common is an ambitious and comprehensive commitment to artificial intelligence (AI). This emphasis on AI is well founded. According to Accenture analysis, AI has the potential to significantly raise economic growth rates in the region, adding \$215 billion and \$182 billion in annual gross value add (GVA) to the economies of Saudi Arabia and UAE, respectively, by 2035. Moreover, our analysis shows that AI can help address a wide range of economic and social challenges facing the region, ranging from volatility of oil prices, to rapid urbanization, and to water scarcity and food security (See infographic on “The Super Seven: seizing the social dividend of AI”, page 21-24).

Recognizing the potential of AI, many countries within the region are already becoming early adopters of the technology and laying the foundations for a global leader position in the future.

The UAE is a case in point. According to our recent technology vision survey, half of executives are already planning investments in AI over the next year, second only to the internet of things (See Figure 2).<sup>4</sup> In 2017, the Emirates

launched the UAE Strategy for Artificial Intelligence, a major initiative within the country's Centennial 2071 objectives. Among its aims to boost government performance at all levels; it will also encompass nine other sectors, including transport, health, education, environment and renewable energy. Sheikh Mohammad bin Rashid Al Maktoum, UAE vice president and prime minister, called AI “the new wave upon which all our services, sectors and future infrastructure will rely on.” And to drive the point home, the Emirates named a cabinet-level Minister of Artificial Intelligence, the world's first.

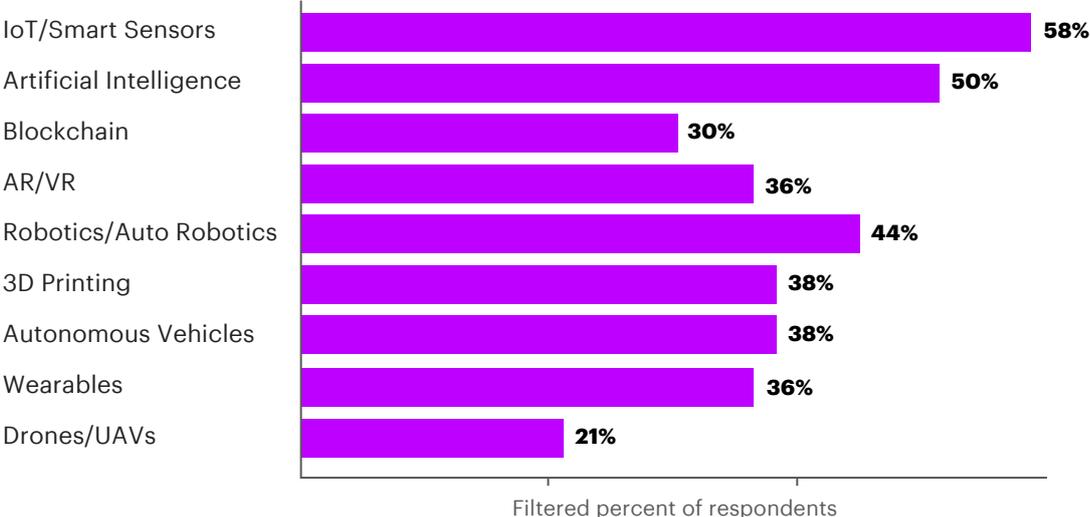
Saudi Arabia has taken equally bold steps toward the post-oil future. At the heart of the kingdom's Vision 2030 national development plan (which is financed by the world's largest sovereign wealth fund) is the technology sector, which is the engine of its diversification strategy. And technology – in government, business, services, industry, healthcare, education – is increasingly enabled by AI.

The clearest sign of this commitment, at least on paper, is NEOM – a planned \$500 billion, 26,500 square-kilometer “megacity”: part technology and R&D hub, part international trade center, part business and advanced manufacturing zone. “Everything will have a link with artificial intelligence and the Internet of things – everything,”<sup>5</sup> Crown Prince Salman told Bloomberg last year. And in a world first, the kingdom granted citizenship to Sophia, a humanoid robot created by Hong Kong company Hanson Robotics.

**Figure 2: Percentage of UAE executives planning to invest in new and emerging technologies over the next year**

**Filtered Sample**

Number of respondents: 111



**Sheikh Mohammad bin Rashid Al Maktoum, UAE vice president and prime minister, called AI “the new wave upon which all our services, sectors and future infrastructure will rely on.”**

# THE NEW FACTOR OF PRODUCTION

## How does AI contribute to growth?

Any discussion of AI and growth must begin by looking at the role of new technologies in the economy, particularly as they affect productivity. Traditional models look at capital and labor – “factors of production” – as the key drivers of economic growth, either through the increase in these factors, their more efficient use or both. In these models, economic growth attributable to innovation and new technologies is captured in “total factor productivity.”

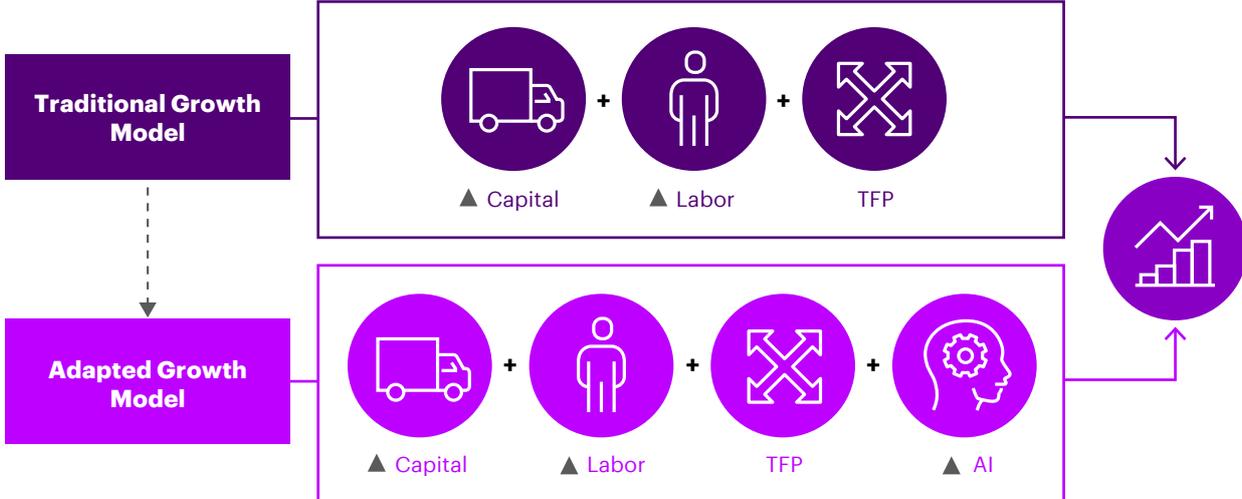
The Accenture growth model treats AI (which is in fact a set of transformative technologies) as a new and discrete factor

of production rather than simply another technology-based productivity enhancer. In this model, AI is a capital-labor hybrid, able to replicate work activities at a much greater scale and speed, often well beyond human capabilities. Another important aspect of AI is machine learning, AI’s ability to learn faster than humans, if not yet as deeply. By using virtual assistants, for example, 1,000 legal documents can be reviewed in a matter of days; it would take three humans six months to complete the same task.<sup>6</sup>

Unlike conventional capital such as buildings and machinery, AI in its physical forms – robots, for example, and intelligent machines – can also improve over time, thanks to its self-learning capabilities.

Figure 3: The AI growth model

Our model adapts the traditional growth model by including AI as a factor of production



▲ Indicates the Change in that factor.

Source: Accenture Analysis

To better understand the effect of AI as a new factor of production in the Middle East, Accenture, in association with Frontier Economics, modeled AI’s potential for the economies of Saudi Arabia and the UAE, in terms of both the rate of growth and the gross value added (GVA is a close approximation of GDP). Because it takes time for the effect of a new technology to be absorbed into the economy, we used 2035 as the year of comparison (see “Appendix: Modeling the GVA impact of AI”).

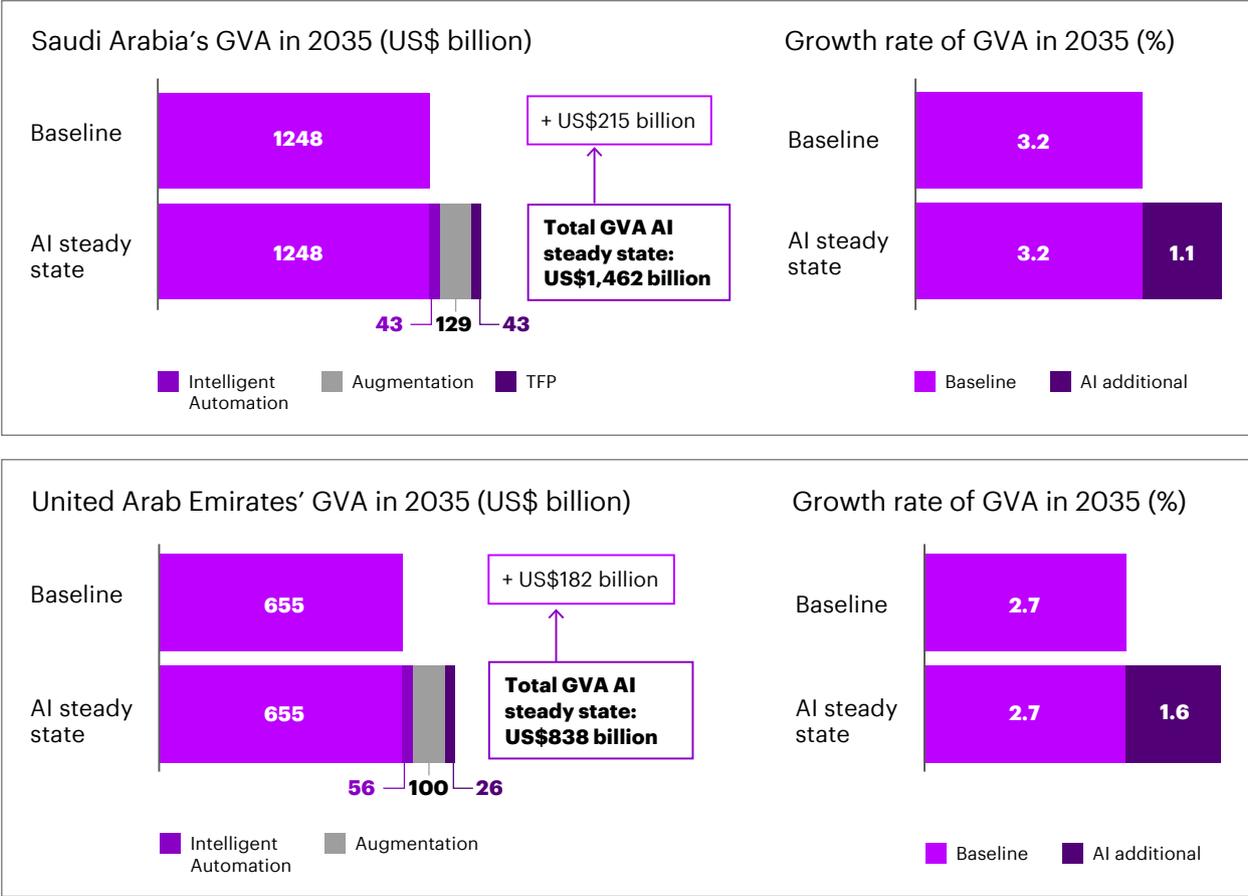
The two sets of graphs below (Figure 4) show growth scenarios for each country, in terms of both the rate of growth and GVA. For each country, the pair of graphs on the

left shows AI’s impact on total GVA; the pair on the right, the impact on the growth rate. The two growth scenarios depicted for each country are a “baseline” (business as usual) scenario, that is, with no AI effect, and an “AI steady state” scenario illustrating the potential effect of adding AI as a new factor of production.

AI’s impact is transformative: It can add up to 1.1 percentage points to Saudi Arabia’s economic growth rate and as much as 1.6 percentage points to the rate of growth in the UAE. The potential GVA of that AI-augmented growth is equally significant: \$215 billion for Saudi Arabia, \$182 billion for the Emirates.

**Figure 4: Growth scenarios for Saudi Arabia and United Arab Emirates**

**AI as a new factor of production can lead to significant growth opportunities for these economies**



Source: Accenture and Frontier Economics

# WHAT IS ARTIFICIAL INTELLIGENCE?

**AI is not a new field; much of its theoretical and technological underpinning was developed over the past 70 years by computer scientists such as Alan Turing, Marvin Minsky and John McCarthy.**

Today, the term refers to multiple technologies that can be combined in different ways to:

## SENSE

Computer vision and audio processing, for example, are able to actively perceive the world around them by acquiring and processing images, sound and speech. The use of facial recognition at border control kiosks is one practical example of how it can improve productivity.

## COMPREHEND

Natural language processing and inference engines can enable AI systems to analyze and understand the information collected. This technology is used to power the language translation feature of search engine results.

## ACT

An AI system can take action through technologies such as expert systems and inference engines, or undertake actions in the physical world. Auto-pilot features and assisted-braking capabilities in cars are examples of this.

All three capabilities are underpinned by the ability to learn from experience and adapt over time. AI already exists to some degree in many industries but the extent to which it is becoming part of our daily lives is set to grow fast.

Two key factors are enabling AI growth:

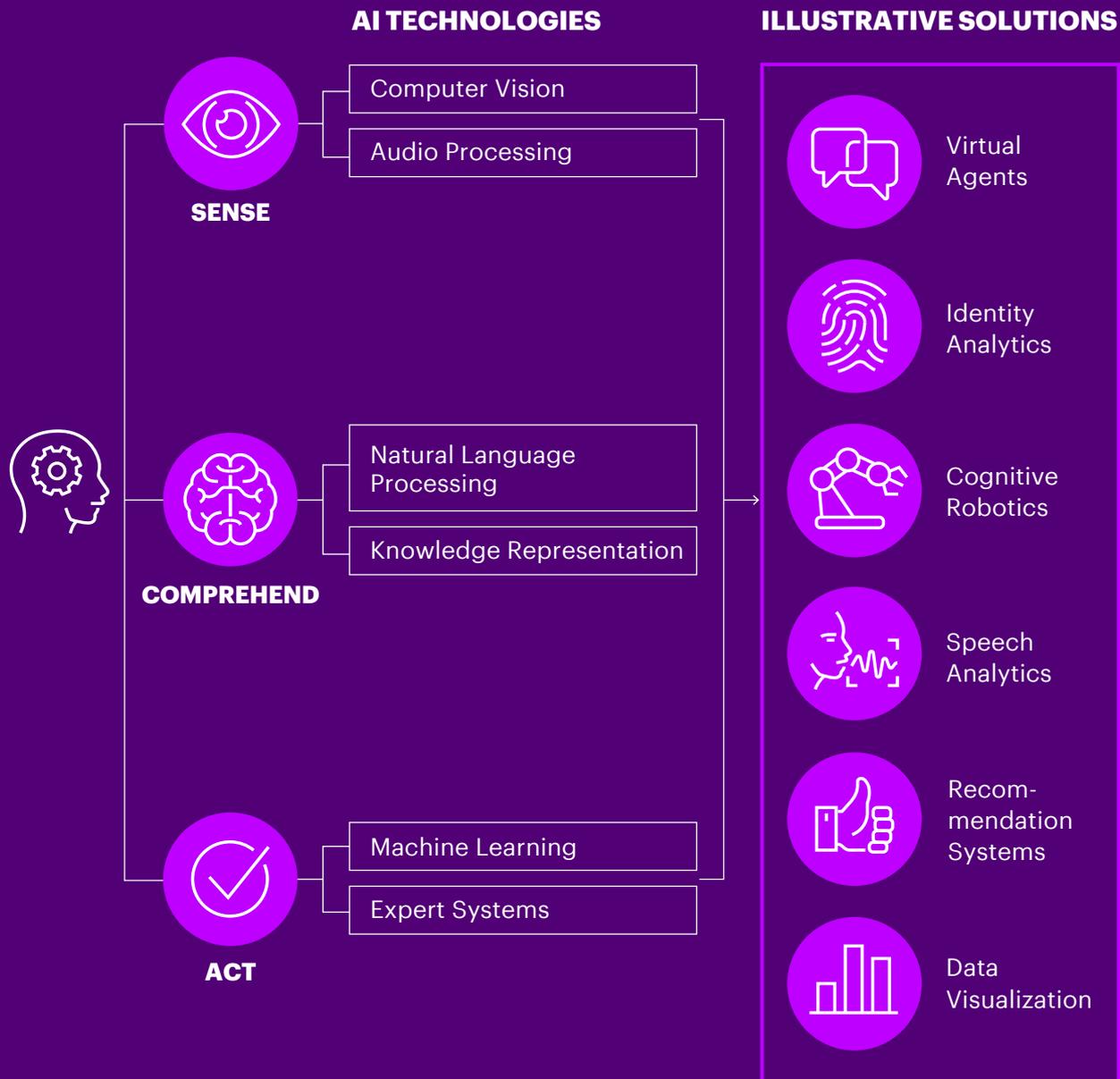
### **1. Unlimited access to computing power**

Public cloud computing was estimated to reach almost US\$70 billion in 2015 worldwide. Data storage has also become abundant.

### **2. Growth in big data**

Global data has seen a compound annual growth rate (CAGR) of more than 50 percent since 2010 as more of the devices around us have become connected.

As Barry Smyth, professor of computer science at University College Dublin, told us: “Data is to AI what food is to humans.” So in a more digital world, the exponential growth of data is constantly feeding AI improvements.



Source: Accenture analysis

# THREE CHANNELS OF AI-LED GROWTH

AI as the new factor of production can drive growth in at least three important ways.

First, it can create a new virtual workforce, what Accenture calls “intelligent automation.” Second, AI can complement and enhance the skills and ability of existing workforces and physical capital. Third, like other previous technological advances, it can drive innovations in the economy. Over time, this becomes a catalyst for broad structural transformation as economies using AI not only do things differently, they will also do different things.

## Intelligent automation

AI-powered intelligent automation is already creating growth through a set of features not found in traditional automation solutions.

### **The ability to automate complex work tasks that require agility and adaptability:**

For example, robots from Fetch Robotics already in use in warehouses use lasers and 3D depth sensors to navigate safely and work alongside human workers. Used in tandem with people, they can handle the vast majority of items in the typical warehouse.<sup>7</sup>

### **The ability to solve problems across industries and job titles:**

Amelia, an AI platform from IPsoft in New York with natural language processing capabilities, can support maintenance engineers in the field, having read all the manuals.<sup>8</sup> Amelia has also learned the answers to the 120 questions most frequently asked by mortgage brokers.<sup>9</sup>

### **Self-learning, enabled by repeatability**

**at scale:** This self-learning aspect of AI represents a fundamental change: Whereas traditional automation capital degrades over time, intelligent automation assets constantly improve. For example, more and more companies are using “chatbots,” intelligent virtual assistants, to improve customer interactions. Chatbots can recognize gaps in their own knowledge and take steps to close them. When they cannot answer a customer’s question, they escalate the issue to a human colleague, then observe how the person solves the problem.

There is ample scope for automation in the Middle East, in both the public and private sectors. The World Economic Forum (WEF) report on the future of jobs and skills in the region estimated that 47 percent of work activities in the UAE was susceptible to automation, 46 percent in Saudi Arabia.

The UAE has been an early adopter of AI-enabled intelligent automation in the public sphere, having built the requisite technology infrastructure over the past two decades. It was the first country in the region to embrace e-government, an initiative that by 2013 had evolved into the UAE’s Smart Government system. The goal is to ultimately cut annual government spending in half by using AI to streamline the country’s 250 million yearly paper transactions, which currently require 190 million hours and one billion kilometers in travel. The Dubai government plans to complete its last paper transaction in 2021.<sup>10</sup>

## Labor and capital augmentation

A significant part of AI-driven economic growth will come from not replacing labor and capital, but in enabling them to be used much more effectively. Relay, an autonomous service industry robot developed by San Jose, California-based Savioke, made more than 11,000 guest deliveries in the five large hotel chains where it was deployed, freeing hotel staff to focus on parts of their role that add the most value.

Artificial intelligence can also augment labor, complementing human capabilities, offering employees new tools to enhance their natural intelligence. For example, an AI startup in China has launched a legal semantic case search service. According to the case description and key word input, it retrieves the most relevant case histories with their full written judgments, as well information as regarding participants, proceedings, investigations, defense and other matters, saving lawyers from the time-consuming search process.<sup>11</sup>

For industries where physical capital represents a large sunk cost, AI, using analytics and advanced machine learning, can also improve capital efficiency – by reducing factory downtime, for example.

Augmenting – and in many cases, creating – human capital is a primary focus of AI strategies in the Middle East as two dominant trends converge: the diversification of these economies, which creates the need for a more knowledge-intensive, higher-value-added workforce in virtually every sector; and a growing burden of youth unemployment, made even more acute by the saturation of the public sector labor market, a favored source of

jobs in the past. If more productive work and employment opportunities are to be created to meet these needs, it is critical that this new workforce is educated and has the right skills.

AI is the key to success in this sphere, says Omar Bin Sultan Al Olama, the UAE's Minister of Artificial Intelligence. And this is not simply about learning new skills in areas like data analysis, computer science and engineering: "AI will help us to be able to identify what each person is good at, and then allow us to determine how to make sure that everyone has the information delivery system they need in order to excel."<sup>12</sup>

Emirati educators are looking for predictive patterns in areas like dropout rate risk and the employability of graduates, using AI to crunch data – about behavior, scores, academics, attendance, assignments, extra-curricular history and curriculum. Dubai's state education agency, the Knowledge and Human Development Authority (KHDA), uses data-centric, evidence-based AI tools to evaluate individual school performance.<sup>13</sup>

The UAE is also partnering with private companies in its AI-related education and training push. Earlier this year the country's Higher Colleges of Technology signed an agreement with Oracle to begin training first 500 Emirati men and women in artificial intelligence.<sup>14</sup>

## Innovation diffusion

If innovation does indeed beget innovation – if AI has the ability to propel innovation as it diffuses through the economy – there is perhaps no better proving ground for this maxim than the Middle East, which has seen an explosion in the number competing hubs dedicated to developing innovative new technologies.

NEOM (meaning “new future”), Saudi Arabia’s ultra-high tech future megacity (“Bigger than Dubai! More robots than humans!”) project, is in some ways a vast R&D campus. Envisioned as a quasi-independent special zone, with its own laws, regulations and judiciary (though it will remain under the kingdom’s sovereignty), its primary purpose is to attract as much global investment, business and talent as possible, particularly in fields like biotech, advanced and additive manufacturing, and robotics. NEOM is also intended to showcase the latest examples of machine learning, data mining and cognitive computing, AI tools that will enable the sort of interdisciplinary, cross-industry innovations – in areas like energy and water, transport and food production – that NEOM was created to incubate.<sup>15</sup>

Its planners are confident that NEOM will ultimately pay for itself, predicting that it will eventually contribute as much as \$100 million a year to the Saudi economy.

But NEOM is not the only Saudi project devoted to AI-powered innovation.

The National Digitization Unit (NDU) was established to pursue a range of initiatives and public-private partnerships with the goal of further developing the kingdom’s digital environment (and create 200,000 jobs in the bargain); among the NDU’s corporate partners are SAP and GE. The Future Investment Initiative, a kind of state-sponsored standing colloquium on technology, has been charged with, among other goals, identifying which industries will be transformed most by AI and how to smooth the transition of workers disadvantaged by technological disruption.

Similar efforts are underway in the UAE. In January Oracle launched the Zayed Innovation Hub, which AI Olama characterized as “a milestone in the artificial intelligence space.” The hub’s aim is to invest in local AI talent.<sup>16</sup> Dubai Future Accelerators is a nine-week program that pairs technology companies (which compete to participate in the program) and local entrepreneurs and government organizations, a “living test bed” for creating breakthrough solutions to some of the world’s most intractable problems.

**“AI will help us to be able to identify what each person is good at, and then allow us to determine how to make sure that everyone has the information delivery system they need in order to excel.”**

# HOW AI CAN SUPPORT INDUSTRIAL GROWTH AND DIVERSIFICATION

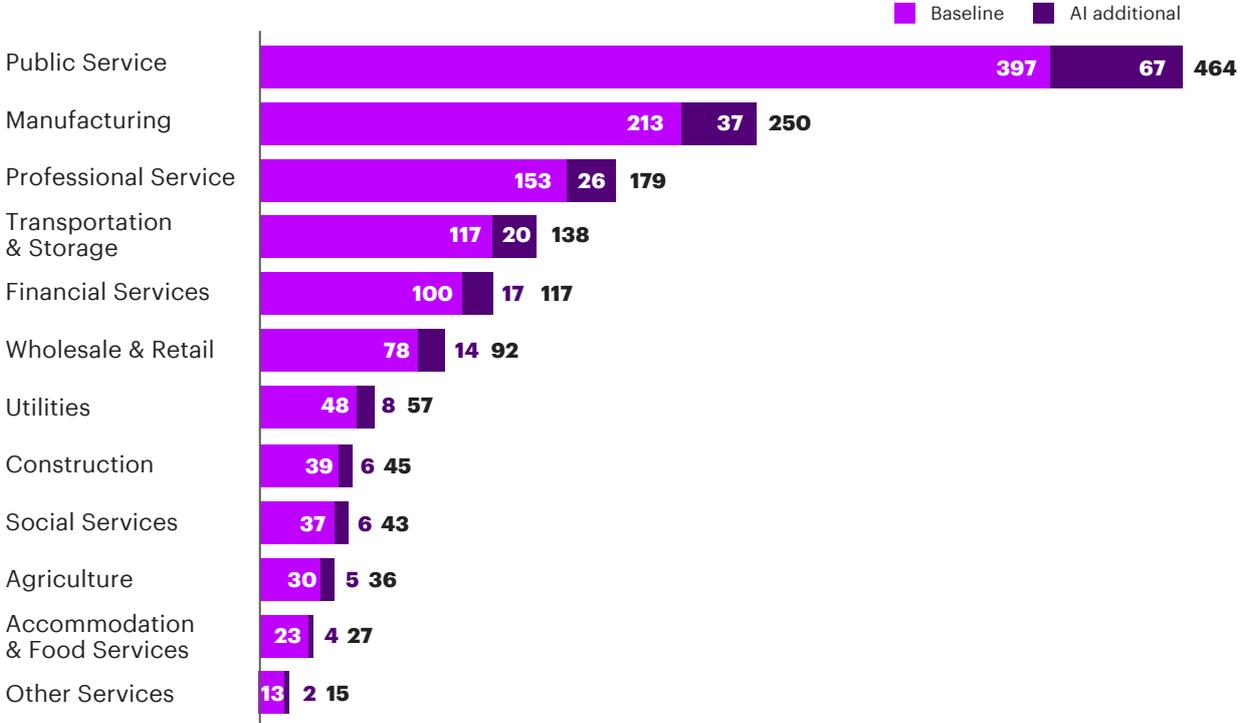
To determine the potential sector-specific impact of artificial intelligence on the economies of the Middle East we looked at 13 industries in Saudi Arabia and 15 in the UAE, combining the results of our macro AI modelling with industry size data.

Our model shows that, in absolute dollar terms, Manufacturing, Public Services and Professional Services will benefit the most in Saudi Arabia, with boosts in industry GVA of \$37 billion, \$67 billion and \$26 billion, respectively, by 2035. In the UAE, Financial

Services, Healthcare, and Transport and Storage will be the big winners in terms of AI-aided growth, with increases in their annual GVA of \$37 billion, \$22 billion and \$19 billion, respectively, over the same period.

Figure 5: AI's impact on industries

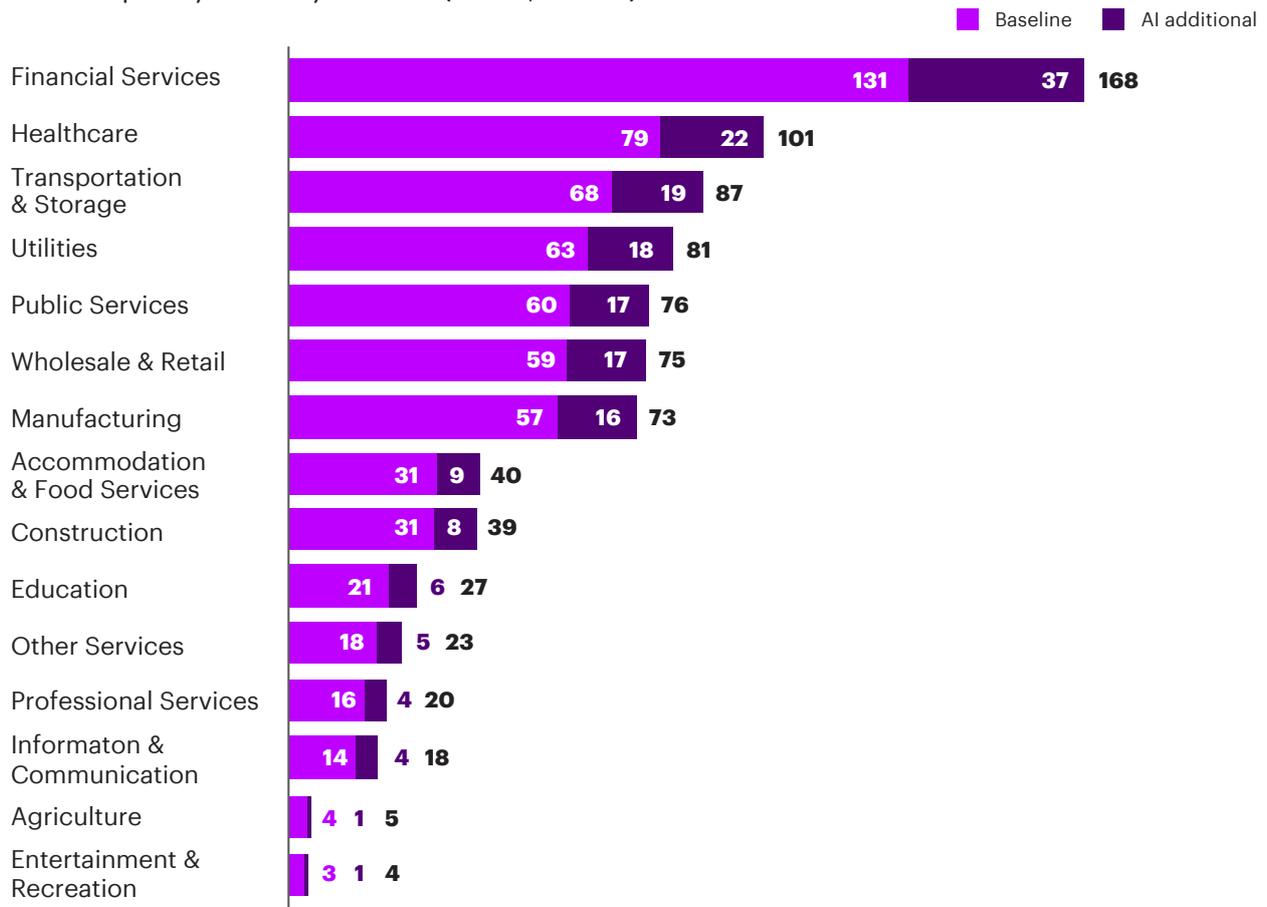
Manufacturing & Mining and Public Services look set to benefit the most from AI in Saudi Arabia  
GVA output by industry for Saudi Arabia (in US\$ billion)



Source: Accenture and Frontier Economics

## Financial service look set to benefit the most from AI in UAE

GVA output by industry for UAE (in US\$ billion)



Source: Accenture and Frontier Economics

## Industry Highlights

### Financial services

While the use of cognitive/AI systems will see significant growth across all industries, our analysis suggests that AI will have a significant impact on the financial services sector, boosting its annual industry value add by \$17 billion and \$37 billion in Saudi Arabia and UAE, respectively, by 2035.

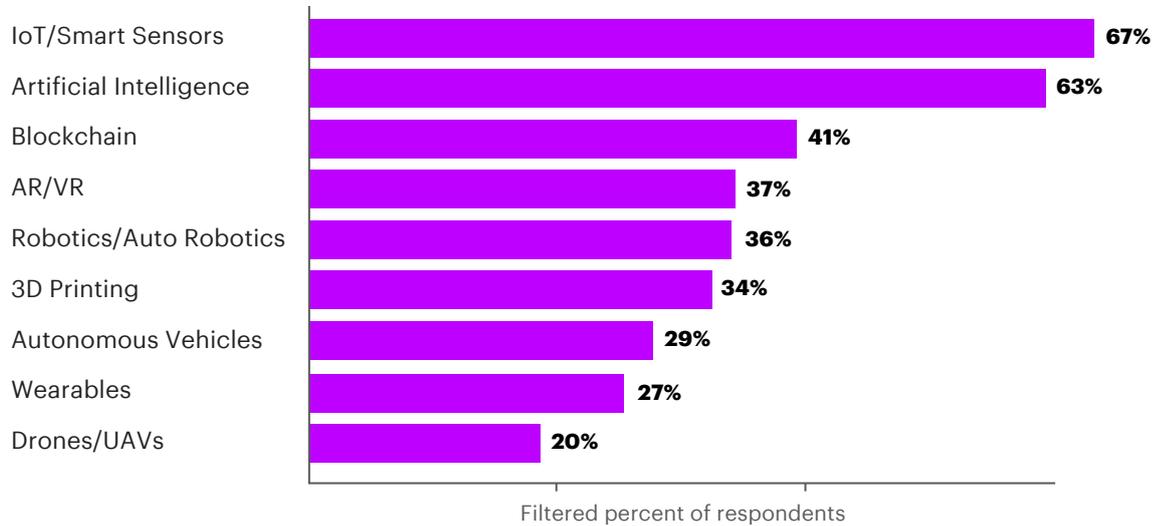
Accenture analysis shows that some current functions in the industry – such as bank

tellers, loan officers, mortgage brokers, claim processors, underwriters and other routine white-collar office jobs – can all be usefully augmented with AI and machine learning.<sup>17</sup> Banking executives globally are already taking action to transform their businesses through the use of AI. According to our recent Technology Vision Survey, 63 percent of banking executives globally plan to make investments in AI over the next year, considerably ahead of blockchain, extended reality and other advanced technologies (See Figure 6).

**Figure 6: Percentage of banking executives globally planning to make investments in new and emerging technologies over the next year**

**Filtered Sample**

Number of respondents: 787



**Transport**

The growing use of AI technologies will inevitably affect jobs. To minimize the impact of labor market dislocation, there will be a need for retraining of affected workers in non-routine skills like problem-solving, fast-learning, the ability to acquire new knowledge, communication and interpersonal relations, among others.

According to Khaleej Times, Emirates airlines has undertaken a fast reskilling program alongside the introduction of AI technologies. The airline is developing a new fleet of autonomous vehicles that will meet specialized mobility needs of airport airside operations. To complement this project, the airline is developing a solution that will transform the way Emirates teaches cabin crew and how they learn.

# NEXT STEPS FOR POLICY MAKERS AND BUSINESS LEADERS

**Can artificial intelligence help free the Middle East from a decades-long dependence on oil and be a key driver in the rebalancing of their economies that is critical to future growth?**

Middle East leaders, and the analysis in this report, strongly suggest that it can. But we should not underestimate the challenges that will lie ahead in integrating AI into the economic, social and business systems of these countries. Below are some guidelines for government and business leaders to consider.

## **For policy makers: Clearing the path to an AI future**

### **Prepare the next generation of workers for the AI future**

As we have shown, with young, fast growing populations, the Middle East needs jobs, and lots of them. While AI can free workers from the drudgery of monotonous and mundane tasks through intelligent automation, these technologies also have a major role to play in bolstering worker productivity and driving new and better ways to innovate. Done in the right way, AI can boost employment, economic growth and business profitability.

Key to this will be successfully integrating human intelligence with machine intelligence, so that they coexist in a two-way learning relationship. As the division of labor between man and machine changes, policy makers need to reevaluate the type of knowledge and skills imparted to future generations.

The advent of AI will require a fundamental transformation in the learning environment, both in schools and in business.

Currently, technological education goes in one direction: People learn how to use machines. Increasingly, this will change as machines learn from humans, and humans learn from machines. For example, customer service representatives of the future will need to act as “role models” to their digital colleagues, and potentially vice versa.

More pointedly, AI technologies themselves can transform the education and learning environment, both within the formal education system and within companies. Think about the opportunities for ‘liquid learning’, where individuals can switch seamlessly between human and AI-based teachers located across the world—a virtual lesson on coding from a teacher in Beijing, or a seminar on quantum computing delivered from a national learning hub using the latest AI tools.

Technical skills will also be required to design and implement AI systems, exploiting expertise in many specialties, including robotics and vision, audio and pattern recognition. But interpersonal skills, creativity and emotional intelligence will also become even more important than they are today.

### **Grow the local talent pipeline using AI**

High unemployment alongside massive reliance on imported talent. A young and highly educated workforce but chronic worklessness among the young, The MENA talent base is a series of paradoxes that have proved frustratingly difficult to resolve. This is where AI could prove to be a game changer. With its power to augment human skills, drive innovation and create new ways of working, AI presents a once in a life time opportunity to build domestic talent equipped for the industries of the future. Over time this would enable the regional to overcome skills bottlenecks, create local jobs and potentially even become an exporter of AI talent in the future.

### **Become the global testbed for social AI**

Better cancer detection rates. New machine-discovered medicines to combat diseases. Reduced environmental pollution and congestion. Better management of food, water, energy and natural resources. The list goes on. The social dividend from AI technologies, frequently neglected, is potentially massive and wide-ranging. Through the right investment and encouragement of interdisciplinary research, the Middle East could become a dynamic R&D laboratory for AI-led social innovation

while also driving industry diversification and growth. NEOM, Saudi Arabia's future AI city, shows the necessary ambition and scale. But much more can and should be done across the region.

### **Advocate a code of ethics for AI**

Intelligent systems are rapidly moving into social environments that were once only occupied by humans.

This is raising ethical and societal issues that can slow down the progress of AI. These range from how to respond to racially biased algorithms to whether autonomous cars should give preference to their driver's life over others in the case of an accident. Given how prevalent intelligent systems will be in the future, policy makers need to ensure the development of a code of ethics for the AI ecosystem. Also, ethical debates must produce more tangible standards and best practices in the development of intelligent machines.

### **Address the redistribution effects**

Many commentators are concerned that AI will eliminate jobs, worsen inequality and erode incomes. Such fears are particularly heightened in the Middle East, where rates of unemployment, especially among young people, are already high.

The response should be twofold. First, policy makers should emphasize the tangible benefits of AI. For instance, AI promises to alleviate some of the world's greatest problems, such as climate change (through more efficient transportation) and poor access to healthcare (by reducing the strain on overloaded systems). Benefits like these should be clearly articulated to encourage a more positive attitude toward AI's potential.

Second, policy makers need to actively address and preempt the downsides of AI. Some groups will be affected disproportionately by these changes. To prevent a backlash, policy makers should identify the groups at high risk of displacement and create strategies that focus on reintegrating them into the economy.

## **For business leaders: Creating a new playbook for an AI world**

### **Take a strategic approach to data management**

The performance of AI will directly depend on the quality and amount of data that are available. Accenture research shows that the majority of executives are unsure of the business outcomes they derive from their data analytics programs, which can mean that enterprise data remains vastly underutilized.<sup>19</sup>

While many large companies already have added a chief data officer (CDO) to the C-suite, the main focus for these executives is understandably on data security, regulations and governance. Instead, they should see themselves as stewards who construct and maintain an integrated, end-to-end data supply chain. These AI-savvy CDOs will concern themselves with issues such as: What is the balance between internal and external data sources? What is the company's data churn and cost per day? Where are the data silos? How can our company simplify data access?

### **Invent new business capabilities for an AI-powered organization**

To achieve the full potential of AI, human and machine intelligence must be tightly interwoven. There will be a need for new skills in the workforce that go beyond technical expertise to embrace a new emphasis on human abilities — judgment, communication, creative thinking — that complement technologies.

Are organizations adequately preparing for the challenge ahead? Recent Accenture research, surveying 1,200 CEOs working with AI and 14,000 workers spanning all skills levels, highlighted a “Catch 22” situation prevailing in many organizations. More than two thirds of workers consider it important to develop their own skills to work with intelligent machines. Yet only three percent of executives say their organization plans to increase investment in AI training programs significantly in the next three years. One of the reasons cited is the fear of worker resistance. Better workforce dialogue and investment in AI training will be critical to resolving this impasse.

Adoption of AI also presents new challenges to human resources management. Since AI is a form of virtual labor, it will interact with the workforce, contributing and adding value in the same way a human co-worker would. Hence, the role of the Chief HR Officer will not only be about managing human employees, but also the supervision of AI workers — Human AI Resources.

This will raise questions, such as: How do companies remodel performance metrics? How do they optimize workforce requirements between human and AI labor? As a result, the CHRO will play a much bigger role in business strategy and innovation, as well as accumulate a greater technical understanding of AI technologies and how these will shape the future of work.

# APPENDIX: MODELING THE GVA IMPACT OF AI

AI has the potential to have a broad-based disruptive impact on society, creating a variety of economic benefits. While some of these benefits can be measured, others, such as consumer convenience and time savings, are far more intangible in nature. Our analysis focuses on measuring the GVA impact of AI.

We began with a modified growth model developed by Robin Hanson, professor of economics at George Mason University, Virginia, United States. We looked at the additional increase in growth that would occur as a result of AI by contrasting it with the baseline growth rate.

In our model, we defined labor as a continuum of tasks that can either be performed by a human or artificial intelligence — not work solely done by humans. The intent was to introduce intelligent systems as an additional workforce capable of handling activities that require an advanced level of cognitive agility.

To estimate the shares of workers' tasks that could be performed by intelligent machines (AI absorption rates), we drew on research by Frey and Osborne who take a task-based approach to identifying roles and occupations that are affected by AI.<sup>15</sup> The estimates are aggregated at country and industry-level, taking into account the different mix of occupations and industries within each country. These figures were adjusted to reflect:

- **Assumption about long-run employment:** We assume that employment will be constant in the long term.

- **Differences between AI's technological potential and actual potential achieved:**

We considered the uptake of AI — from zero to the maximum technological potential. We assumed that a 50 percent uptake would be reasonable in the time frame analyzed, that is, AI substitution is assumed to achieve 50 percent of its technological potential.

- **Capacity of countries to absorb AI technologies:**

A key driver of the impact of AI on growth is how well each country is positioned to benefit from the emergence of new technologies and how ready it is to integrate them into its economy — measured by what we refer to as a country's "national absorptive capacity" (NAC). This includes factors such as access to a sophisticated information and communication technology infrastructure, a reliable regulatory framework, and considerable public and private investments in the digital economy. All economies that derive a significant AI dividend rank high on this index. This is a relative measure where countries are compared to the top performer, the United States.

With these calculations and adjustments, we arrived at our final estimates of AI absorption rates used in our macro model. Along with the quantitative model, we supplemented our research by conducting interviews with experts from a range of different disciplines and secondary research to give insight into the capacity of AI to generate economic growth.

# THE SUPER SEVEN: Seizing the social dividend of AI

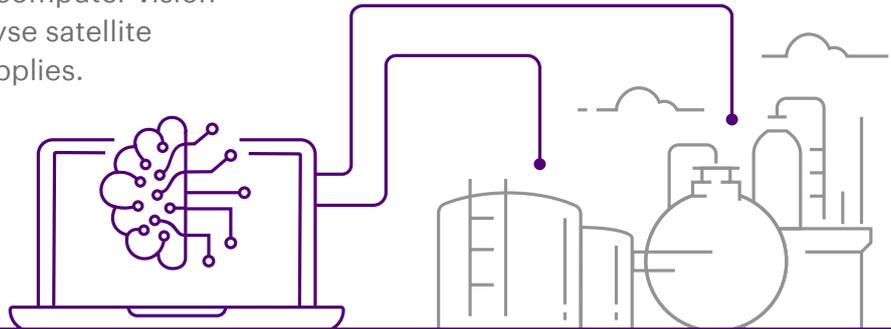


## VOLATILE OIL PRICES

Oil prices down **38%** since 2014

### HOW AI CAN HELP

Machine learning and computer vision technologies can analyse satellite images of crude oil supplies.



## CLIMATE CHANGE

The number of extremely hot days in the region **has doubled** since 1970



By the end of the century, midday temperatures on hot days could reach **50 degrees Celsius** (approximately 122 degrees Fahrenheit)



**Heat waves could occur ten times more often** than they do now leading to health risks, disruption of food production, and areas becoming uninhabitable

### HOW AI CAN HELP

AI can improve the efficiency of coal-fired power plants and reduce emissions. Estimates suggest efficiency improvement of about 1%, equivalent to 1,000 cars coming off the road.





## WATER SCARCITY

MENA has **5%** of the world's population, but less than 1% of the world's available water supply

**6 out of 10 people** in the region live in areas with high or very high water stress

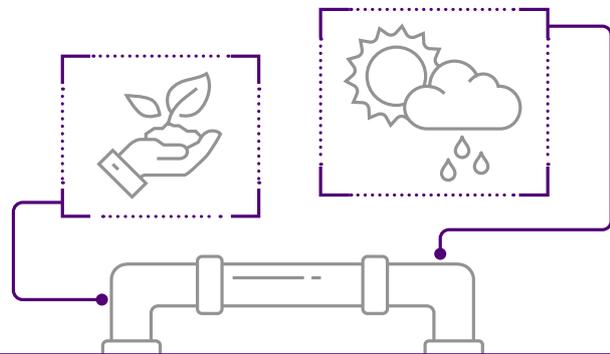


**70%** of region's GDP generated in areas with high or very high water stress



### HOW AI CAN HELP

Machine learning can be used to analyse soil type, topography and weather records to identify failure risk in water pipelines.



## RAPID URBANISATION

UAE urban population is expected to reach **14 million by 2050**

MENA's urban population grew four-fold from 1970 to 2010 and is expected to double by 2050, from **199m to nearly 400m**

Saudi Arabia urban population has grown from 12.4m to 24.3m in 2014, and is expected to grow to **35.8m by 2050**

### HOW AI CAN HELP

AI can manage traffic flows in real-time conditions instead of relying on pre-programmed cycles. Deployed to a network of 47 intersections in Pittsburgh, the system has cut travel time by 25% and reduced time spent waiting at intersections by 40%.





## HIGH YOUTH UNEMPLOYMENT

**30%**  
youth unemployment

Half of the population of the Middle East and North Africa is **aged below 24 years**

### HOW AI CAN HELP

AI can be used to give university students advice on training and career development, helping them successfully transition into the working world.



## FOOD INSECURITY

The Middle East is one of the most **food import dependent** regions in the world



The percentage of arable land in MENA is **4.7%**

**11%** GLOBAL AVERAGE

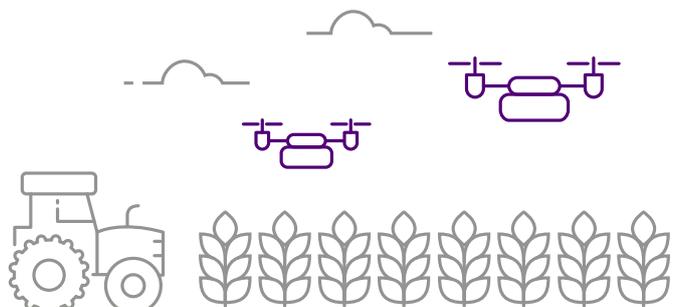
**25.3%** IN EUROPE



Food import dependency in UAE is around **70%**, one of the highest in the world

### HOW AI CAN HELP

Machine learning can be combined with satellite imagery to predict crop yields.





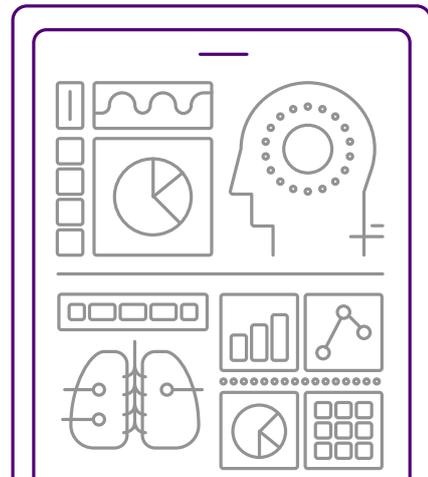
## DETERIORATING HEALTH

Rising obesity and diabetes rates

4 Middle East countries make up the top 10 in global diabetes prevalence per capita. Spending on diabetes care in MENA is set to rise from **\$16.8 billion in 2014 to \$24.7 billion in 2035**

### HOW AI CAN HELP

AI can uncover patterns of how blood glucose levels change in response to insulin injection and lifestyles of people with diabetes. The findings can help patients choose between different types of food and exercise, in order to effectively control their glucose levels and lower the risk of diabetes complications.



Source: Accenture analysis

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