

4th Industrial Revolution

November 2018

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Forum & Exhibition
Dhahran Expo, Khobar, Saudi Arabia
Nov. 26 - 27, 2018

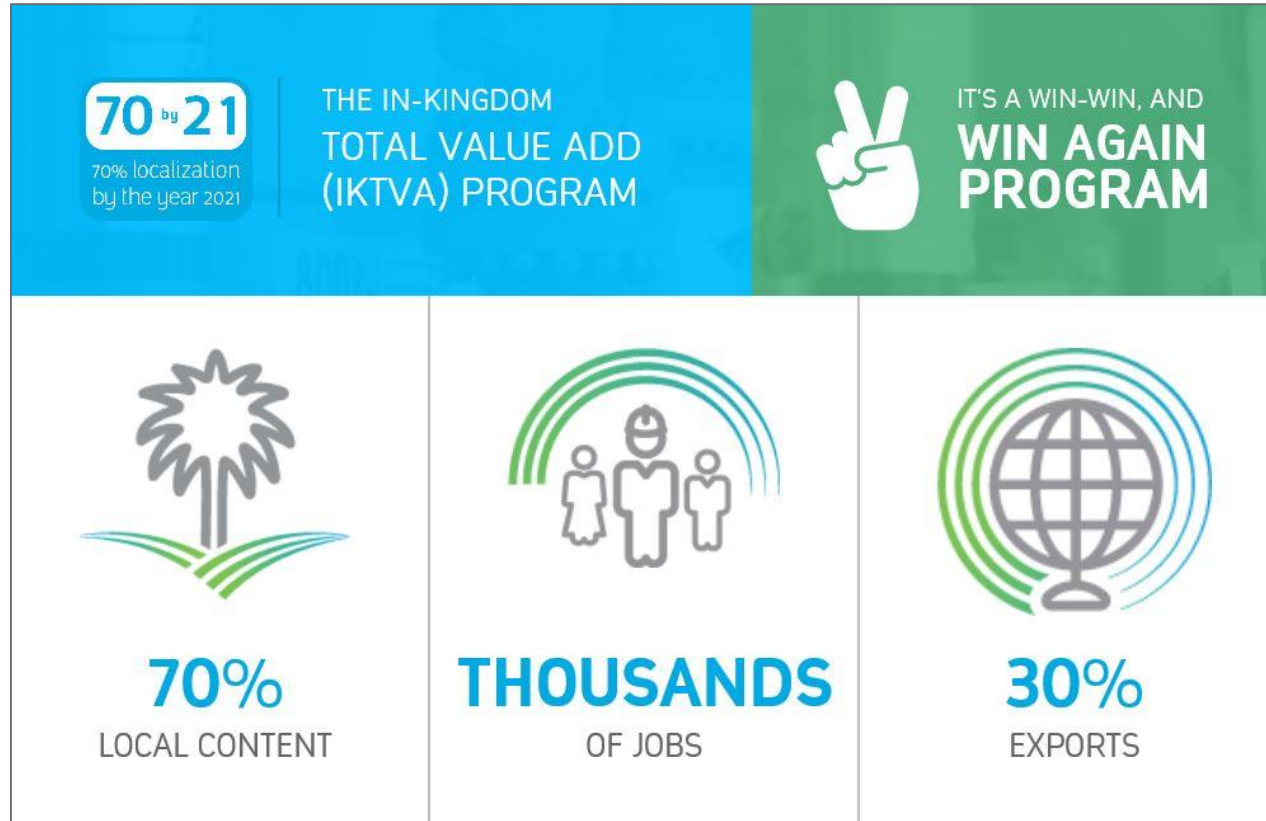




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Localization is a focus for the KSA – Saudi Aramco’s IKTVA program aims to achieve 70% local content by 2021



- Drives domestic value creation by working with suppliers for mutual benefits
- Envisions to improve investment, and maximize long term economic growth and diversification
- Focuses on delivering quality jobs, advancing innovation and enhancing global competitiveness

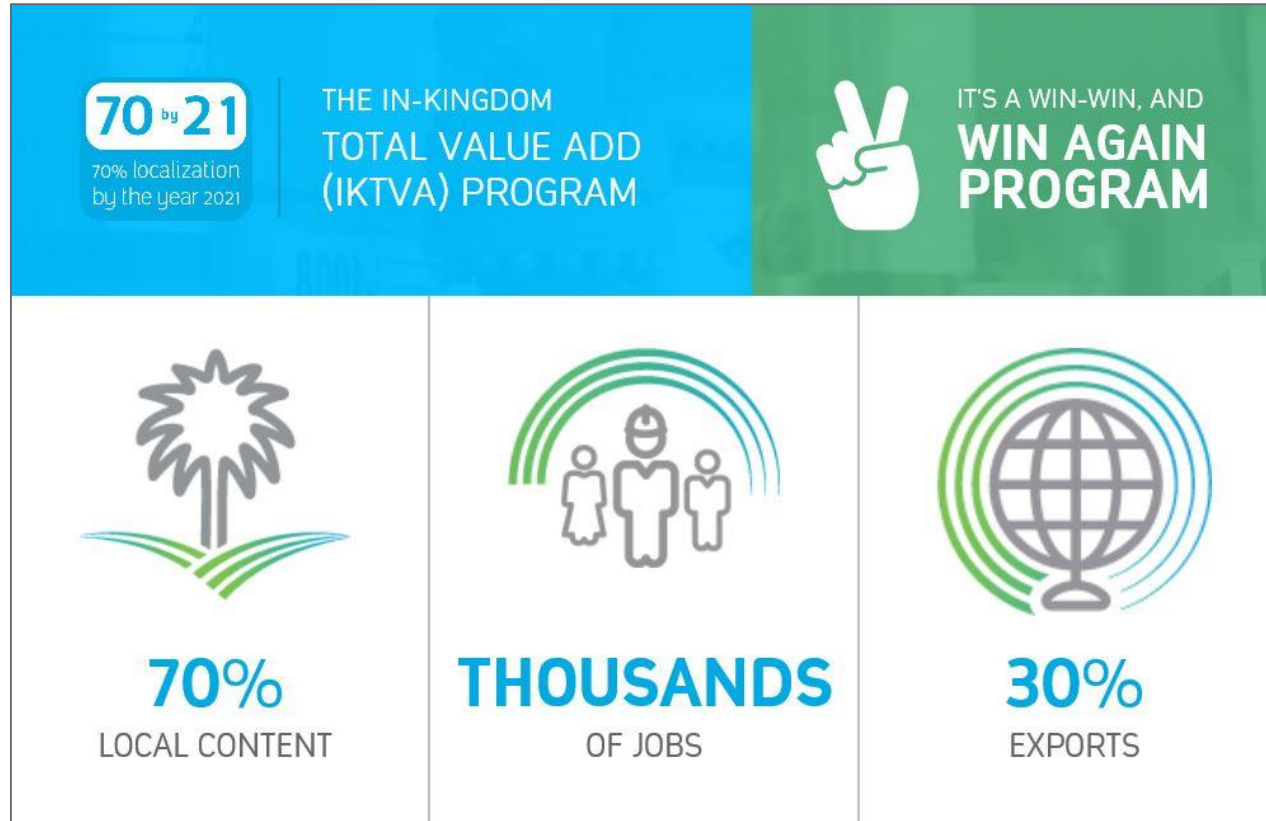
IKTVA is designed to reward Saudi Aramco’s suppliers for the use and development of local labor and sub-suppliers



Agenda – 4IR

Session Title	Presenter
Opening	Ahmed Al Faleh
Saudi Aramco's Digital Transformation Program	Majid Al Gwaiz
Digital Hub Overview	Ahmed Al Faleh
Value Proposition 1: Cyber Security	Mansour Ansari
Value Proposition 2: Cloud Computing	Mansour Ansari
Value Proposition 3: Robotics & UAVs	Khaled Abusalem
Value Proposition 4: Big Data & Advanced Analytics	Mansour Ansari
Value Proposition 5: Mobility	Mansour Ansari
Value Proposition 6: Additive Manufacturing	Osama Zidan
Value Proposition 7: Smart Sensors	Mohammed Jughaiman
Value Proposition 8: IoT & Automation	Bodong Li
Value Proposition 9: Artificial Intelligence	Nasher BenHasan
Value Proposition 10: Advanced Materials	Abdulkarim Sofi

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IKTVA is designed to reward Saudi Aramco’s suppliers for the use and development of local labor and sub-suppliers

Localization is supported by a comprehensive ecosystem of government stakeholders

Saudi Export Development Authority –
enablement of export opportunities for SMEs

Human Resources Development Fund –
implementation of HR practices

MERAS – Unified electronic platform to facilitate business start-ups

Small and Medium Enterprises Authority –
improvement of regulations and promote SMEs

Certificate of Conformity – provision of confirmation certificates for KSA imports

Saudi Industrial Development Fund –
provision of finance and advisory services



National Industrial Clusters Development Program – investors to industrial clusters connection

Royal Commission of Jubail and Yanbu –
development of Jubail and Yanbu industrial cities

Saudi Industrial Property Authority –
development of industrial cities

Saudi Arabian General Investment Authority –
oversight of investment affairs in the KSA

Ministry of Finance – monitoring of loan policies for the KSA Government

Public Investment Fund – SME investment on behalf of KSA

Industry 4.0 Enabling Technologies & Major Trends



Digital Hub Goals and Structure

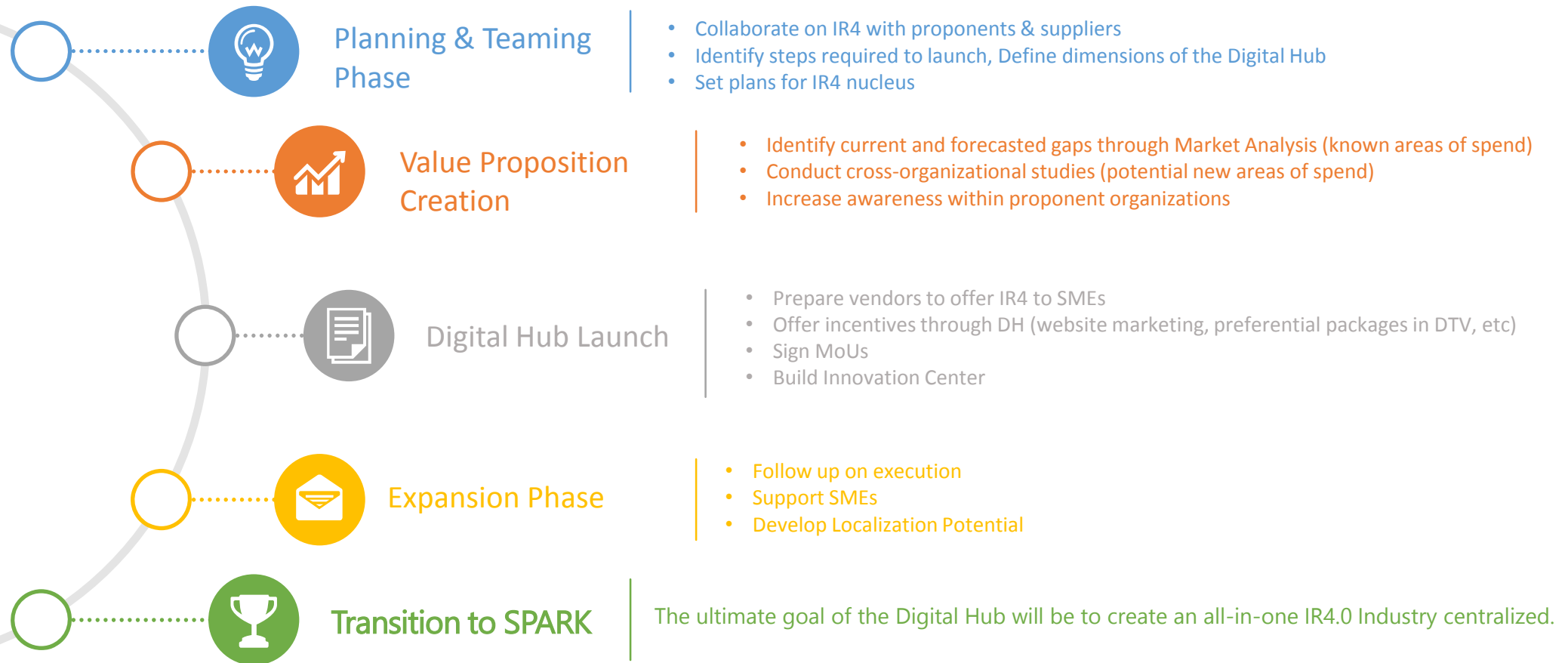
DIGITAL HUB OBJECTIVES

- Establish a Digital Hub (Virtual & Physical)
- Increase localization
- Develop Local Supply Chain
- Focus on SME development
- Custom Tailor Technologies
- Enhance local support and availability
- Reduce Operating Costs
- Validate opportunities and value propositions

DIGITAL HUB STAKEHOLDERS

Internal	External
<ul style="list-style-type: none">• Iktva• Information Technology• Engineering Services• EXPEC Computer Center• EXPEC Arc	<ul style="list-style-type: none">• Suppliers• Government entities (MIEM, MCIT,..etc)• Chambers of Commerce

Digital Hub Roadmap



Saudi Aramco's Digital Transformation

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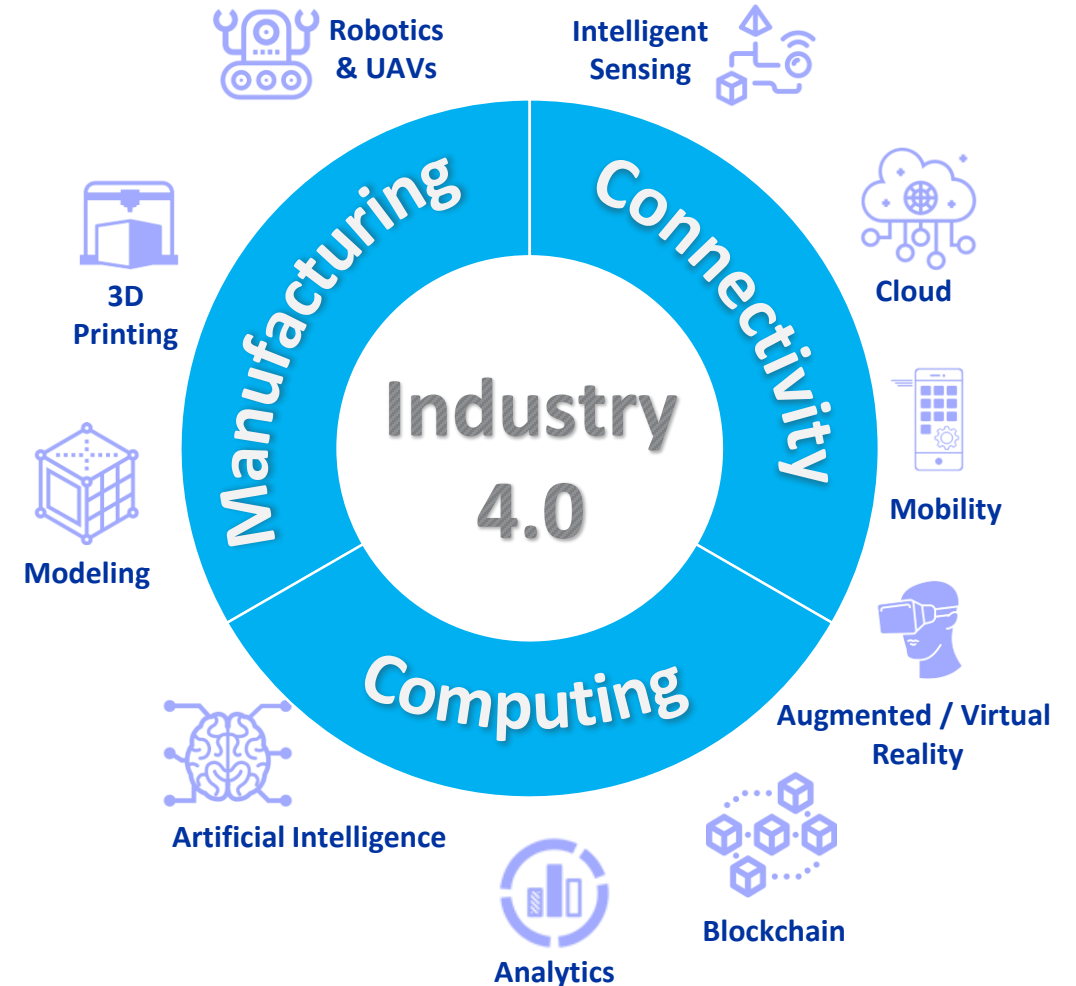


Saudi Aramco's Digital Transformation Program

12 Business Domains



10 Technology Domains



Saudi Aramco's Digital Transformation Program



A Forward Looking Innovation Hub



Saudi Aramco Digital Vision

In 2022, Saudi Aramco is the world's leading digitalized energy corporation, maximizing shareholder value and spearheading digital innovation in energy globally.

Digital Mission



Improve the Margin



Innovate with Technology



Revenue Diversification



Develop the Digital Workforce



Maximize Localization

Cybersecurity

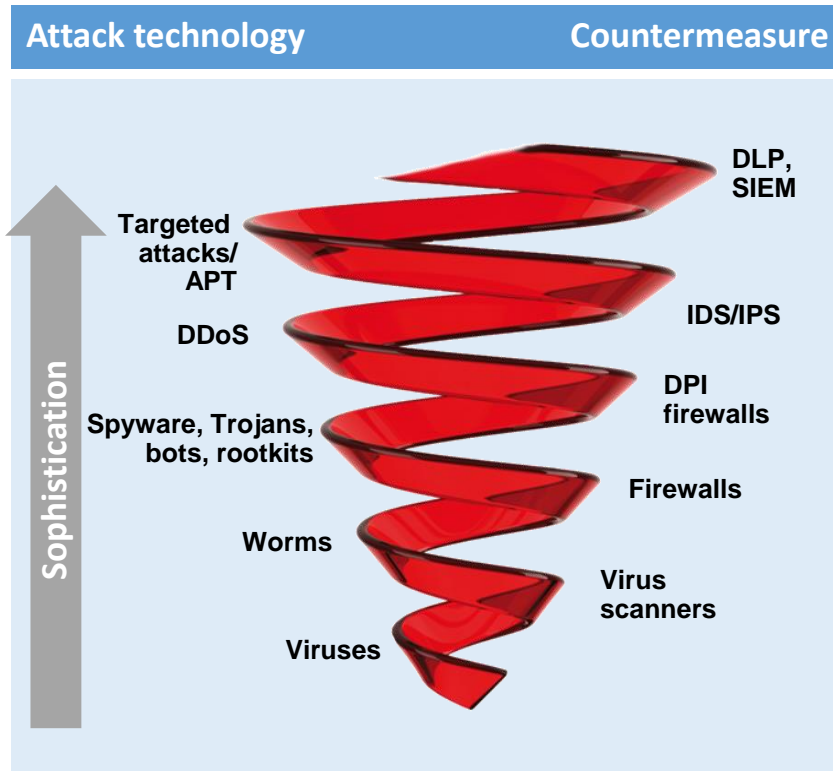
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Attack techniques are becoming increasingly sophisticated, requiring continuous developments in countermeasures

Development of technology



- Technology of attacks evolves quickly: While known threats continue, **new ones** are added **all the time**
- **Easy to use attack tools** and compromised systems as base for launching the attacks are sold on the black market
- Attacks are fully professionalized and often **backed** by big money of **national intelligence agencies** or organized crime

Note: APT = advanced persistent threat, DLP = data loss prevention, SIEM = security information and event management, DDoS = distributed denial of service (attack), IDS = intrusion detection system, IPS = intrusion prevention system, DPI = deep packet inspection

Security architectures typically consist of intrusion detection, intrusion prevention and event management systems

Intrusion detection system (IDS)

- Monitors network traffic or events on a single host
- Analyzes monitored data for suspicious behavior and possible incidents



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Intrusion prevention system (IPS)

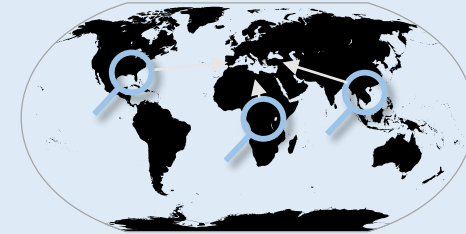
- Initiates measures to stop a possible attack detected by an IDS, e.g. dropping malicious packets, resetting connections and/or blocking traffic
- Needs to be placed in-line with monitored traffic



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Security information and event management (SIEM)

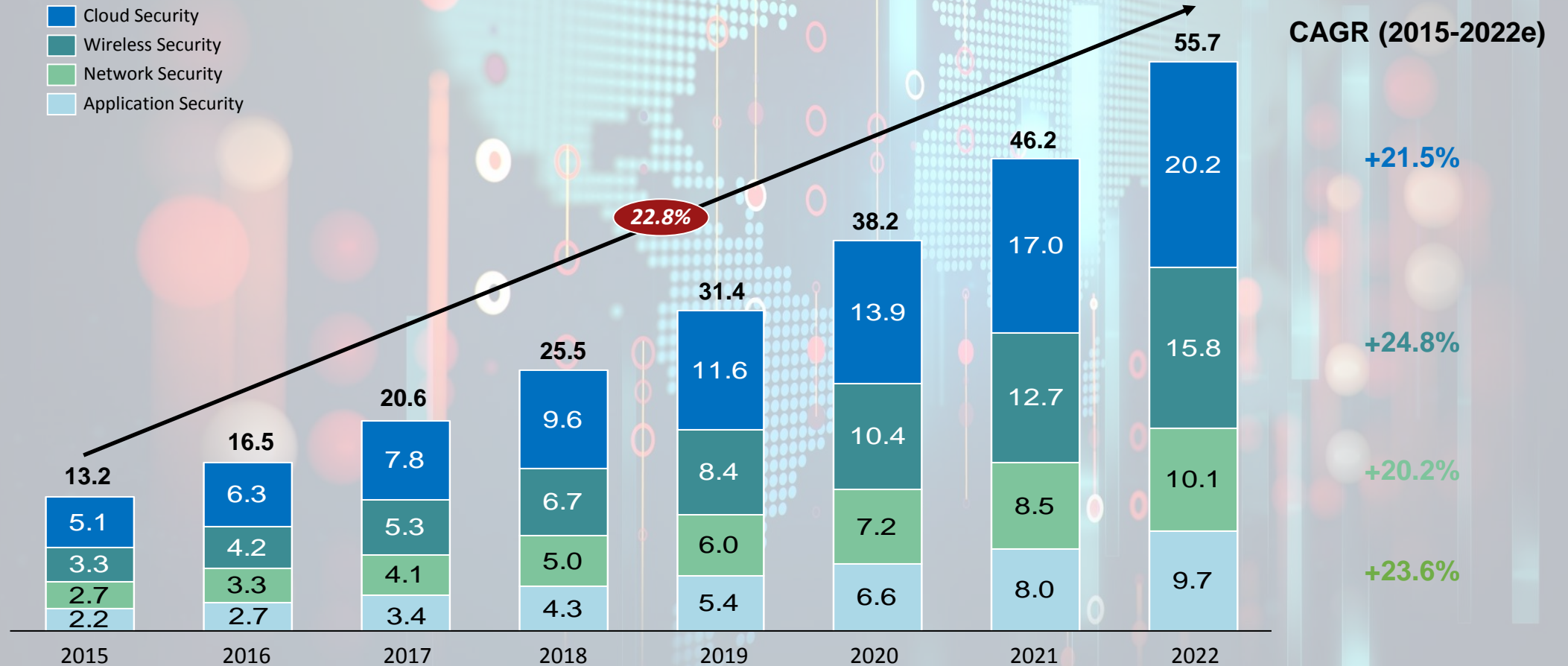
- Combines security information from networks, systems and applications in a single place
- Complements IDS/IPS by correlating events and validating alarms



In modern security architectures, IDS are used in conjunction with prevention and information & event management systems

Sources: [National Institute of Standards and Technology](#)

The ME Cybersecurity market is \$13.2 B in 2015 and will reach \$55.7 B by 2022 at an estimated CAGR of ~23%

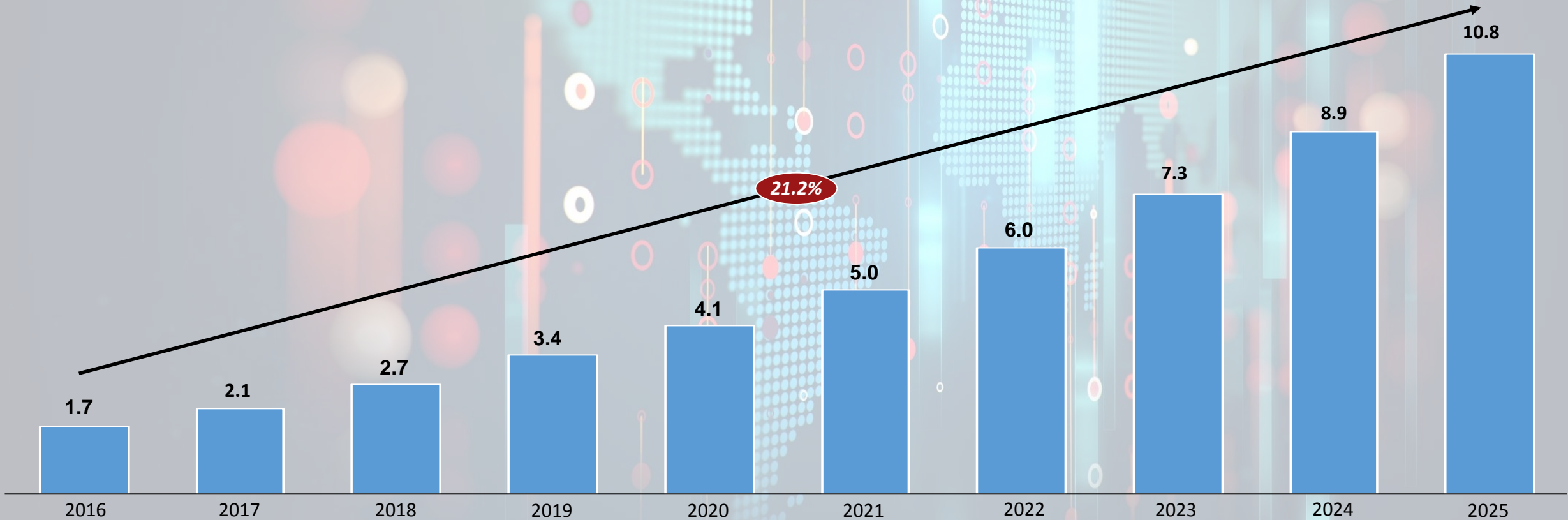


Sources: Infoholic

In KSA, cybersecurity is expected to grow at a CAGR of ~22% with anti-virus/anti-malware leading the growth

Cybersecurity KSA Spend (\$Bn)

CAGR (2016-2025e)



Sources: Budde Comm

There are opportunities to localize cybersecurity in KSA across two main functions

Opportunities in cybersecurity

1 Infrastructure & Platforms



- Opportunities exist for SMEs to localize **security infrastructure design and hardware manufacturing**

2 Cybersecurity Software



- SMEs can offer solutions that **prevent and detect attacks**, with an emphasis on **endpoint protection software**.

Source: A.T.Kearney

Key messages and next steps

Key messages

- ✓ Cybersecurity infrastructure and software have great potential in fortifying Saudi Arabia's industries.
- ✓ The KSA and ME market for cybersecurity are growing rapidly at **~22% and ~23% CAGR, respectively, to reach ~\$11 BN and ~\$56 BN by 2022**

In case you are interested in discussing this opportunity further, please contact



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Cloud Computing

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Cloud is a “service model”

It is a way of providing IT-enabled business services with multiple sourcing options (SaaS, PaaS, IaaS etc.) and multiple hosting options (Private, Public, Hybrid etc.)



Software as a Service (SaaS)

- In SaaS, **software is licensed on a subscriptions basis and is centrally hosted.**



Platform as a Service (PaaS)

- In PaaS, a third party **provides the necessary platform and tools for running, developing and/or managing software.**





Infrastructure as a Service (IaaS)

- In IaaS, the **fundamental computing resources such as processing, storage, networks are provisioned and managed for the consumer.**

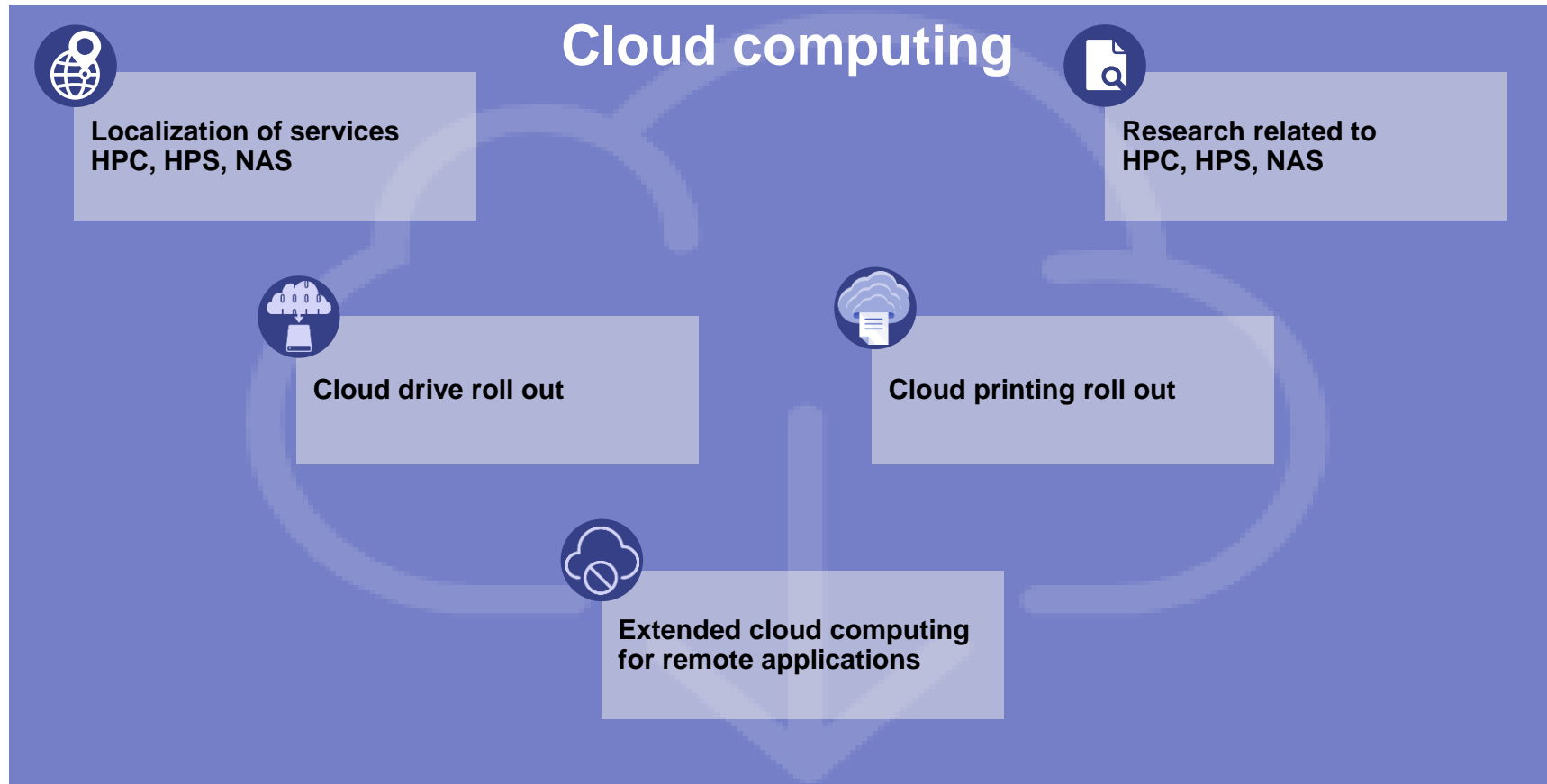
The energy industry is not new to cloud computing- several players globally have already embraced the cloud

Cloud computing initiatives in the energy industry

	Situation	Cloud solution
	<p>In 2013, Hess decided to streamline its business to focus on energy exploration and production (E&P). As part of the process, the company decided to divest its downstream businesses, including retail, energy marketing, and terminals</p>	<p>In anticipation of separating business systems and data for potential buyers, Hess IT initiated work on Amazon Web Services (AWS) in July 2013 and entered a contractual agreement to have the environment operational and in production by January 2014.</p> <p>The project was about speed to market and they completed the migration to the AWS Cloud in six months, twice as fast as it would have taken with physical servers.</p>
	<p>GE Oil & Gas migrated 500 applications to the cloud by the end of 2016 as part of a major digital transformation</p>	<p>The company's leveraged Amazon AWS cloud solutions eliminating legacy processes, resulting not only in lower IT costs but also in greater speed to market and more agility to compete even better in an industry experiencing immense market challenges.</p> <p>Project resulted in 52% reduction in TCO</p>

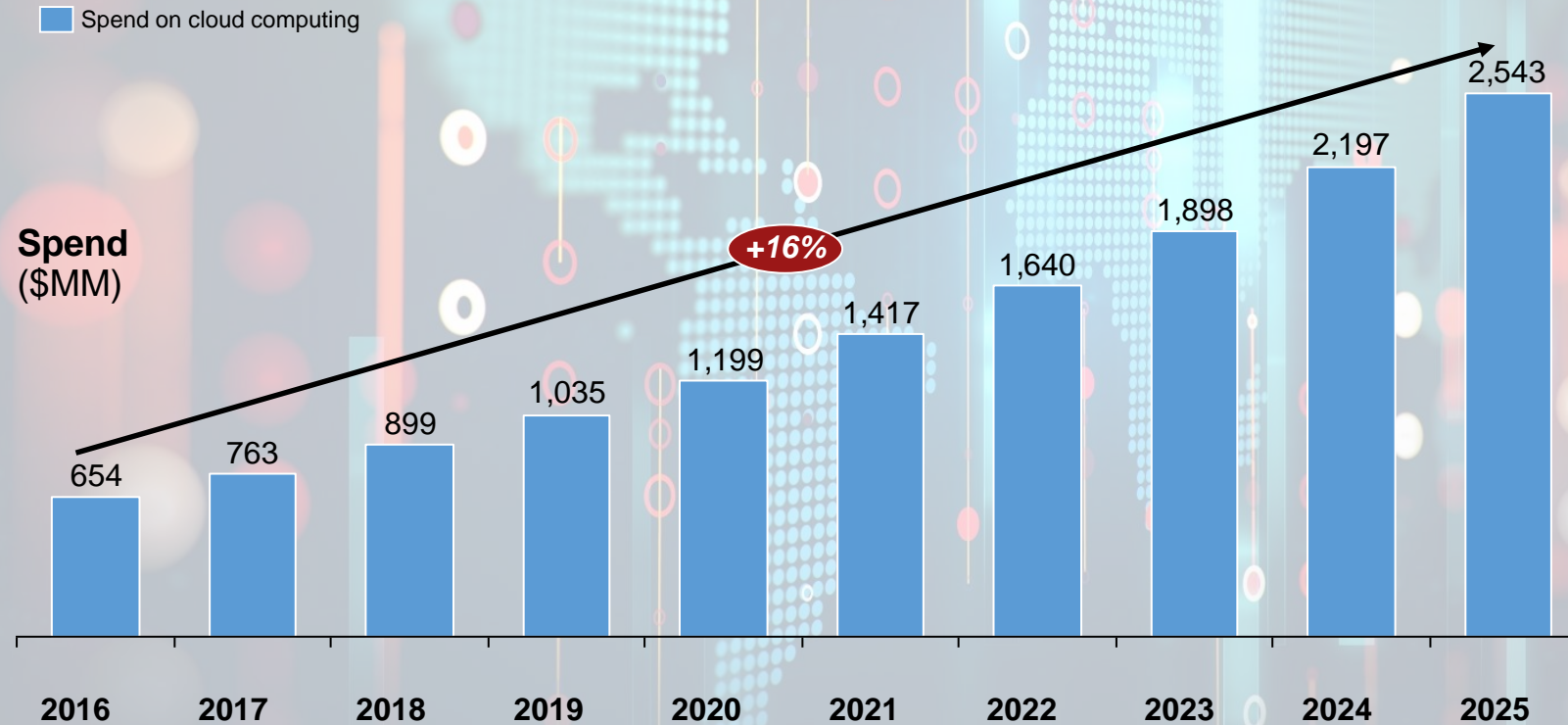
Source: Press research, Saudi Aramco

Saudi Aramco is also pursuing a number of cloud computing related initiatives



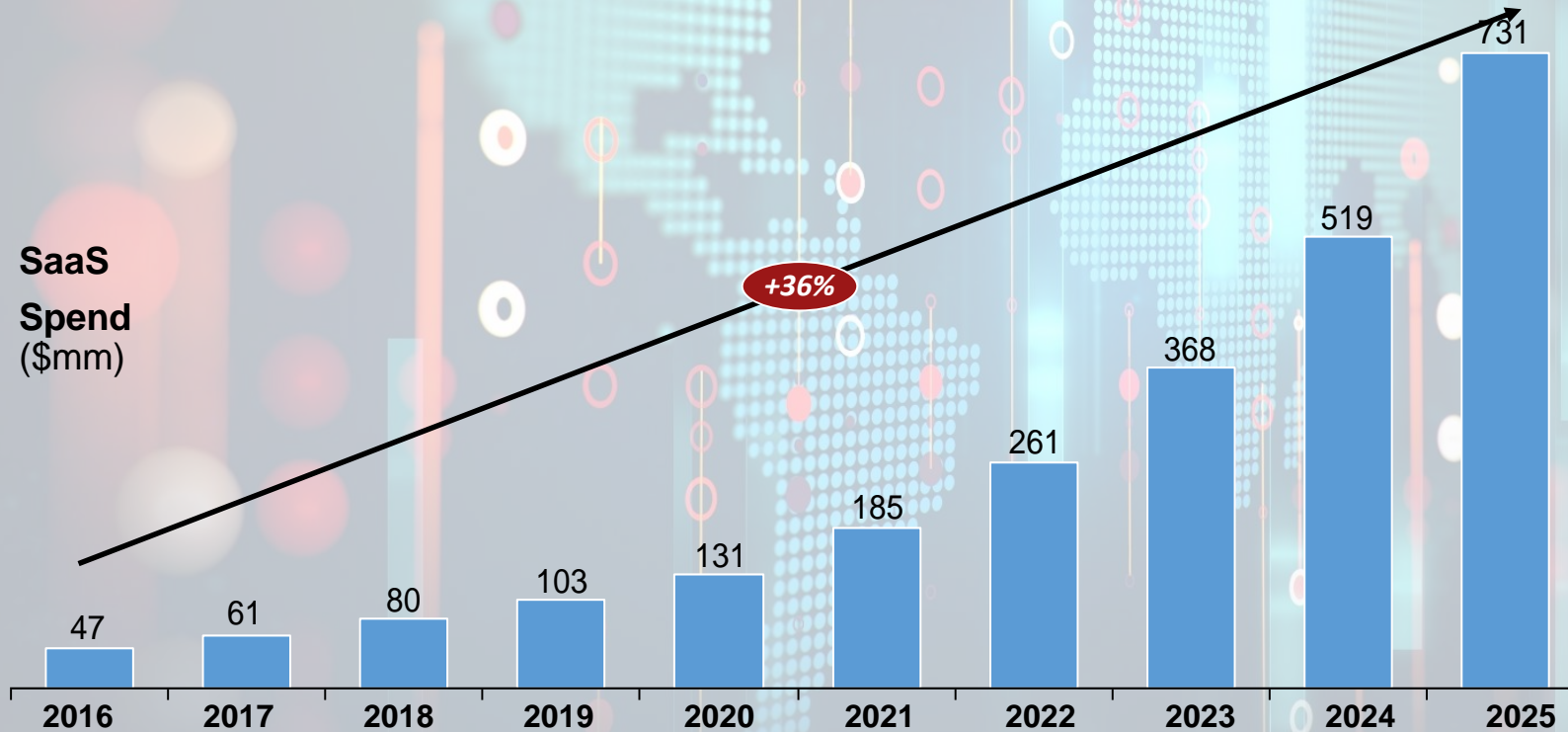
Source: Saudi Aramco analysis

Market for cloud computing in KSA is expected to grow at 16% CAGR to reach a value of \$2.5 bn by 2025



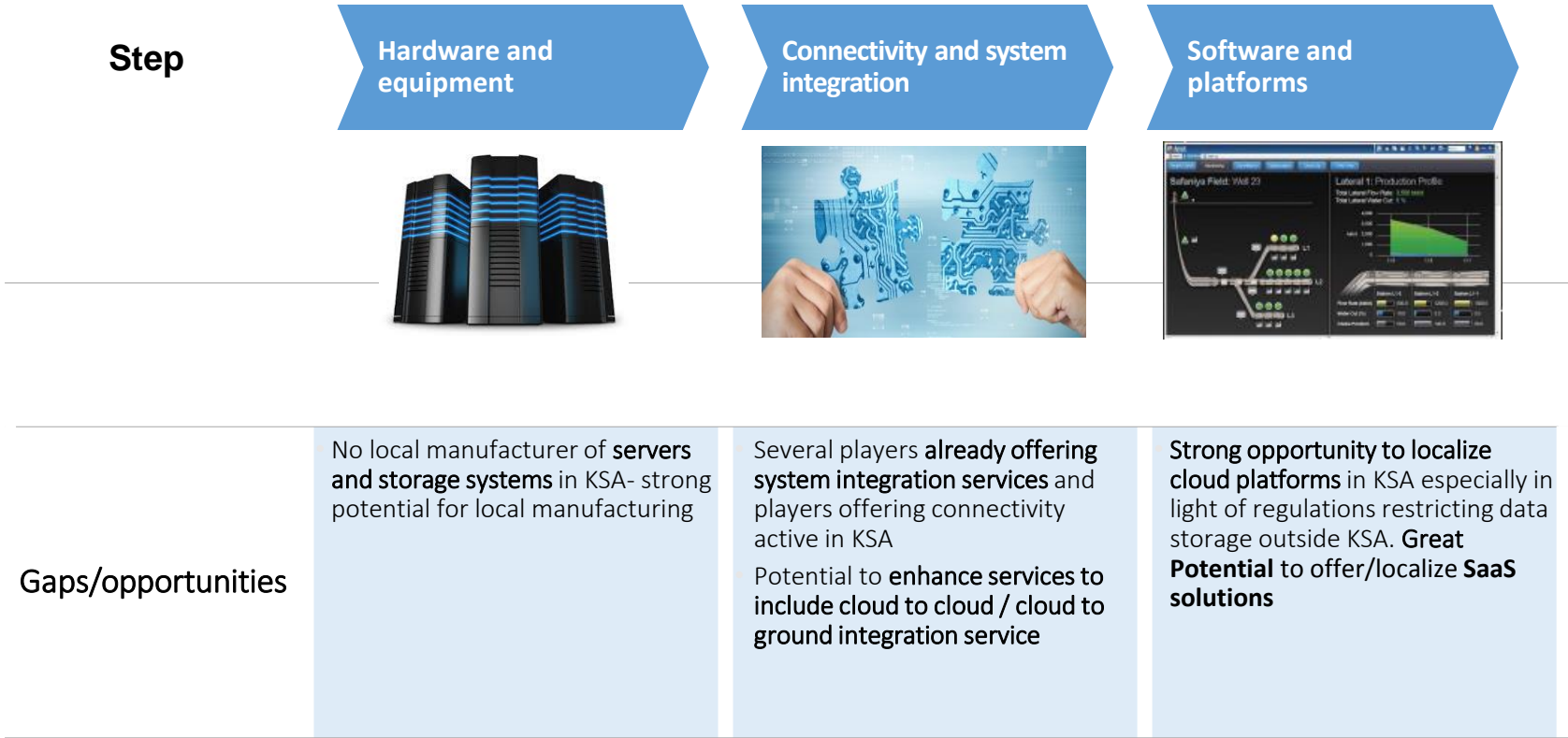
Source: BMI Research

Within cloud computing, SaaS services are growing at 36% CAGR, to reach ~\$730 mm by 2025



Source: AT Kerney, IDC

Localization potential exists at all stages of the cloud computing value chain



Source: A.T.Kearney, Intel, Cisco

Key messages and next steps

Key messages

- ✓ Cloud computing is taking off and has **applications both in oil and gas and several other industries** in KSA (e.g. shared services)
- ✓ The KSA market for cloud computing is growing rapidly at **~16% CAGR to reach ~\$2.5 bn by 2025**
- ✓ Within cloud computing, SaaS services are growing at **~36% CAGR to reach ~\$730 mm by 2025**

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Robotics & UAV

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The energy industry is adopting robotics

Resolve Challenges and Create Opportunities

**Robotics
Technology**

**Reduce
Cost**

**Enhance
Safety**

**Avoid
Interruption**

**Agile
Emergency
Response**

Focus Areas

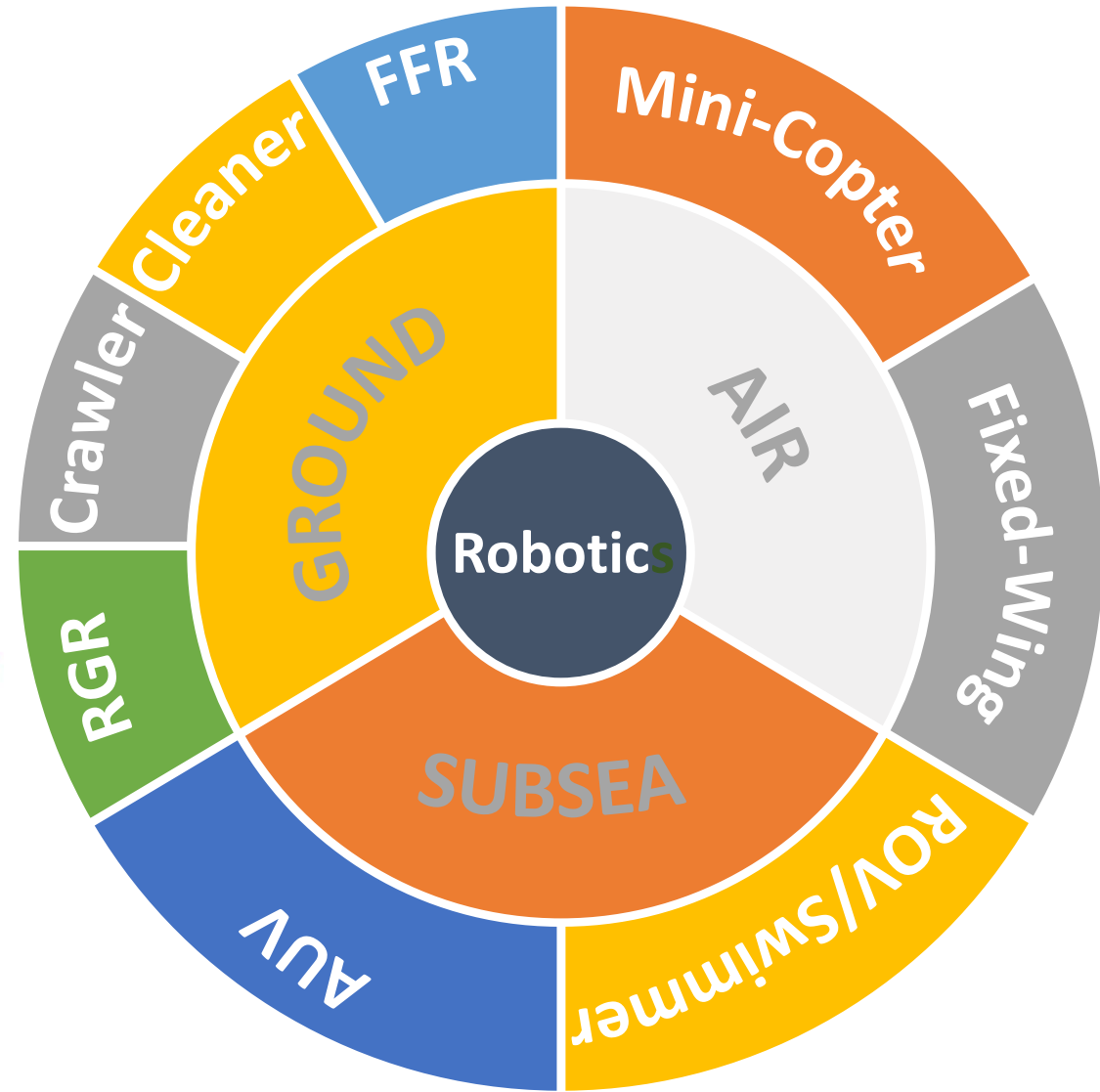
Air Robotics (UAV)



Ground Robotics



Subsea Robotics



Saudi Aramco robotics program

Technology

- Deployed Mini-Copter UAVs
- Expanding UAV fleet
- Deployed Mini-ROV
- Developed Robotic technologies

Procedure & Governance

- Established UAV & Robotics Standard Committee
- Developed robotics and UAV standards & procedures

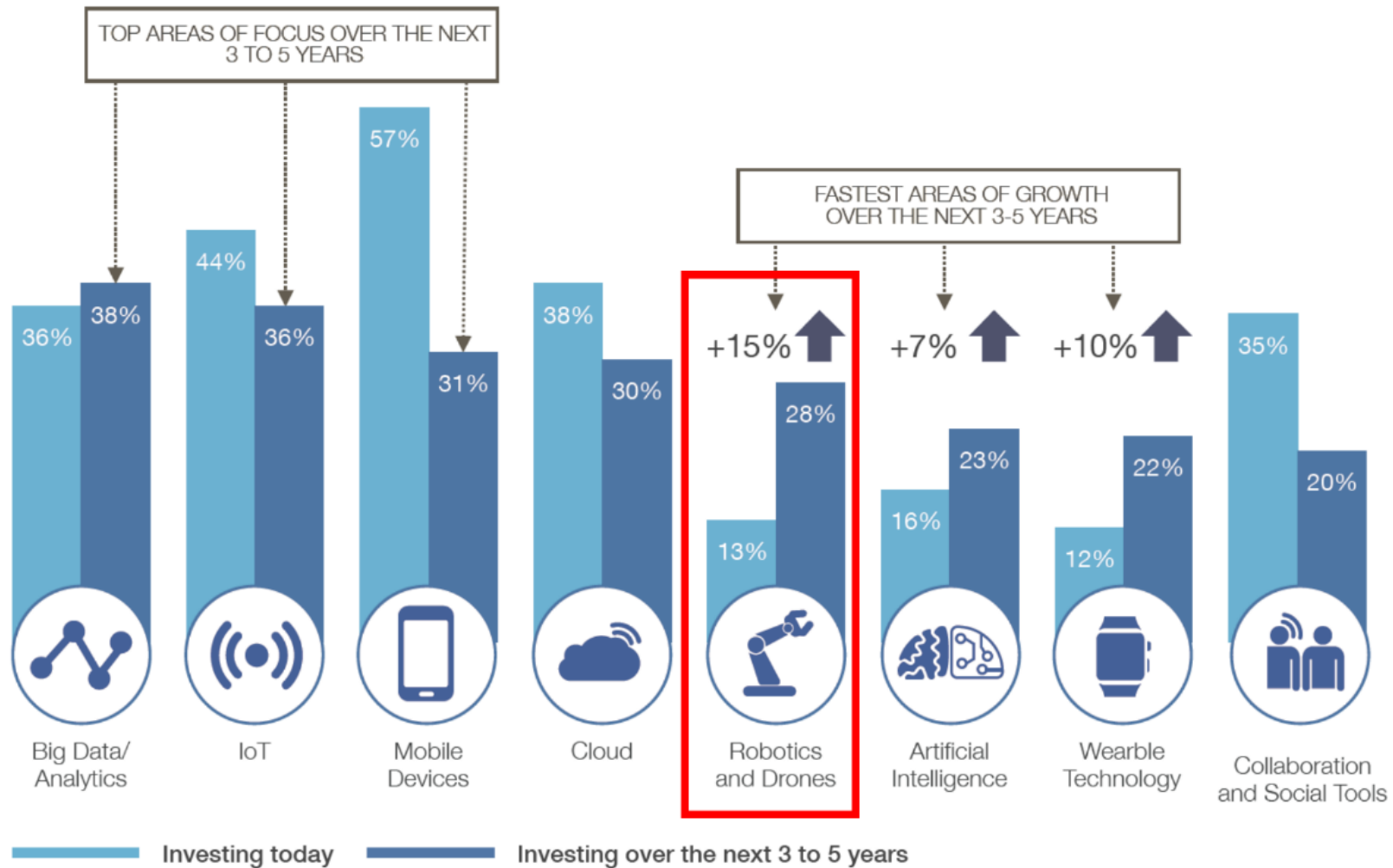
Workforce

- Developed UAV & Robotics SDP Specialty
- Established PEDD training & Certification Program
- Collaboration with ABB, Avitas, Airbus on UAV & Robotics



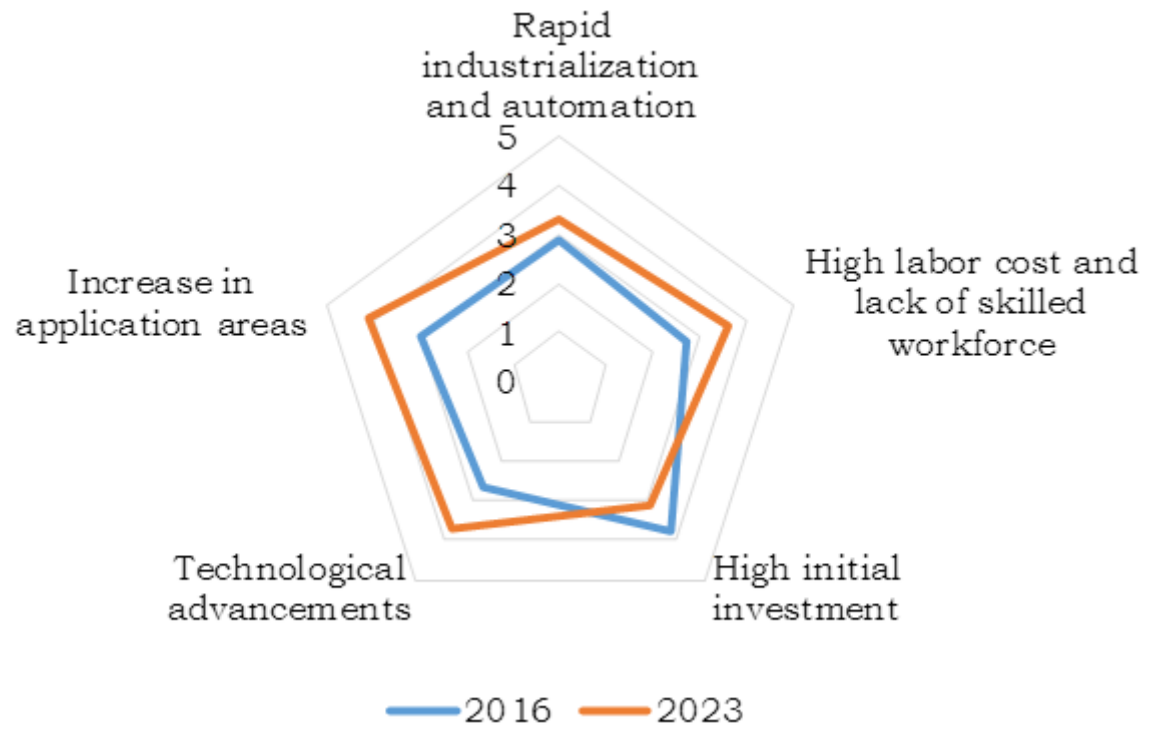
**UAV &
Robotics**

Industrial Robotics Market

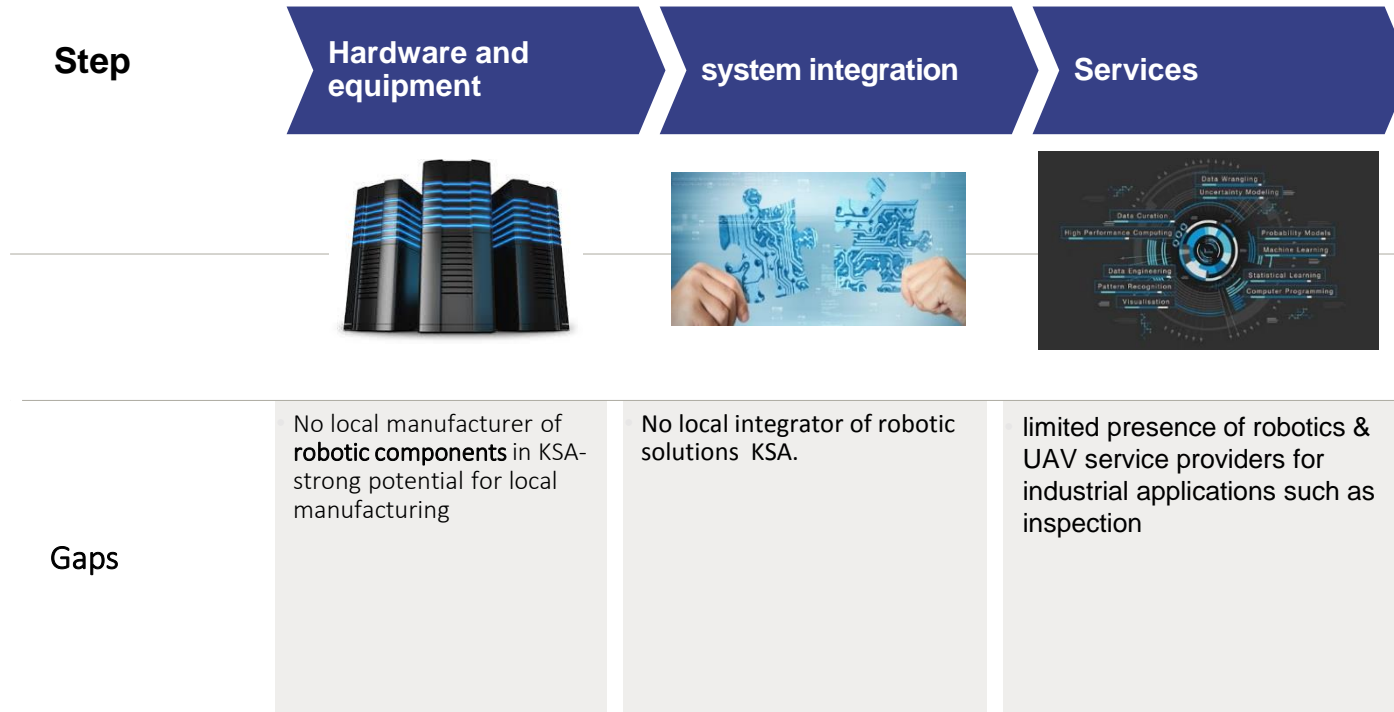




Industrial Robotics Market



Localization potential exists at most stages of the Robotics value chain



Source: Desktop research, Saudi Aramco analysis

Key messages and next steps

Key messages

- ✓ Robotics is taking off and has **applications both in oil and gas and several other industries** in KSA (e.g. shared services)
- ✓ The KSA market for robotics is in line with global growth of at **15% over the next 3-5 years**
- ✓ Saudi Aramco is also adopting robotics solutions to enhance its operations and improve performance.

In case you are interested in discussing this opportunity further, please contact



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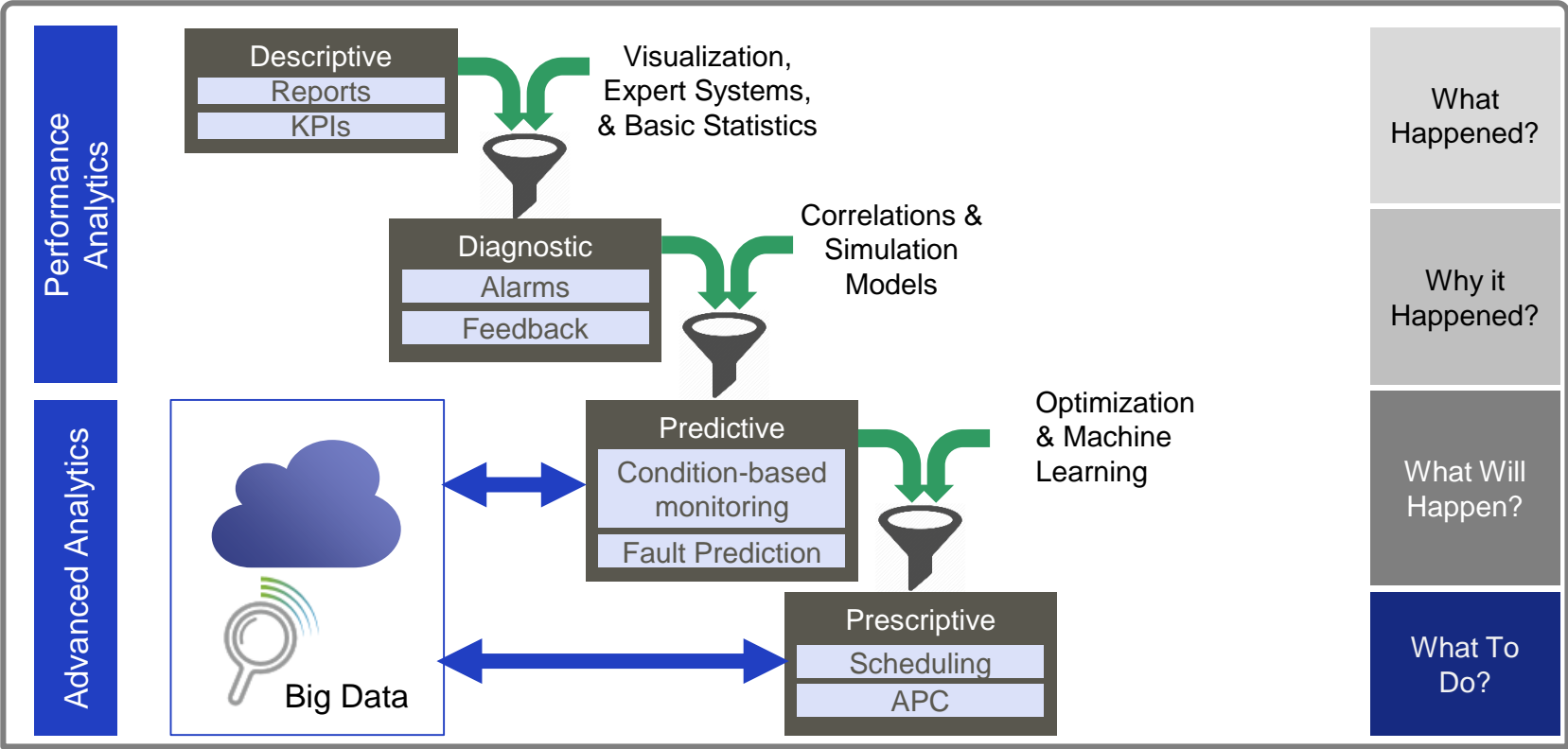
Big Data & Advanced Analytics

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Analytics vs. Advanced Analytics







The energy industry is realizing the value of analytics solutions

	Situation	Solution
	<ul style="list-style-type: none"> To drive optimization, ExxonMobil unified data storage to one huge data lake. 	<p>ExxonMobil created its first Big Data shared service across an enormous enterprise – from data ingestion at the edge using Hortonworks DataFlow to long-term storage in Hortonworks Data Platform</p>
	<ul style="list-style-type: none"> BP recognized that it is underutilizing its data repository and needed to invest in data mining to fully leverage all available data 	<p>In 2012, the organization established a decision analytics network – now 200-strong among its professionals – to examine ways to advance use of data and maximize business productivity</p>
	<ul style="list-style-type: none"> Dow Chemicals creates enormous amounts of data in numerous silos and wished to effectively utilize it to drive business efficiency 	<ul style="list-style-type: none"> Dow Analytical Technology Center was recognized for tackling two distinct challenges <ul style="list-style-type: none"> integrating multiple data sources into a uniform operational domain and then applying leading edge data analytics to conquer the multiple large data sets tied to its industrial chemical production processes,

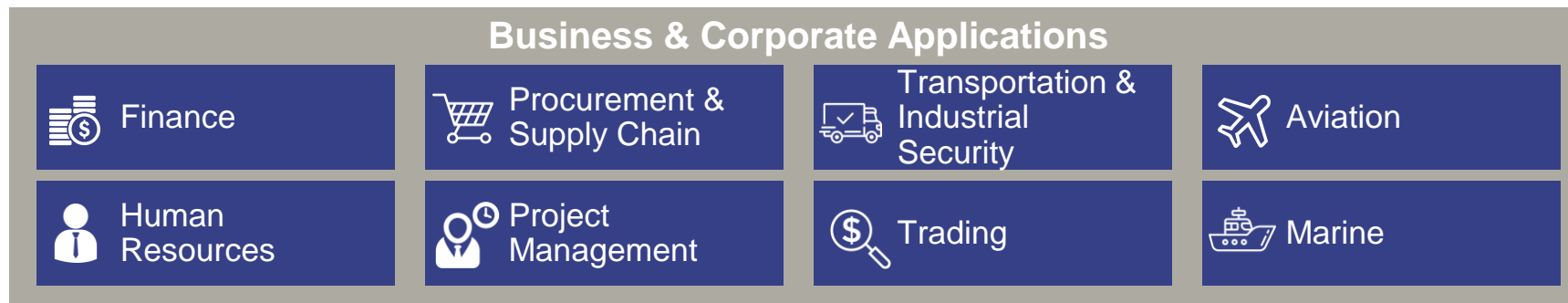
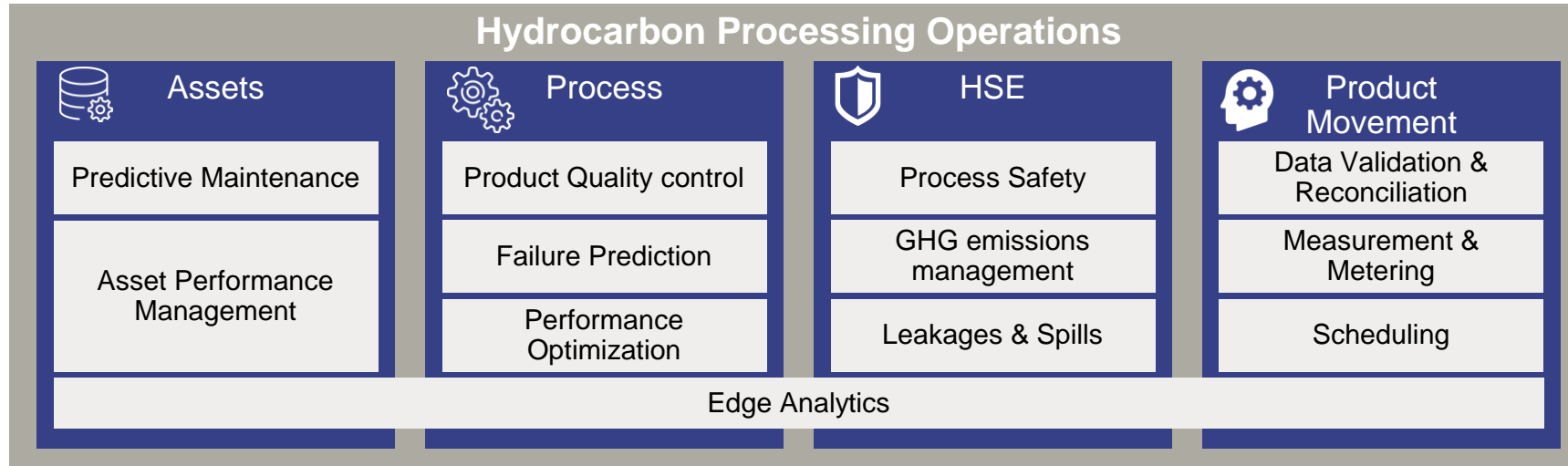
Source: Press Releases

Furthermore, several large enterprises in KSA are already embracing data analytics solutions

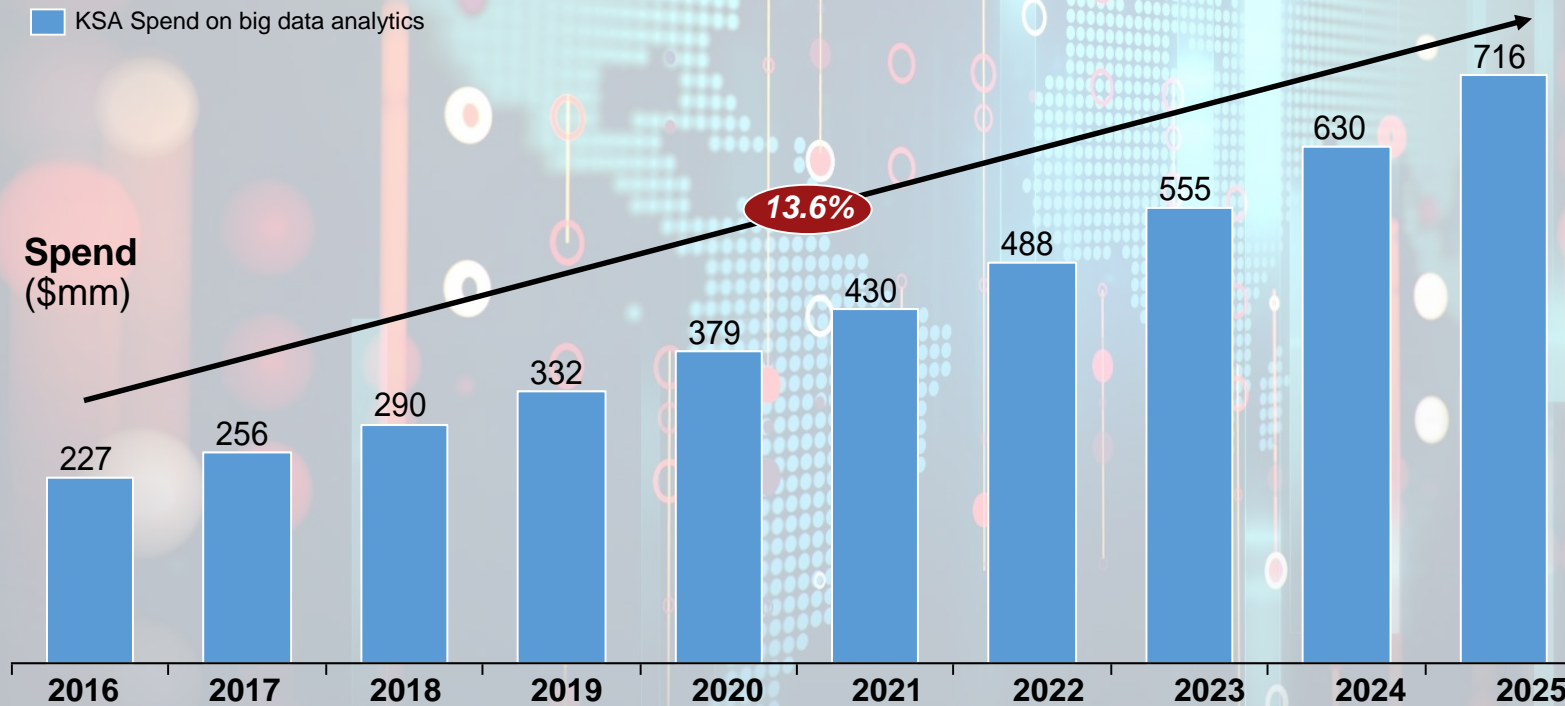
Examples of Analytics deployment	
	<ul style="list-style-type: none">• Saudi Aramco have been utilizing big data in its upstream business for years.• Implemented several advanced analytics solutions ranging from operational predictive analytics to text and sentiment analysis.
	<ul style="list-style-type: none">• SABIC selected ZEMA to meet its business users' requirements for a fully automated data collection, validation, and auditing tool that will easily integrate up-to-the-minute market data with SABIC's downstream systems.
	<ul style="list-style-type: none">• Bahri identified 31 Big Data unique models to improve ROCE, 12 of which were implemented successfully in 2016, saving the company \$200 MM.
	<ul style="list-style-type: none">• Leveraging Microsoft big data analytics solutions to enhance business efficiency e.g. route optimization, fuel management, streamlining of maintenance and enhanced performance reporting

Source: Desktop research, Microsoft, Saudi Aramco

Big data/analytics have several applications within Oil and Gas- there exists potential for local companies to offer these services

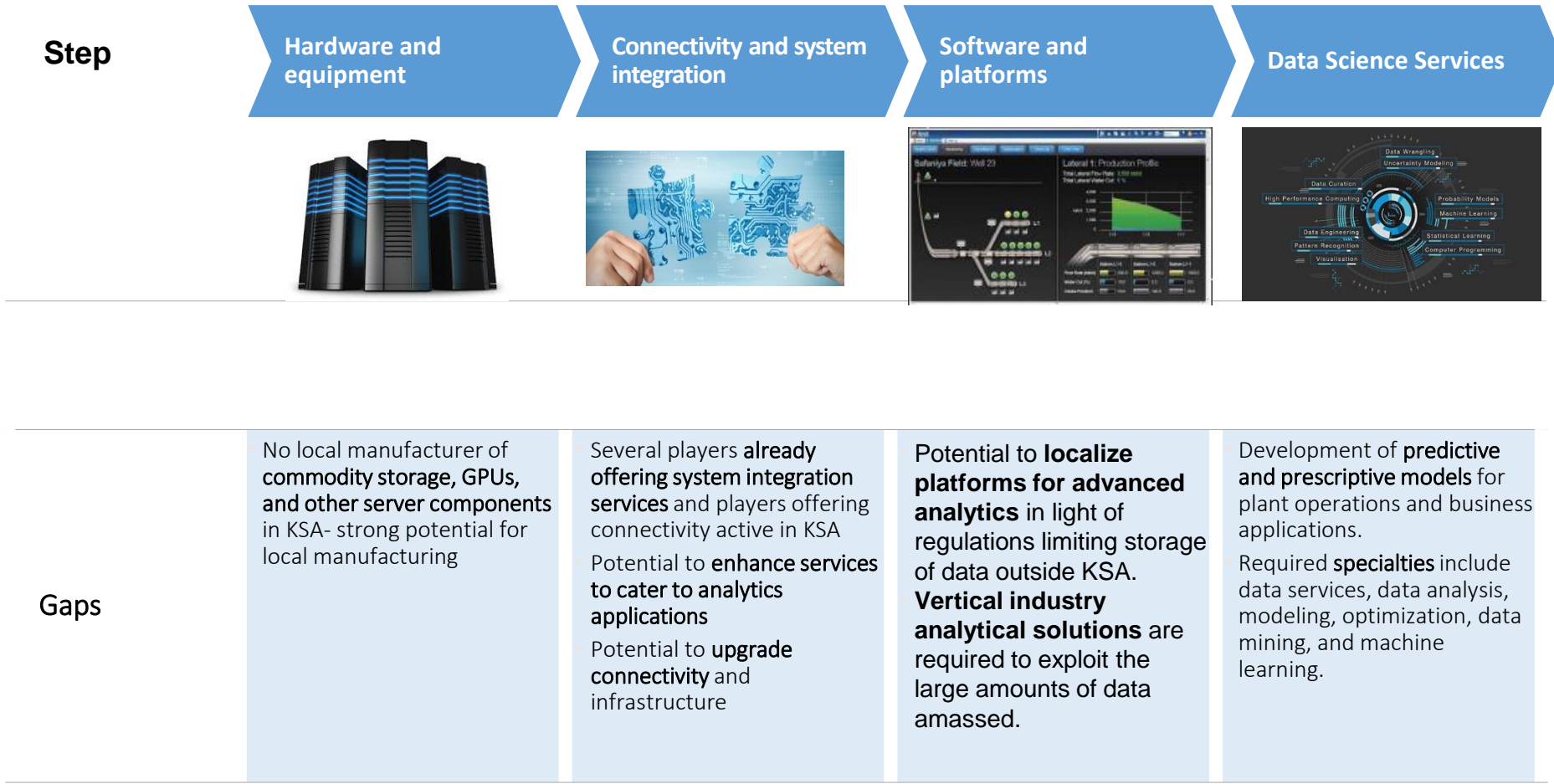


Market for Advanced Analytics in KSA is expected to grow at ~14% CAGR to reach a value of \$716MM by 2025



Source: IDC

Localization potential exists at most stages of the analytics value chain



Key messages and next steps

Key messages

- ✓ Advanced analytics is taking off and has **applications both in oil and gas and several other industries** in KSA (e.g. manufacturing)
- ✓ The KSA market for advanced analytics is growing rapidly at **~14% CAGR to reach ~\$700 mn by 2025**

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Mobility

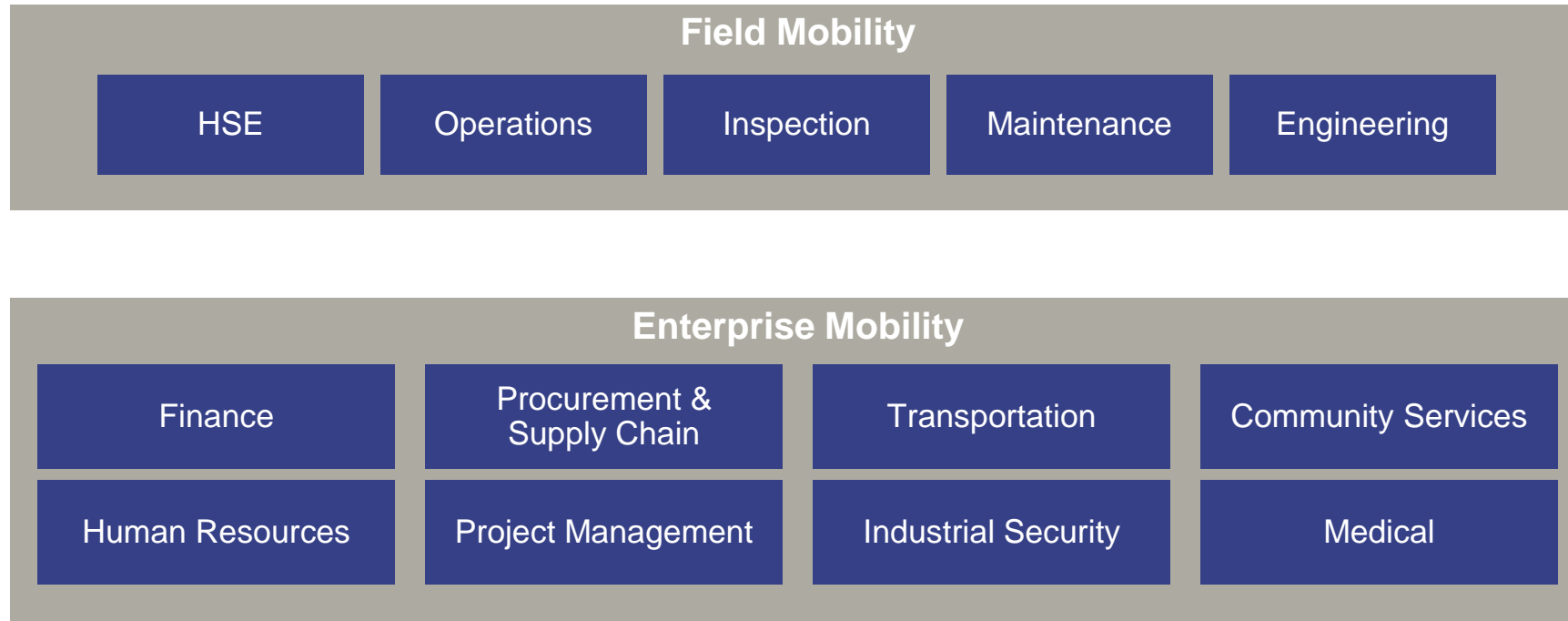
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Mobile solutions have several applications within Oil and Gas- there exists potential for local companies to offer these services

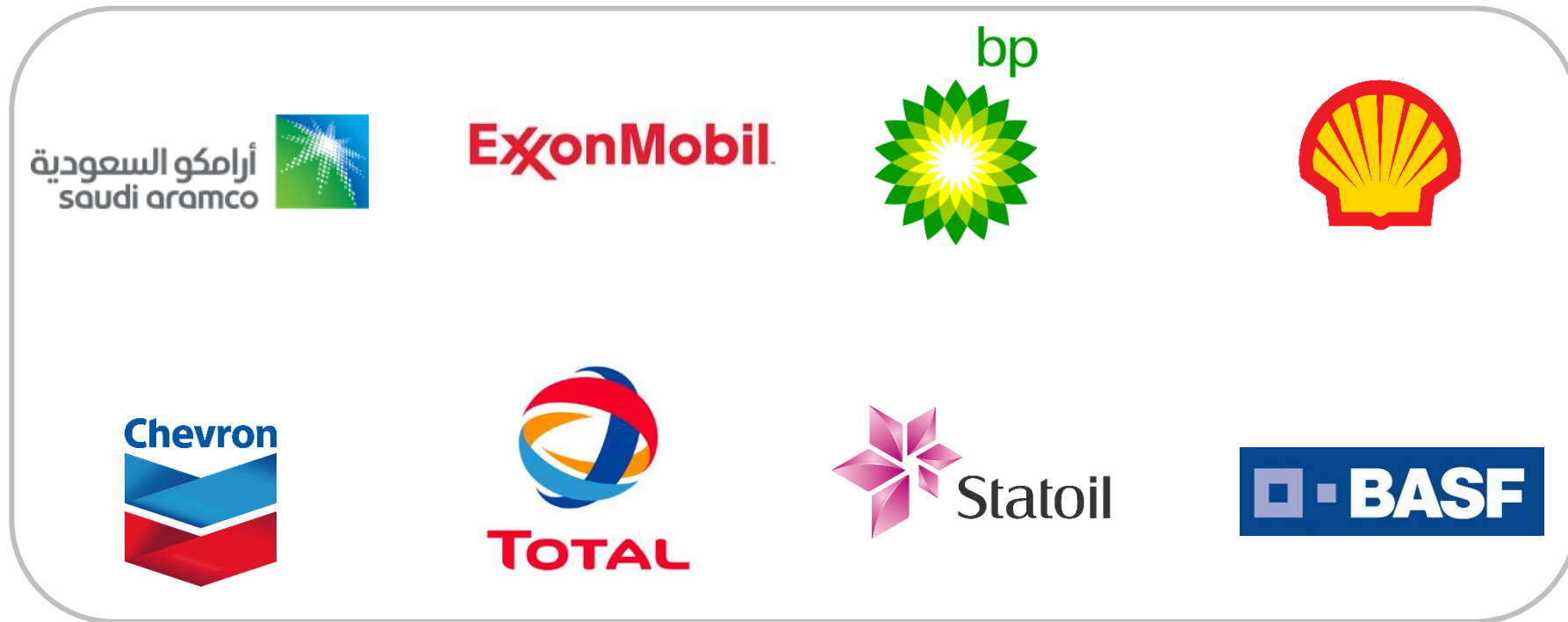
Examples of mobile applications in oil and gas



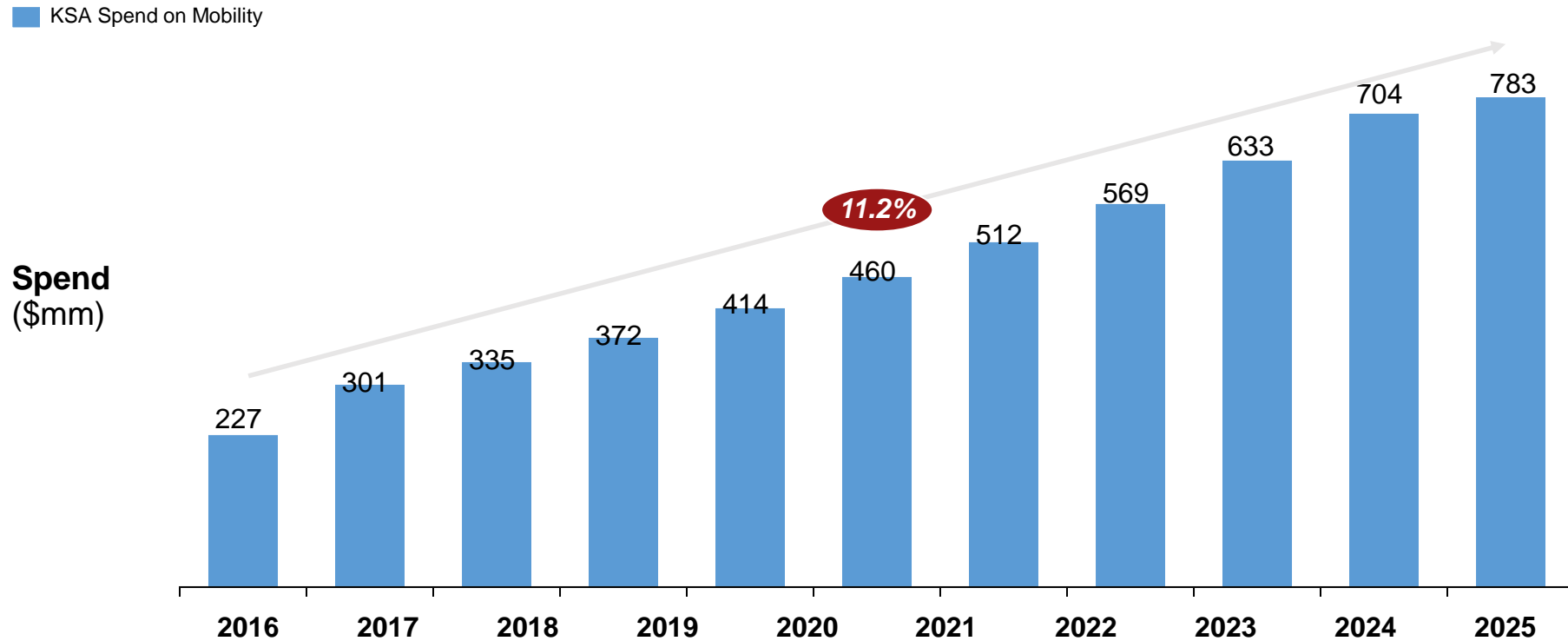
Source: Saudi Aramco

The energy industry is adopting mobile solutions for its field and enterprise applications

Companies that have adopted field mobility in the oil, gas, and chemicals industry

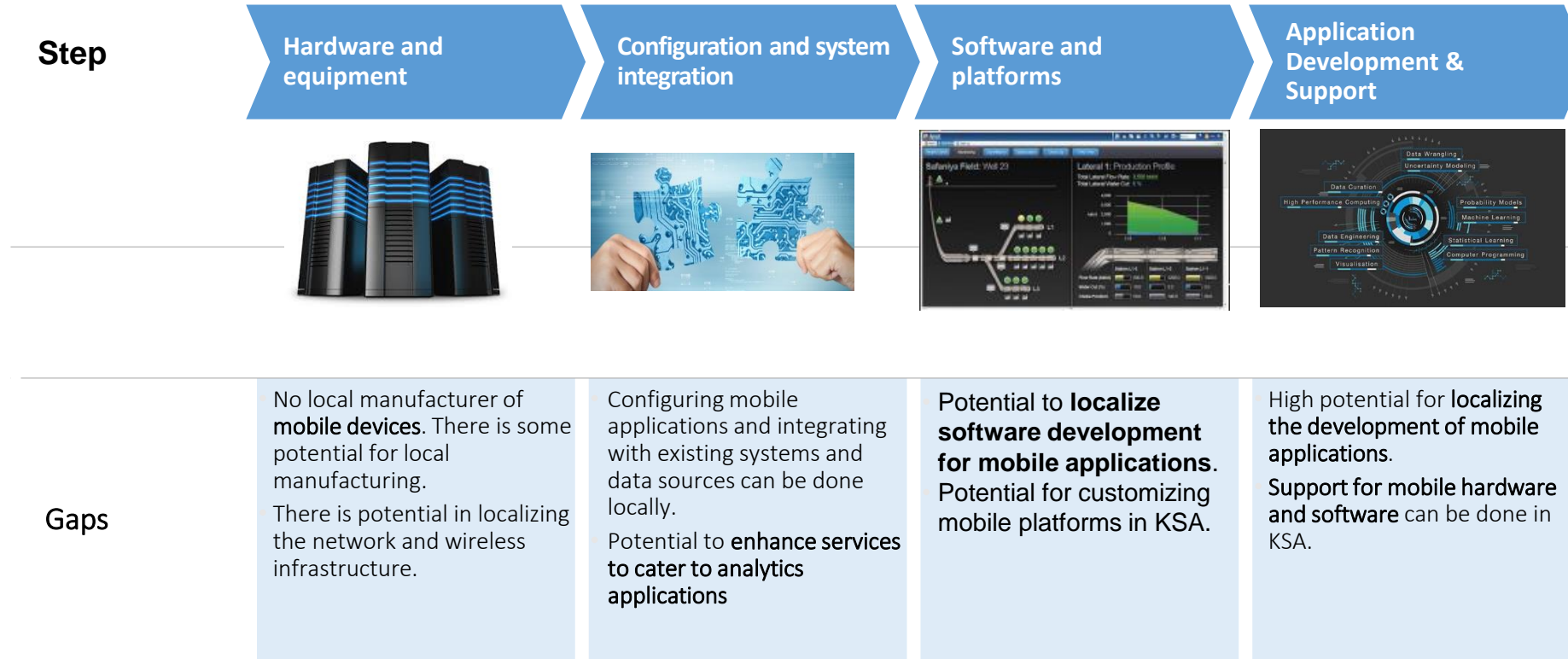


Market for Mobile Apps in KSA is expected to grow at ~11% CAGR to reach a value of \$780MM by 2025



Localization potential exists at most stages of the mobility value chain

○ Low ● High



Key messages and next steps

Key messages

- ✓ The oil and gas industry along with other sectors in KSA are adopting mobile solutions.
- ✓ The KSA market for mobile apps is growing rapidly at **~11% CAGR to reach ~\$780 mn by 2025**
- ✓ Saudi Aramco is also adopting field mobility and enterprise mobility solutions to enhance its operations and improve performance.

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Source: Saudi Aramco analysis

Additive Manufacturing

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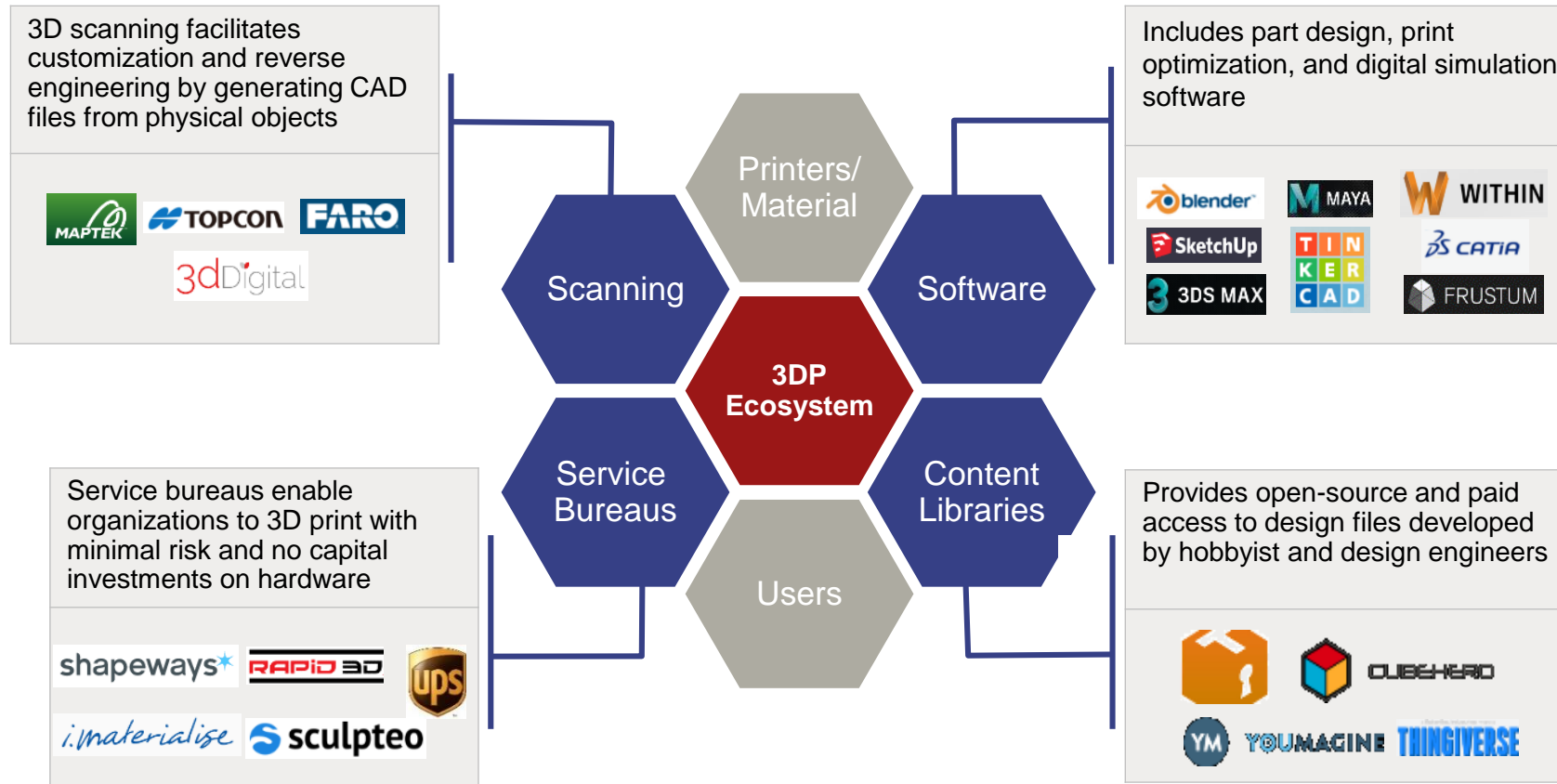
Several Organizations that have already implemented 3DP and have realized improvements across the value chain

Case Studies

Productivity Improvement	Supply Chain Simplification	Speed to Market	Mass Customization	Complex Design
				
<ul style="list-style-type: none">• 3DP used to fabricate jigs and fixtures for the production line. One such tool is used to attach name badge to car	<ul style="list-style-type: none">• The United States Navy uses 3D printing for replacement parts for submarines, missiles, aircrafts etc.	<ul style="list-style-type: none">• Under Armour released a limited edition running shoe with a 3D printed lattice sole and upper. The first batch sold out immediately	<ul style="list-style-type: none">• Phonak uses 3DP to manufacture unique hearing aids customized for each customer's ear	<ul style="list-style-type: none">• GE's LEAP jet engine features 3-D printed fuel nozzles with complex designs that cannot be made using traditional techniques
<ul style="list-style-type: none">• Cost and time savings compared to traditional CNC machining: 58% cheaper and 92% faster	<ul style="list-style-type: none">• USS Essex, a full-up assault ship, has a printer permanently installed	<ul style="list-style-type: none">• The new UA innovation center is outfitted with the latest 3D scanning and printing machines	<ul style="list-style-type: none">• Since 2000, Phonak has sold more than 10 million 3D printed hearing aids	<ul style="list-style-type: none">• GE engineers produced a model of a GENx jet engine using direct metal laser melting 3DP

The 3D printing ecosystem consists of several aspects including scanning, software, and service bureaus

3D Printing Ecosystem

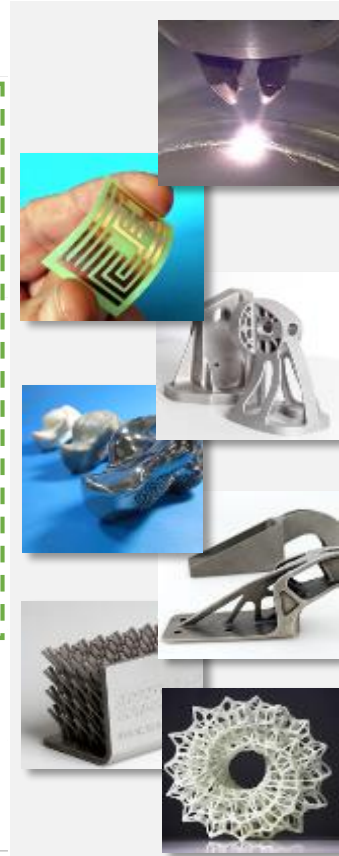


Source: A.T. Kearney, Press Research and Interviews

Today, 5 end-markets account for ~80% of the market, leading the transition from prototyping to direct manufacturing

End-markets revenue allocation (% 2014, 2015)

End-markets	5 year CAGR (Global)
<p>Industrial/ Business Machines¹</p>	15-20%
<p>Consumer Products/ Electronics</p>	25-30%
<p>Automotive</p>	15-20%
<p>Medical</p>	20-25%
<p>Aerospace</p>	20-25%
<p>Defense</p>	15-20%
<p>Other</p>	20-25%



2014 2016

1. Industrial/Business Machines includes the printer hardware and peripherals required for additive manufacturing
Sources: A.T. Kearney, Press Research; Wohlers Associates; Expert Interviews

Several high performance polymers have limited production in KSA and can be localized

High Performance Polymers: Key producer by resin

High Performance Polymers Typical production: >200 kT Typical growth rates: 6-10% CAGR	PEEK • Evonik • Victrex • Solvay	LCP • Celanese • Solvay • Sumitomo • Polyplastics	PI • DuPont • Evonik • Ube America
	PSU • BASF • Solvay • Sumitomo	PEI • SABIC	PPS • Celanese • Solvay • DIC Corp • Toray
Engineering Resins Typical production: >20 MM T Typical growth rates: 4-6% CAGR	ABS • SABIC • Covestro • Teijin • Mitsubishi	POM • Celanese • DuPont • BASF • Polyplastics	PBT • SABIC • BASF • DuPont
	PP Compound • LyondellBasell • Sadara • Japan PP • Borealis	PMMA • Mitsubishi • Evonik • Sumitomo • SABIC	PA • BASF • SABIC • DSM • Solvay

✓ Available in KSA
✗ Not available in KSA

While metals are available, there is no processing of metals to produce powders necessary for 3D Printing

Metals processors for 3D printing

	HQ	KSA presence in 3D printing
	Sweden	✗
	USA	✗
	USA	✗
	Sweden	✗
	Germany	✗
	Austria	✗



From selling aluminum sheets to aluminum powders

Insights	Chemical companies will need to supply chemicals differently to support 3DP adoption
----------	---

Source: Desktop research, Saudi Aramco

Key messages and next steps

Key messages

- ✓ 3D printing is taking off and has **applications both in oil and gas and several other industries** in KSA (e.g. manufacturing, medicine)
- ✓ **~50% of the market** is expected to comprise of **3D printing services** and 30% and 20% for 3D printers and materials respectively
- ✓ On 3D printing materials, potential exists to localize manufacturing of **high performance polymers** (PI, POM, PEEK) and also **metal powders** (Aluminum, Titanium, Steel)

In case you are interested in discussing this opportunity further, please contact



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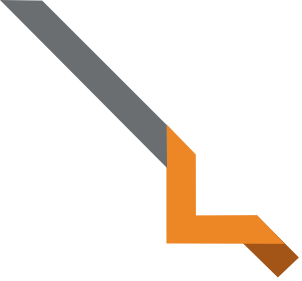
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Smart Sensor & Intelligent Devices

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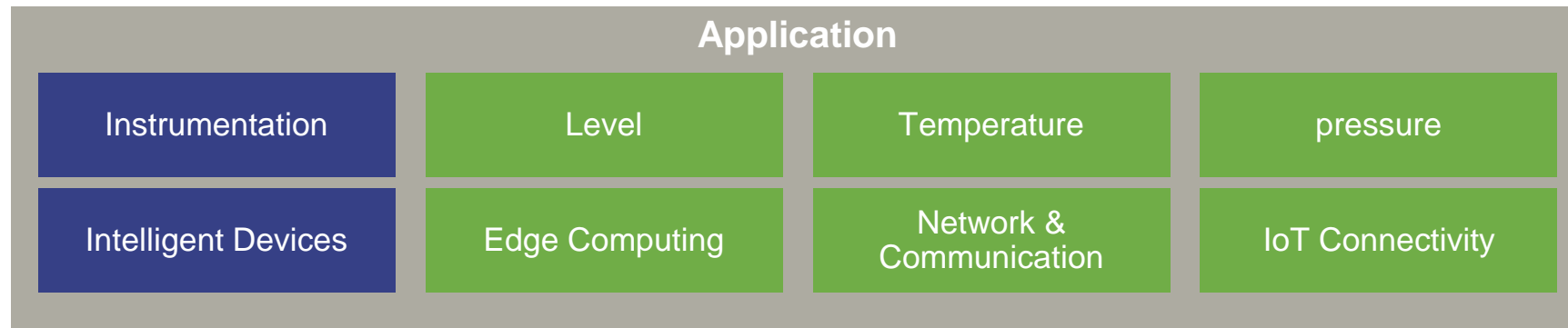
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The Smart Sensor that is capable of modifying its internal behavior to optimize the collection of data from external world along with advance learning capabilities

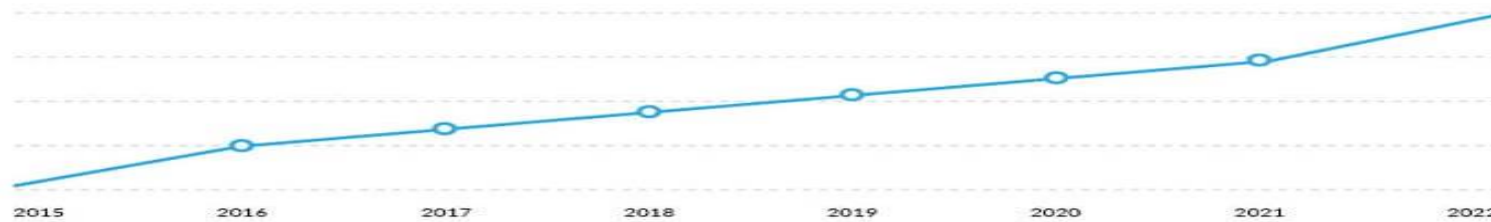
Intelligent Devices is a solution that facilitate data processing at or near the source of data generation which know as Edge computing. For example, in the context of the Internet of Things (IoT), the sources of data generation are usually things with sensors or embedded devices.



• Source: Saudi Aramco

Smart Sensor & Intelligent Devices

Global SMART Sensors and intelligent devices Market is expected to reach \$60 billion by 2022 grown at a CAGR of 19.2% (2016-2022)



GLOBAL SMART SENSORS MARKET BY PRODUCT

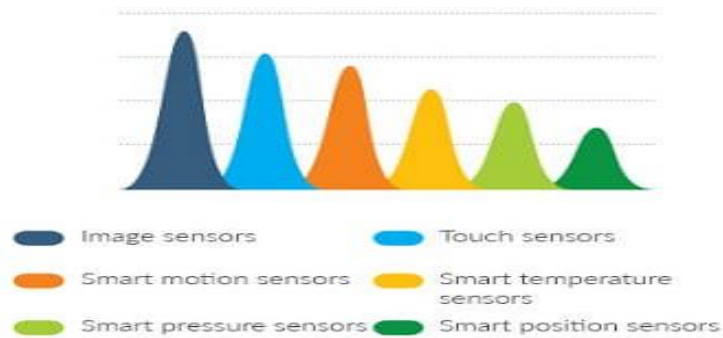
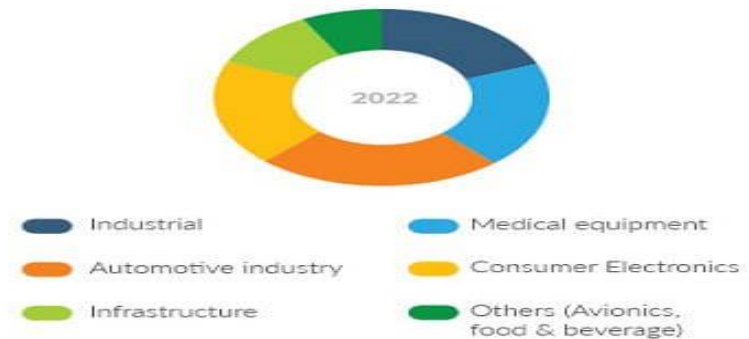


Image sensor is projected as one of the most lucrative segments.

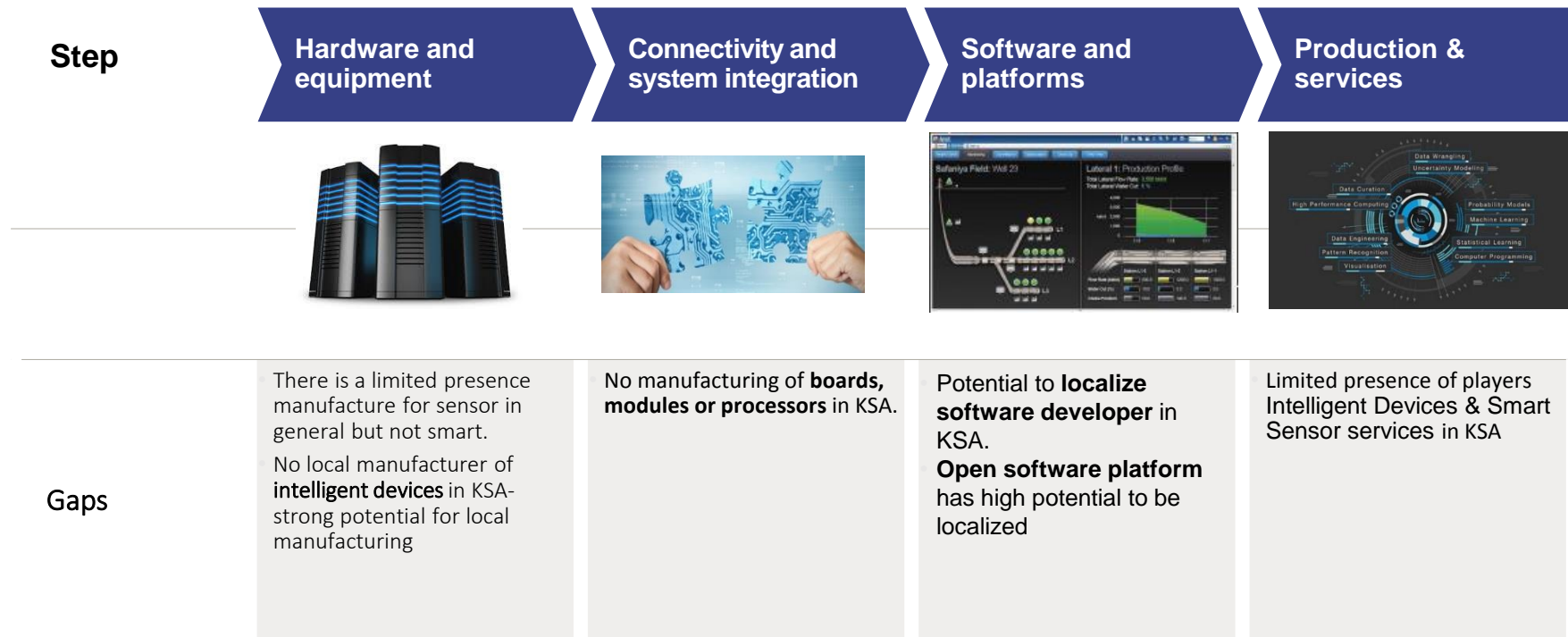
GLOBAL SMART SENSORS MARKET BY END-USER



Automotive end-user industry held a dominant position in 2015 and would continue to maintain the lead over the forecast period.

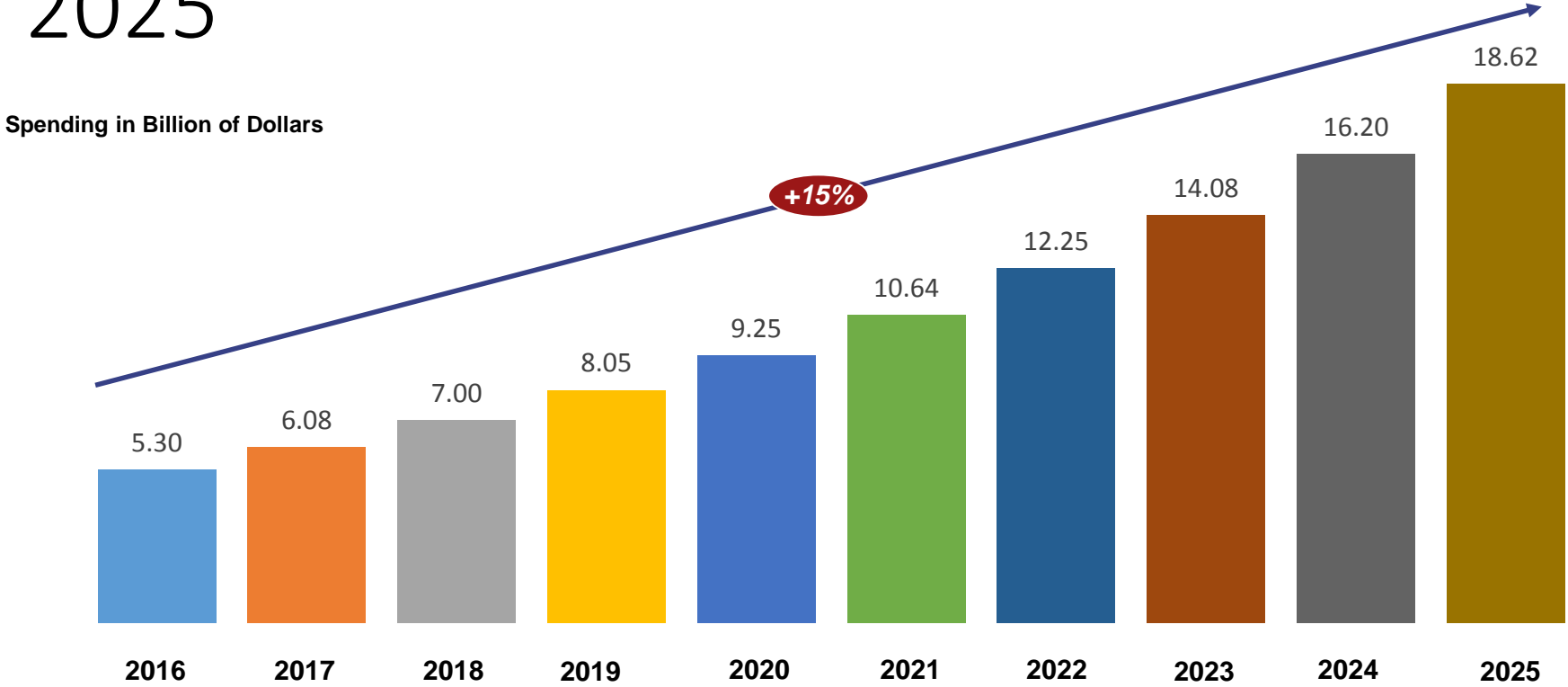
Source: Saudi Aramco

Localization potential exists at most stages of the Intelligent Devices & Smart Sensor value chain



Source: Desktop research, Saudi Aramco analysis

Market for IoT Devices in KSA is expected to grow at ~15% CAGR to reach a value of \$18.62 Billion by 2025



Source: Saudi Aramco analysis

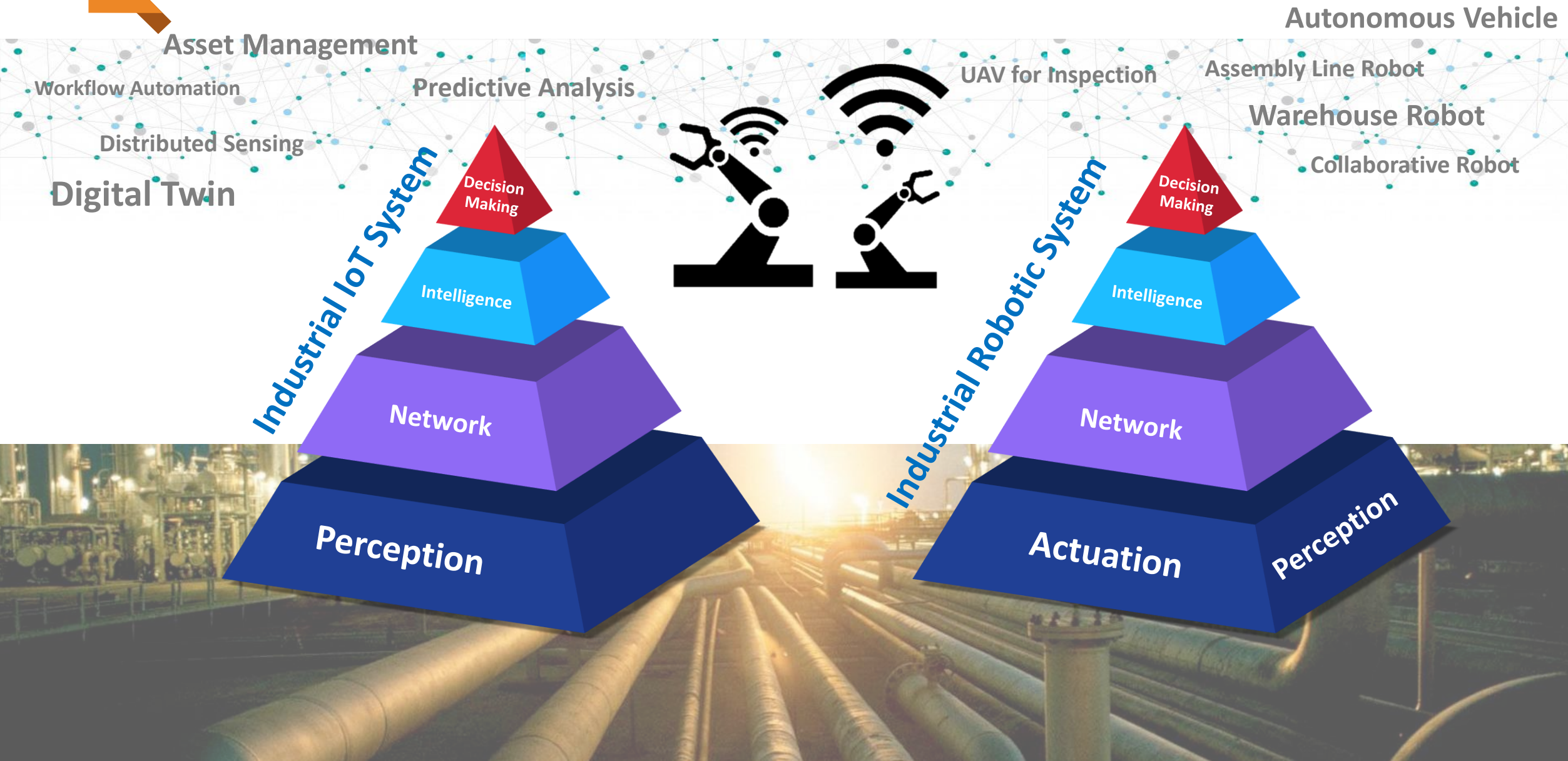
IoT & Automation

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Industrial Robotics and IoT: Bridging the Cyber World and the Physical World

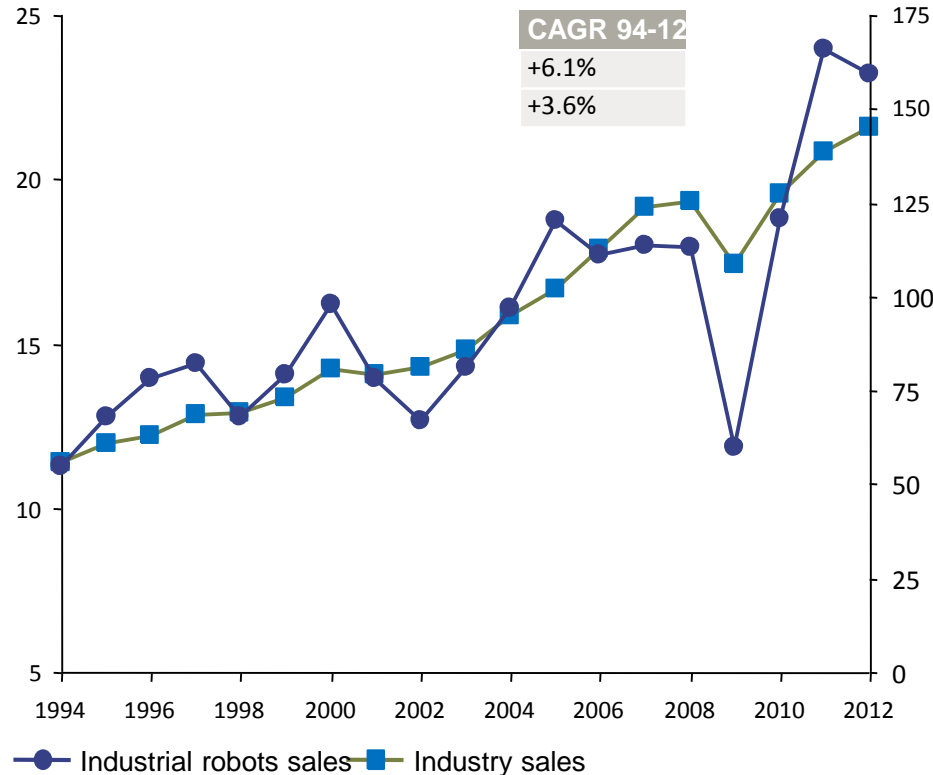


Robot sales growth until 2020 is forecasted to be 8% driven by an industry and automation growth increase

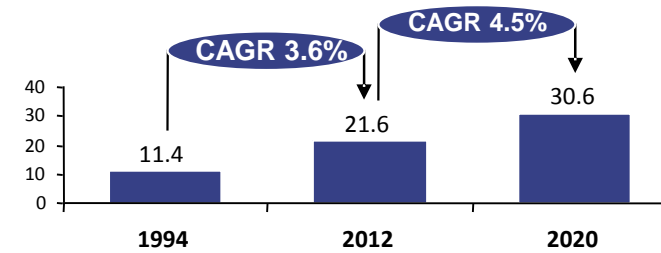
Industry market forecast: Long term development

Manufacturing industry sales [8 main industries]
In real trillion USD, 1994-2012

Industrial robot sales
In 1,000 robots, 1994-2012



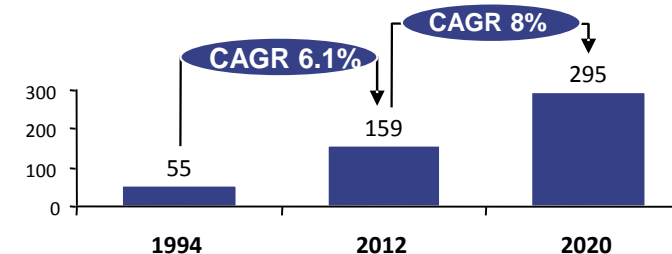
Manufacturing industry sales [8 main industries]
In trillion USD, 1994-2020



Automation driven growth



Industrial robot forecast
In 1,000 robots, 1994-2020



Source: EIU, IFR, IHS

Industrial Highlight - Collaborative Robot

Future of work will require human-machine collaboration

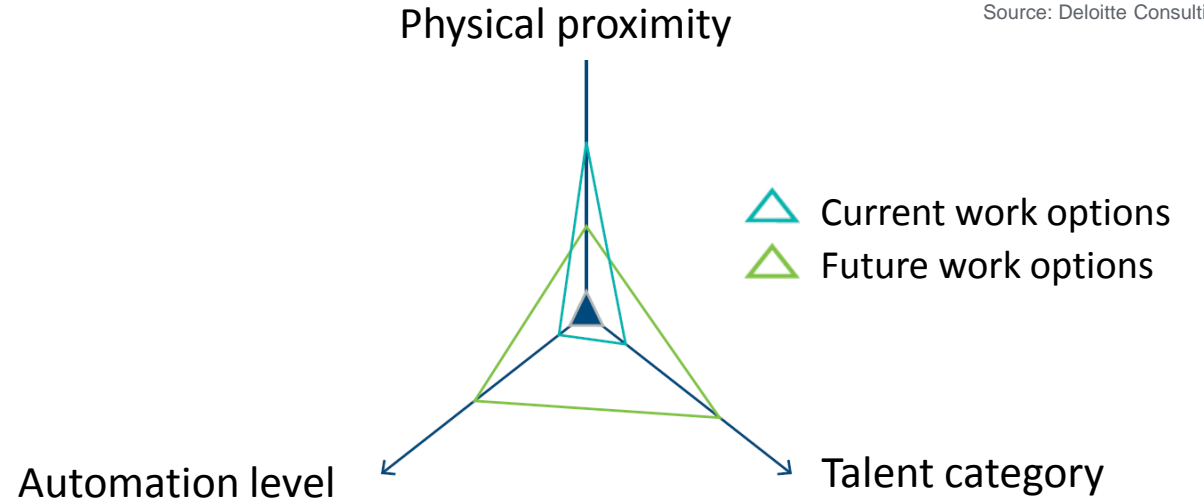
The “what” (technology & automation), “who” (talent & the open talent continuum), and “where” (workplaces, physical location) of work are dramatically changing.

Source: Deloitte Consulting LLC

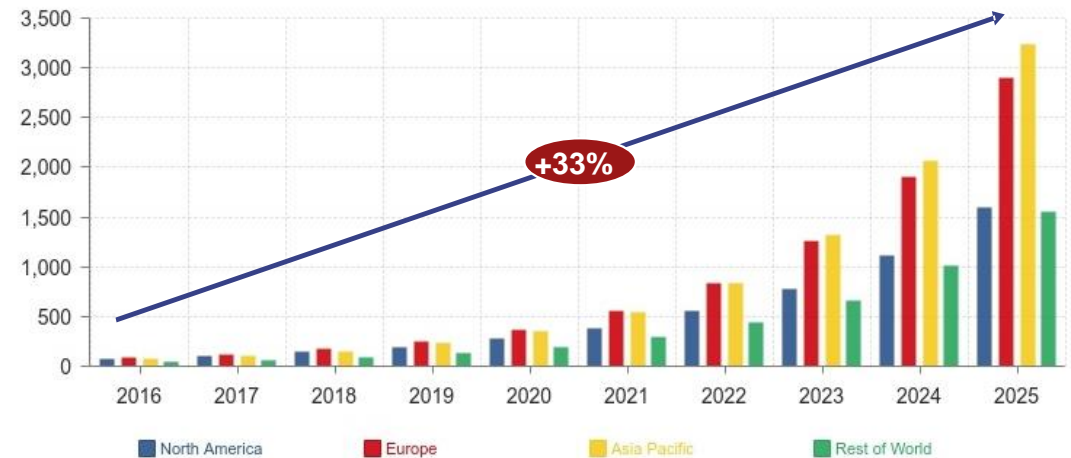


Collaborative robots, known as co-bots, work along side humans without the need for traditional safety cages.

Source: GE Reports/Robotics

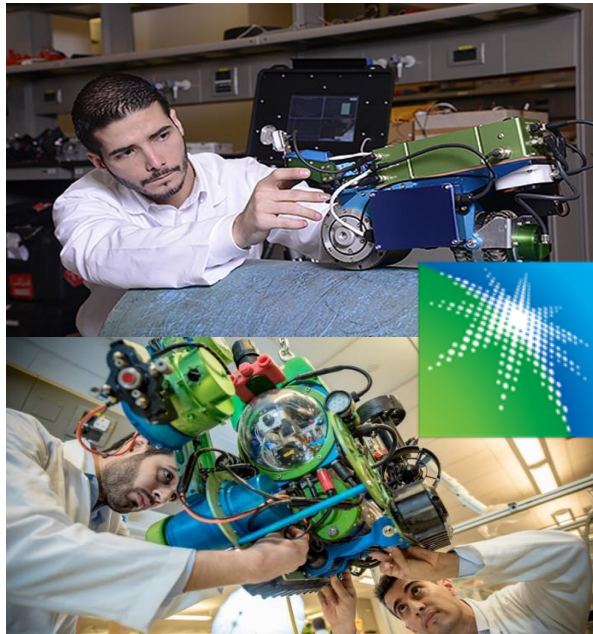


Subdomain Market Growth of Collaborative Robots
2017-2026 (In \$ Millions)



Source: Inkwood Research

Engagement of Robotics in the middle east, from academia to industry



 **REUTERS** #TECHNOLOGY NEWS SEPTEMBER 6, 2017
Saudi sovereign fund, Softbank plan robotic initiative

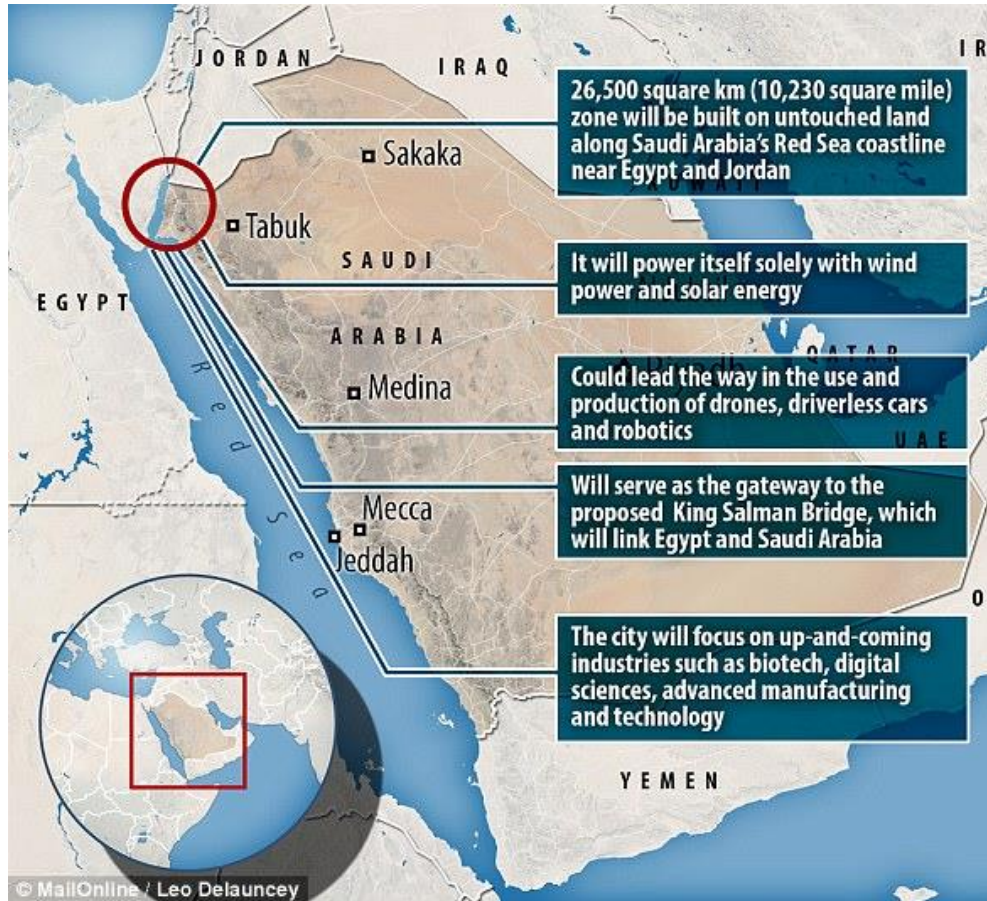


Source: Reuters, Saudi Aramco



NEOM

A city of future equipped with robotics and connectivity



Robots to roam \$500 billion Saudi city

RICHARD WACHMAN | Published — Tuesday 24 October 2017
bodona.li.1

NEOM MEGA CITY PROJECT




A \$500bn project which 70% of the world population can reach within 8 hours

INVESTMENT SECTORS	TECHNOLOGIES
Human civilization	Automated driving and passenger drones
Energy and water	Novel food growing and processing practices
Mobility	Repetitive and arduous tasks automated and handled by robots
Biotech	All services and processes are 100% automated
Food	Free world class online education
Media	Wireless high speed internet
Entertainment	Full scale e-governance
Advanced manufacturing	Artificial intelligence, virtual reality and augmented reality technologies
Technological & digital sciences	City powered by renewable energy

ARAB NEWS Graphic / Naser Ahmed

The energy industry is also actively investing in Robotics and IoT

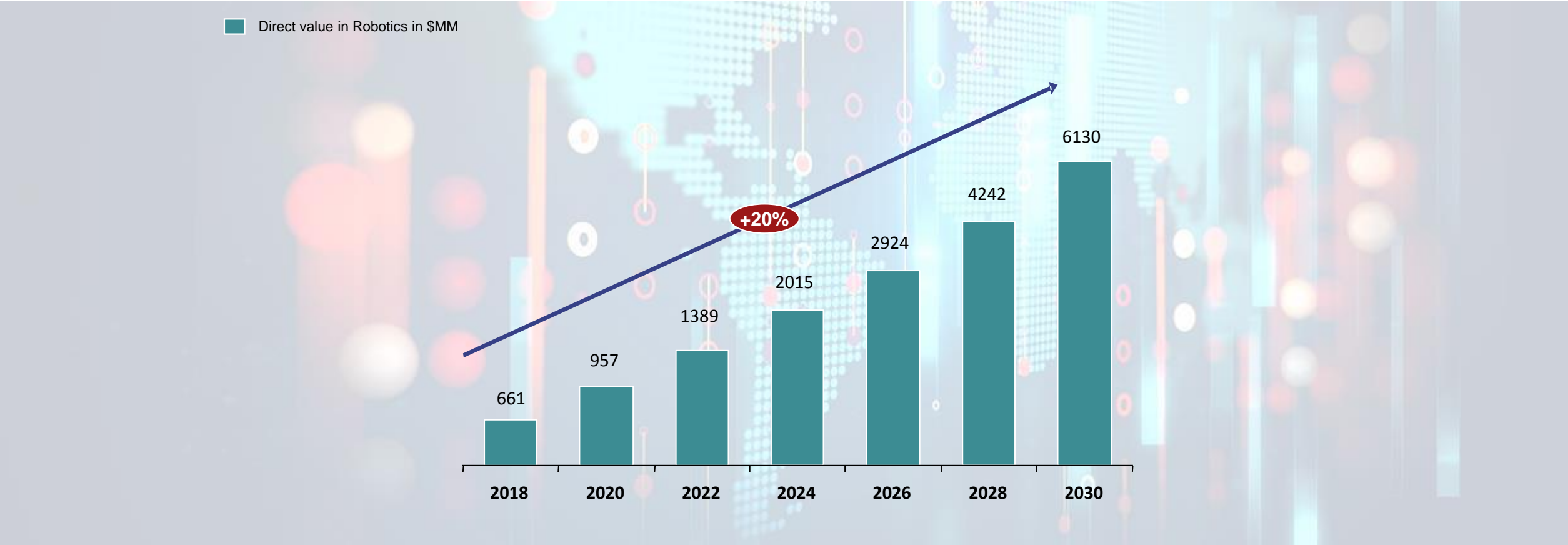
Robotics and IoT initiatives in the energy industry

	Situation	Solution
	Having challenges in acquiring 3D high density seismic data in hard-to-access onshore areas.	TOTAL is currently developing a robotic system (METIS), to revolutionize the land seismic survey operations using a combination of UAV , IoT node , airship , and unmanned vehicle technologies.
	Inspection and monitoring jobs are dangerous and tedious in remote and unmanned oil and gas facilities.	In 2017, Shell deploys Sensabot, a mobile robot to perform inspection and monitoring tasks in extreme temperatures as well as within explosive and toxic atmospheres.
	Exploration demand in remote and hard-to-access areas. Inspection of oil and gas facilities including large network of pipelines, columns, reactors, tanks and boilers.	Saudi Aramco has recently deployed 16 underwater AUVs for seismic survey in the Arabian Gulf. The company has also deployed a mobile robot equipped with ultrasonic sensors for tank inspection. In addition, UAV are being used in for geo 3D modeling and facility inspection.

Source: Press research, Saudi Aramco

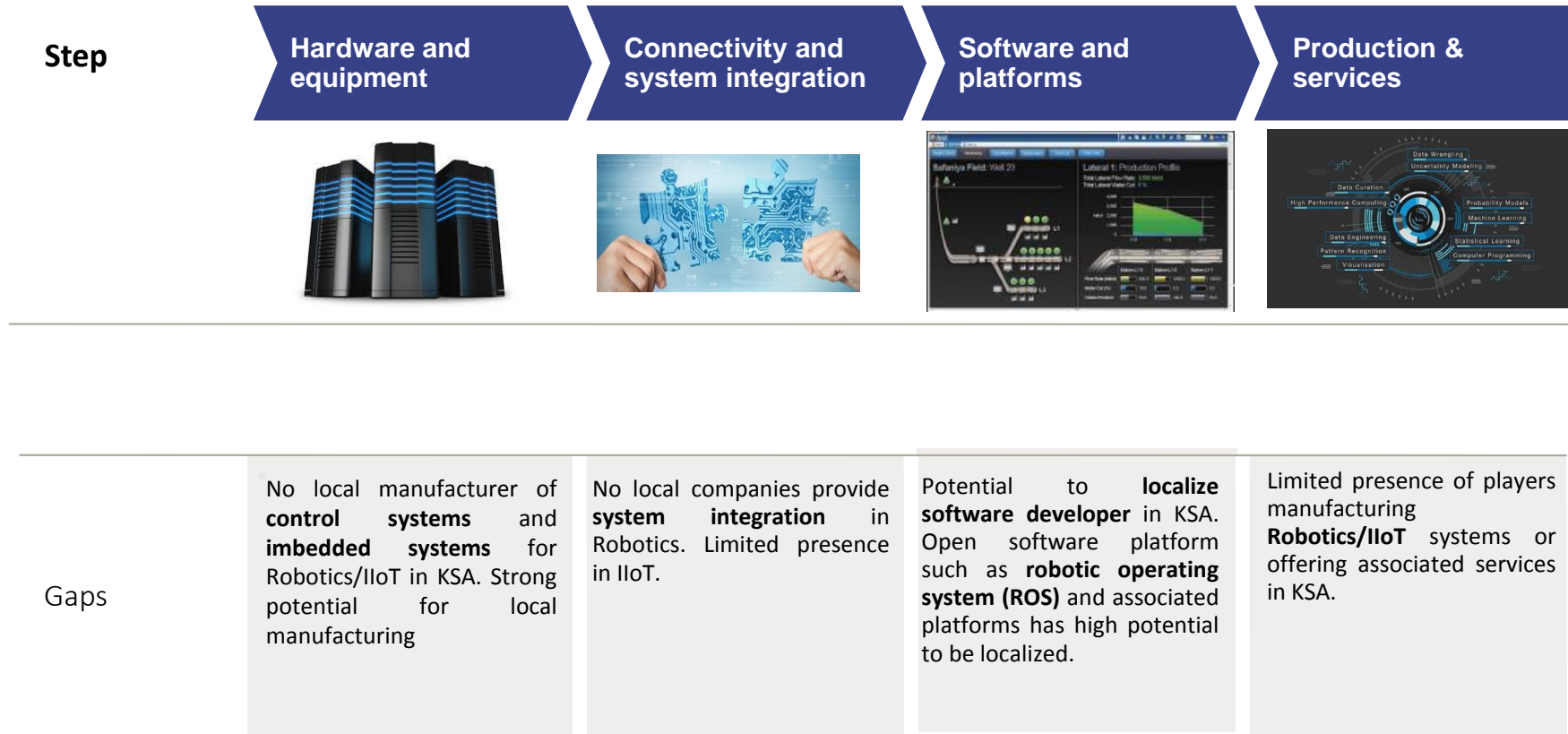
Market for industrial robots in KSA is expected to grow at ~20% CAGR till 2030, reaching \$6130MM

Number of Industrial Robots in KSA



Source: ATKearney

Localization potential exists at most stages of the Industrial Robotics and IoT value chain



Source: Saudi Aramco analysis

Key Messages

Key messages

- ✓ Robotics and IIoT are fast growing technologies and has applications both industrial (oil and gas, manufacturing, transportation) and commercial applications (NEOM)
- ✓ The KSA market for Robotics is growing rapidly at **20% CAGR to reach \$6130MM by 2030.**
 -
- ✓ Investment, at Aramco and national level
 - present great opportunities across the value chain.
- ✓ Demand on local service providers and system integrators on Robotics/IIoT systems.

In case you are interested in discussing this opportunity further, please contact



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Saudi Aramco

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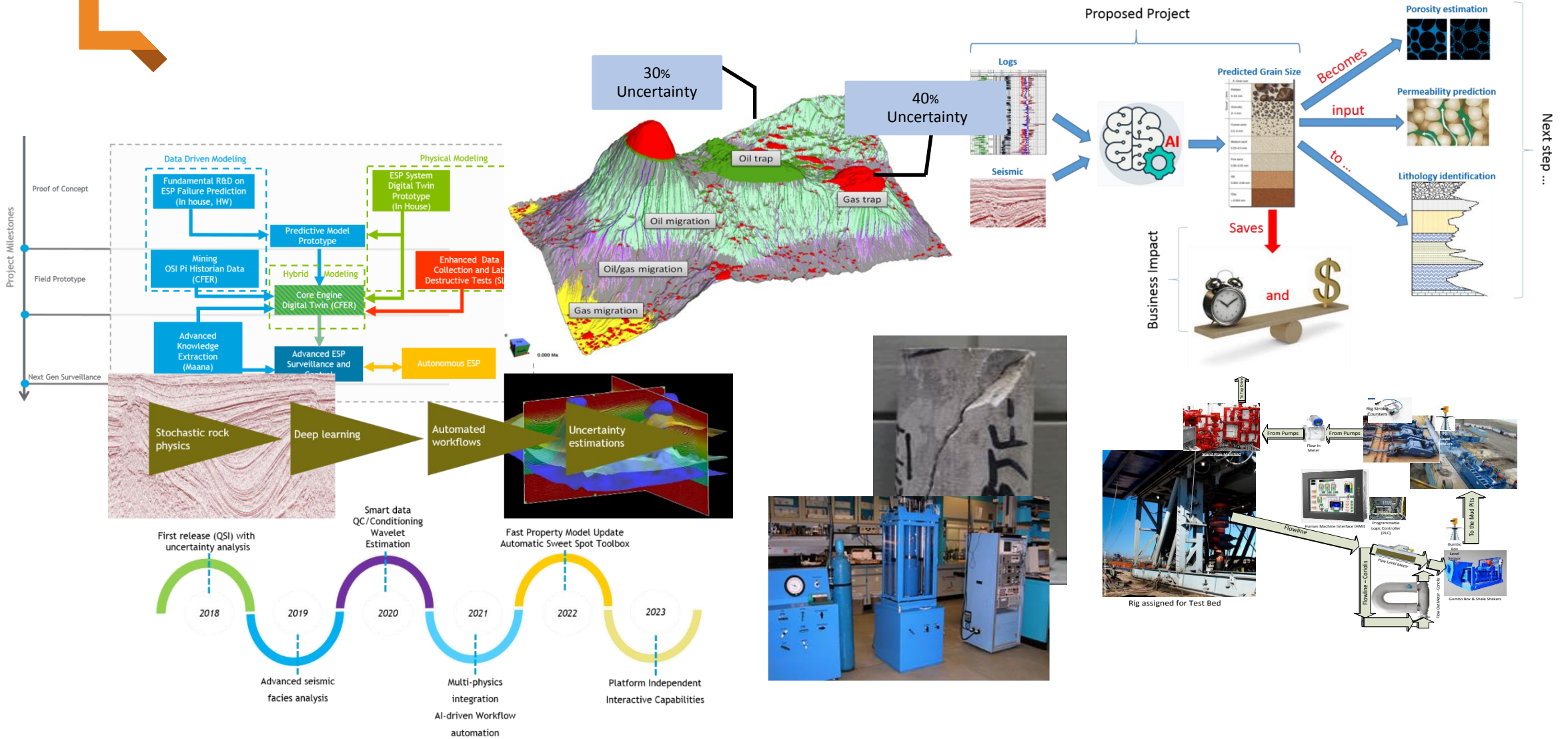
Artificial Intelligence

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Artificial Intelligence, Big Data and Advanced Analytics



Analytics vs. Advanced Analytics

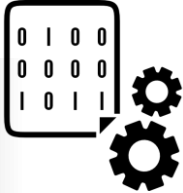
From Reporting and monitoring to predicting and optimizing



- Reactive
- What happened
- Past performance
- Structured data

Performance Analytics

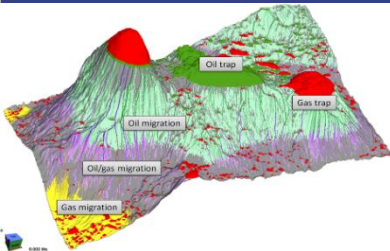
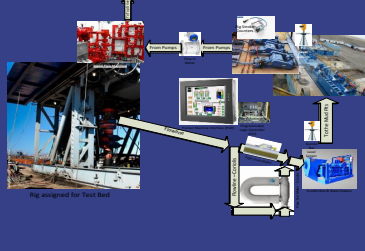
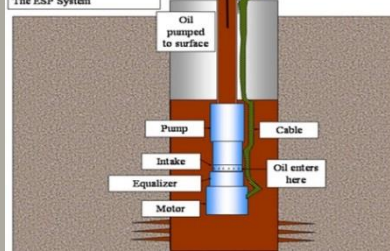
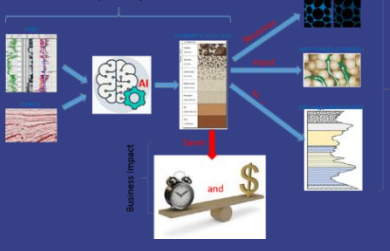
Advanced Analytics











- Proactive
- What will happen
- Future events
- Structured data & unstructured data

Big data/analytics have several applications within Oil and Gas- there exists potential for local companies to offer these services

Hydrocarbon Processing Operations




<p>Prospecting Seismic Interpretation</p> 	<p>Drilling Early Kick Detection</p> 	<p>Production ESP</p> 	<p>Reservoir Characterization</p> 
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Business & Corporate Applications

 Finance	 Procurement & Supply Chain	 Transportation & Industrial Security	 Aviation
 Human Resources	 Project Management	 Trading	 Marine





Source: Saudi Aramco

The energy industry is realizing the value of analytics solutions

	Situation	Solution
	<p>To drive optimization, ExxonMobil unified data storage to one huge data lake.</p>	<p>ExxonMobil created its first Big Data shared service across an enormous enterprise– from data ingestion at the edge using Hortonworks DataFlow to long-term storage in Hortonworks Data Platform</p>
	<p>BP recognized that it is underutilizing its data repository and needed to invest in data mining to fully leverage all available data</p>	<p>In 2012, the organization established a decision analytics network – now 200-strong among its professionals – to examine ways to advance use of data and maximize business productivity</p>
	<p>Dow Chemicals creates enormous amounts of data in numerous silos and wished to effectively utilize it to drive business efficiency</p>	<p>Dow Analytical Technology Center was recognized for tackling two distinct challenges</p> <ul style="list-style-type: none"> integrating multiple data sources into a uniform operational domain and then applying leading edge data analytics to conquer the multiple large data sets tied to its industrial chemical production processes,

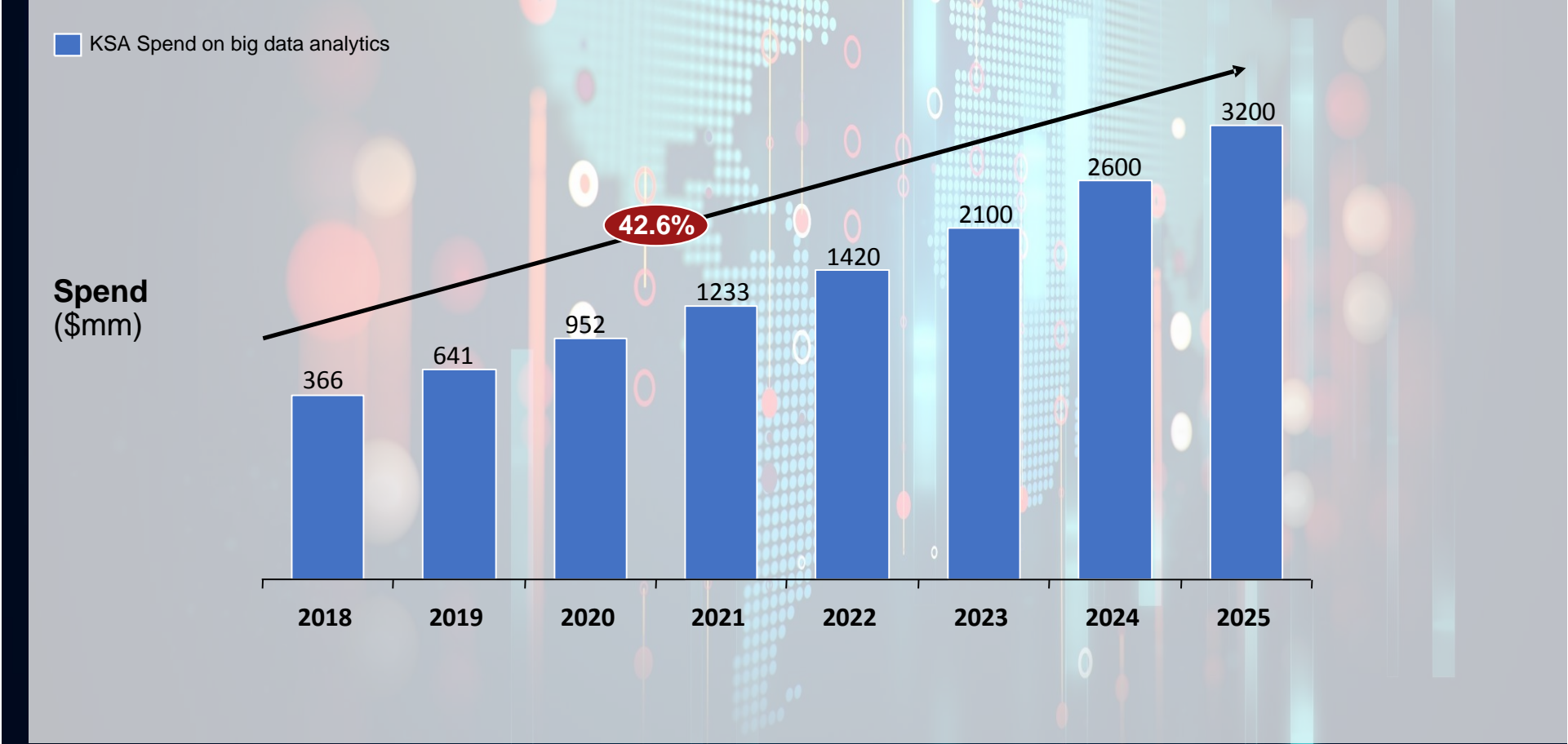
Source: Press research, Saudi Aramco

Furthermore, several large enterprises in KSA are already embracing data analytics solutions

Examples of Analytics deployment	
 <p>أرامكو السعودية saudi aramco</p>	<p>Saudi Aramco have been utilizing big data in its upstream business for years.</p> <p>Implemented several advanced analytics solutions ranging from operational predictive analytics to text and sentiment analysis.</p> <p>Currently piloting and testing several Advanced analytics and big data solutions.</p>
 <p>سابك عابك</p>	<p>SABIC selected ZEMA to meet its business users' requirements for a fully automated data collection, validation, and auditing tool that will easily integrate up-to-the-minute market data with SABIC's downstream systems.</p>
 <p>Bahri</p>	<ul style="list-style-type: none"> • Bahri identified 31 Big Data unique models to improve ROCE, 12 of which were implemented successfully in 2016, saving the company \$200 MM.
 <p>السعودية SAUDIA</p>	<ul style="list-style-type: none"> • Leveraging Microsoft big data analytics solutions to enhance business efficiency e.g. route optimization, fuel management, streamlining of maintenance and enhanced performance reporting





Source: Desktop research, Microsoft, Saudi Aramco

Market for Advanced Analytics in KSA is expected to grow at ~42% CAGR to reach a value of \$3200MM by 2025



Source: AT Kearney

Localization potential exists at most stages of the analytics value chain

Step	Hardware and equipment	Connectivity and system integration	Software and platforms	Data Science Services
				
Gaps	<p>No local manufacturer of commodity storage, GPUs, and other server components in KSA- strong potential for local manufacturing</p>	<ul style="list-style-type: none"> Several players already offering system integration services and players offering connectivity active in KSA Potential to enhance services to cater to analytics applications Potential to upgrade connectivity and infrastructure 	<p>Potential to localize platforms for advanced analytics in light of regulations limiting storage of data outside KSA.</p> <p>Vertical industry analytical solutions are required to exploit the large amounts of data amassed.</p>	<p>Development of predictive and prescriptive models for plant operations and business applications.</p> <p>Required specialties include data services, data analysis, modeling, optimization, data mining, and machine learning.</p>

Source: Desktop research, Saudi Aramco analysis

Key messages and next steps

Key messages

- ✓ Advanced analytics is taking off and has **applications both in oil and gas and several other industries** in KSA (e.g. manufacturing)
- ✓ The KSA market for advanced analytics is growing rapidly at **~14% CAGR to reach ~\$700 mn by 2025**
- ✓ Saudi Aramco is also taking advanced analytics seriously with applications in hydrocarbon processing, support services, and other business domains.

In case you are interested in discussing this opportunity further, please contact



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YYY Dept.

Saudi Aramco

zzz@aramco.com

Source: Saudi Aramco analysis

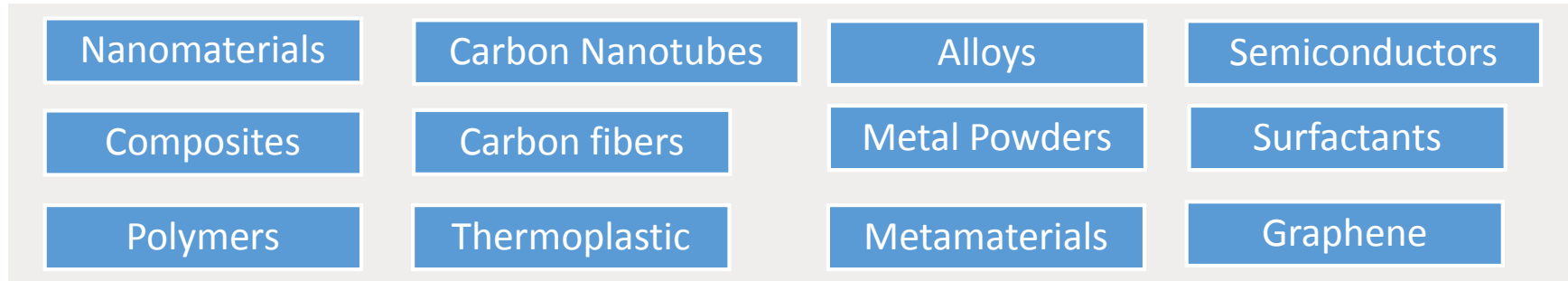
Advanced Materials

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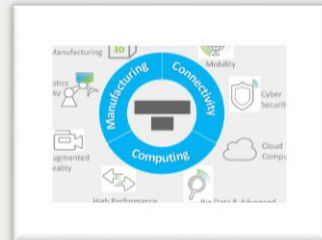


Advanced Materials are enablers to 4IR innovations and have applications across multiple industries



4th Industrial Revolution

- Robotics
- IOT
- Big Data
- AI
- High Performance Computing



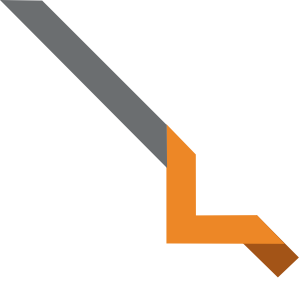
Oil and Gas

- Exploration
- Drilling
- Recovery
- Production
- Transport
- Refining

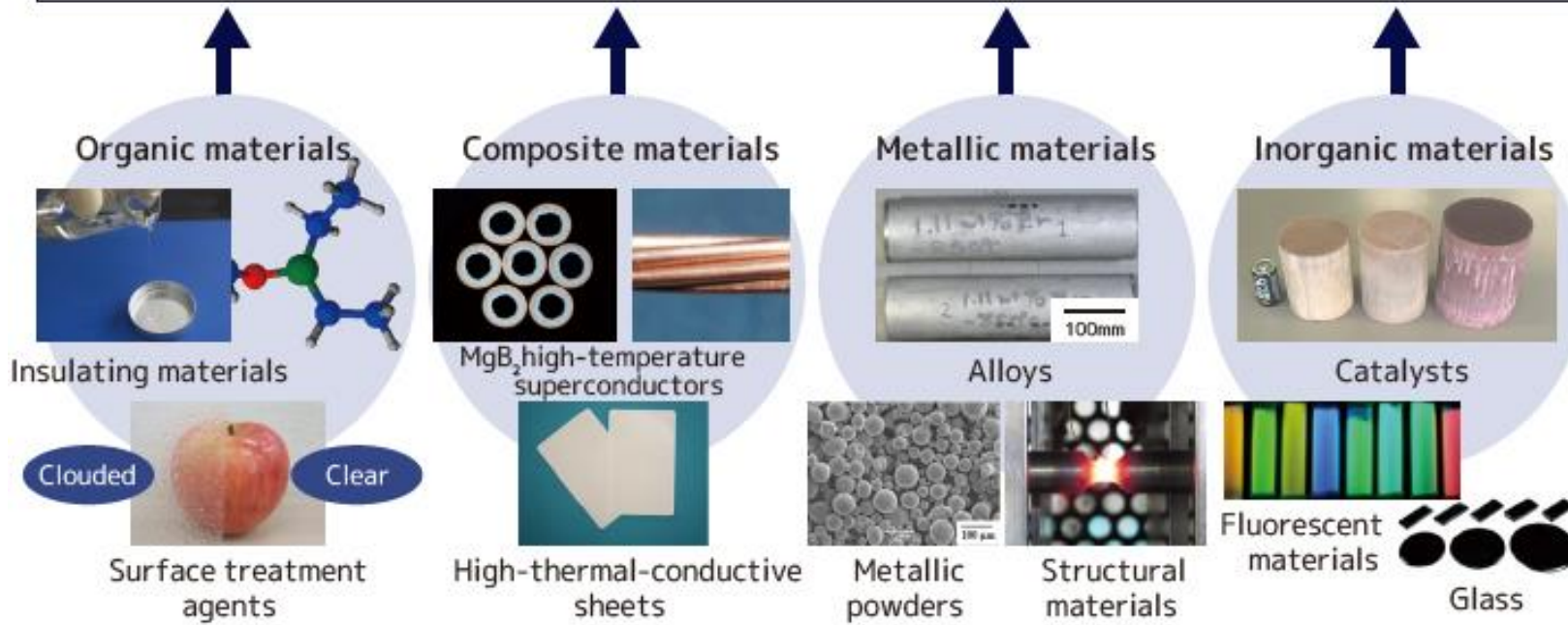
Other Industries

- Military and Defense
- Energy
- Food
- Construction
- Medical
- Automotive
- Aerospace
- Electricals & Electronics
- Power
- Sports





Products

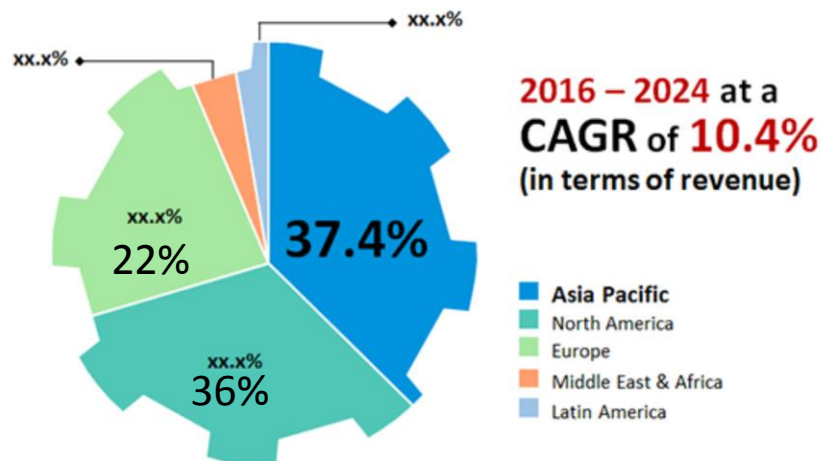


The Global Market for Advanced Materials is expected to rise at a CAGR of 10.6% during 2015-2025

The opportunity in this market, which was worth \$42.76 bn in 2015, rose to \$51.5 bn in 2017 and is anticipated to rise to **\$115.2 bn** by 2025.

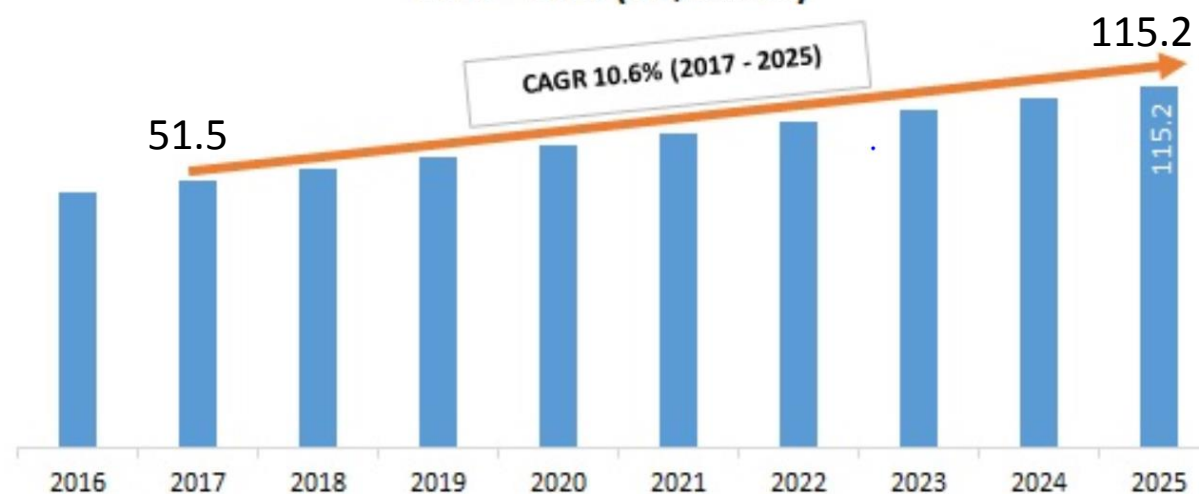
Global Advanced Materials Market Share (%)

By Region (2015)



Source: Transparency Market Research, 2016

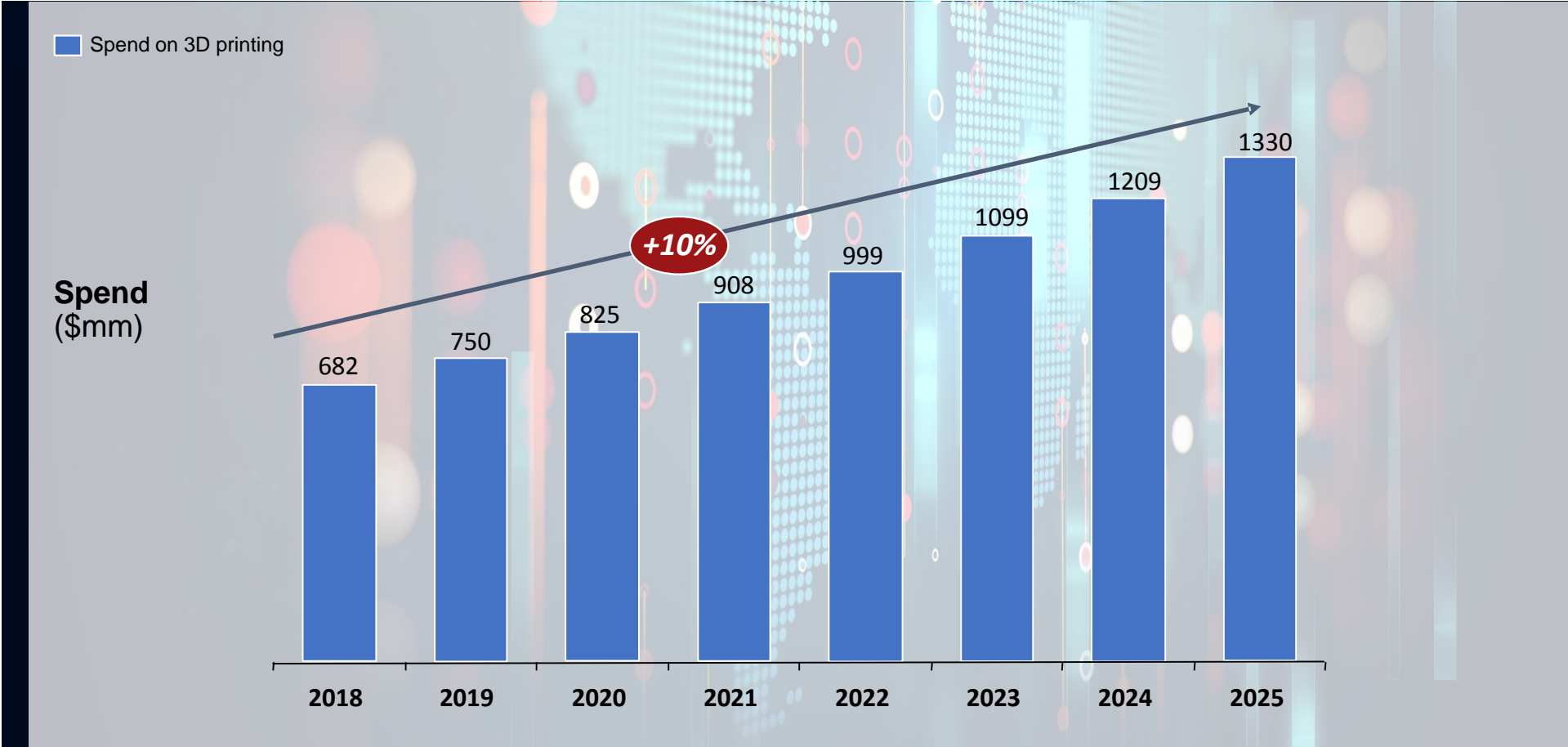
Global Advanced Materials Market Size and Forecast, 2016 – 2025 (US\$ Billion)



Source: Variant Market Research

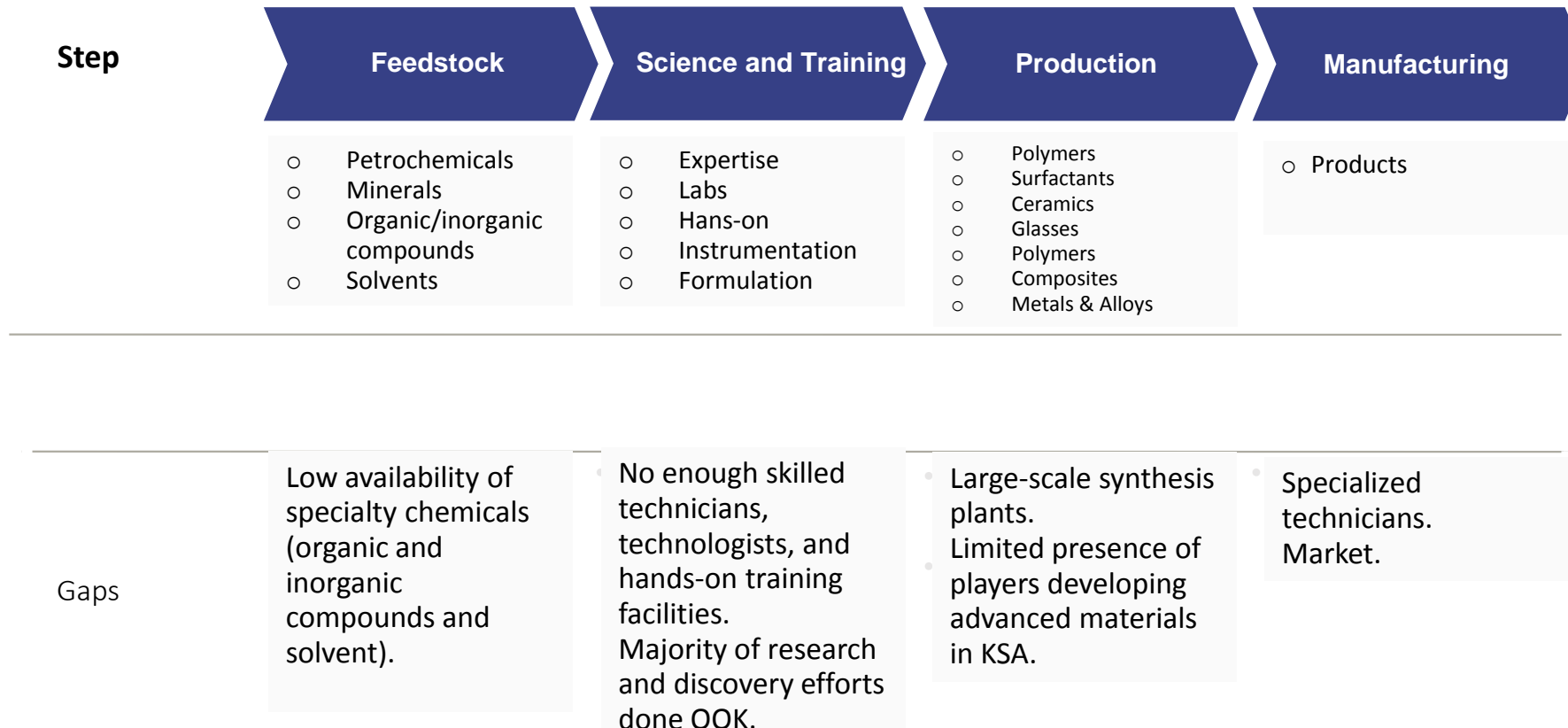
Market for 3D printing in KSA is expected to grow at 10% CAGR to reach a value of \$1330MM by 2025

KSA 3D printing spend (\$mm)



Source: AT Kearney

Localization potential of Advanced Materials Value Chain



Source: Desktop research, Saudi Aramco analysis

Key messages

Key messages

- ✓ **Advanced Materials** industry allows other sectors to turn innovations into sophisticated products that enable digitalization.
- ✓ **Advanced Materials** industry is itself being transformed through digitalization.
- ✓ **Advanced Materials** are foundation to numerous products and applications across multiple industries.
- ✓ The KSA market is **less than 1% CAGR of global market**- opportunities are endless for KSA and Aramco.
- ✓ Knowledge transfer and hands-on training platforms are a **high-potential localization** opportunity.

In case you are interested in discussing this opportunity further, please contact



XXX

YYY Dept.

Saudi Aramco

zzz@aramco.com

Source: Saudi Aramco analysis

The End