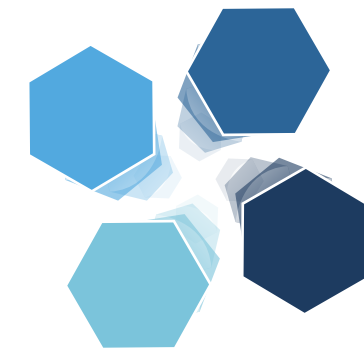شـركة وادي الرياض
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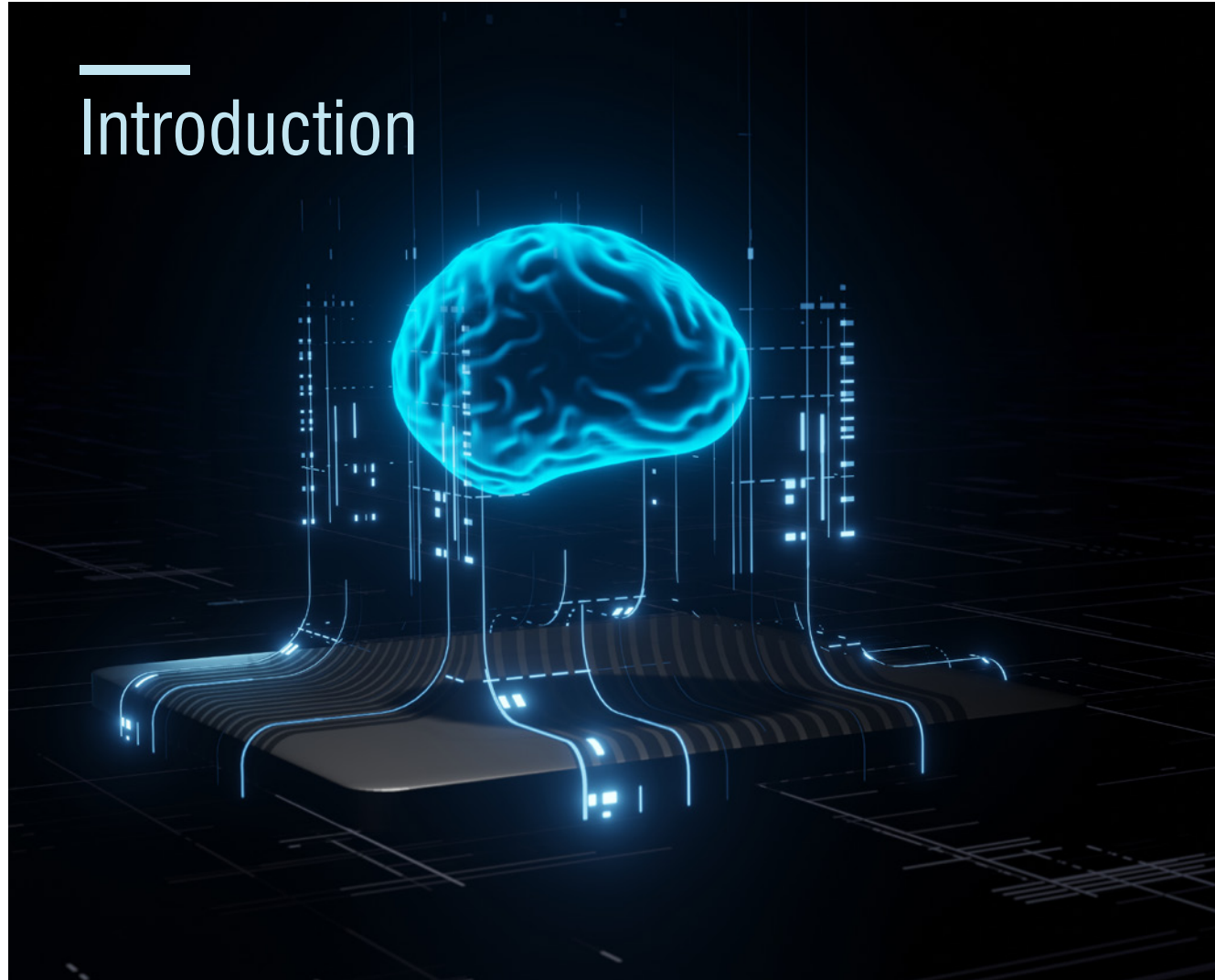
Artificial Intelligence

September 2022

شـركـة وادي الرياض
Riyadh Valley Co

Introduction

In today's digital world, large amounts of data are created by both humans and machines. Analysing, interpreting and making decisions based on this data is enabled by Artificial Intelligence (AI). AI forms the basis for all computer learning and enables complex decision making. From reducing human error to efficiently performing repetitive tasks, AI provides many benefits. Applications of AI such as fraud detection, chatbot, task automation etc. are seeing uptake across industries. Other evolving applications include autonomous vehicles, predictive healthcare, AI assisted surgery.

Globally, AI software revenue is forecast to total USD 62.5 bn in 2022, an increase of 21.3% from 2021[1]. Of all the technology themes, AI attracted the largest number of VC investors in 2021[2]. Of the funding in 2021, U.S constituted USD 107bn while China had attracted USD 49bn. Over the years, U.S and China are leading this wave of investments that tend to concentrate on a few key industries such as mobility and autonomous vehicles, healthcare, drugs and biotech.[3]

[1] Gartner
[2] ITP/Global Data
[3] OECD

Countries worldwide are formulating national AI strategies and other initiatives. AI has the potential to deliver additional global economic activity of around USD 13tn by 2030, or about 16 percent higher cumulative GDP compared with today[4]. In the Gulf region, UAE is prioritizing AI implementation through the UAE Strategy for AI and the National Program for Artificial Intelligence. Saudi Arabia has also been taking initiatives such as formation of Saudi Authority for Data and AI, formulation of National Strategy etc.

Businesses in Middle East also hold a favourable attitude towards AI. 75% of Chief Technology Officers (CTOs) of Middle Eastern Businesses believe that AI will generate value for their organizations. With financial gains becoming apparent, more companies are adopting AI. Of the regional companies surveyed, a BCG study found that 47% had AI pilot projects underway or were using AI in full-scale deployments. Furthermore, 58% of these companies revealed they now have an AI strategy in place[5].

[4] Forbes
[5] BCG,2020

Overview of AI

Alan Turing, the father of AI, defines the field as the science and engineering of making intelligent machines, especially intelligent computer programs. In other words, it is concerned with getting computers to do tasks that would normally require human intelligence. Intelligence refers to some kind of ability to plan, reason and learn, sense and build some kind of perception of knowledge and communicate in natural language.

Use Case of AI in Manufacturing

Use case	Use	Example
Collaborative Robots (Cobots)	Cobots are capable of learning different tasks. They can detect and avoid obstacles, and this agility and spatial awareness allow them to work alongside humans.	Amazon's warehouse robots bring items to human pickers so they can be packaged and labelled for dispatch. Some common cobot applications are pick and place, machine tending, packaging and palletizing, process tasks, finishing tasks, and quality inspection.
Robotic Procedure Automation (RPA)	RPA applications are capable of managing high-volume, repetitive jobs, thereby saving time and labour.	Order processing
Digital Twins	An electronic twin is a digital version of a physical object. The digital version receives information regarding its counterpart through smart sensors attached to the object and provides insights about the object.	Detectors attached to a plane engine will transmit information to the engine digital twin each time the plane takes off or lands, supplying the airline and maker with crucial details regarding the engine's functionality.
Light Out Factory	A light-out factory is designed to use a fully robotic workforce and run with minimal human interaction, using AI, robots and next-generation technologies.	Factory full of robotic workers does not require lighting and other environmental controls, such as air conditioning and heating.

Use case	Use	Example
Machine Learning Algorithms	AI systems that use machine learning algorithms can detect purchasing patterns in human behavior and provide insight to manufacturers and retailers.	Some machine learning algorithms detect buying patterns that trigger manufacturers to speed up production on a given item. This is applicable for services sector also.
Inventory Management	AI systems can keep track of supplies and send alerts when they need to be replenished. This could be helpful in Just in Time production model, thereby reducing waste due to overproduction and holding excess inventory. Manufacturers may also undertake AI programs to identify industry supply chain bottlenecks.	A pharmaceutical company may use an ingredient that has a short-shelf life. The AI system can predict whether this component will arrive on time or, if it is running late, how the delay will affect production.
Supply Chain Management	AI solutions in supply chain management include demand-forecasting models, end-to-end transparency, integrated business planning, dynamic planning optimization, and automation of the physical flow	A car manufacturer may obtain nuts and bolts from two different suppliers. If a supplier accidentally saves a defective batch of nuts and bolts, the car manufacturer needs to know what vehicles were made with those specific nuts and bolts. An AI system can track which vehicles were built with faulty nuts and bolts, making it easier for manufacturers to recall them from dealerships.

Use case	Use	Example
Error Detection	Producers may use automatic visual inspection components to hunt for flaws on manufacturing lines.	Visual inspection cameras can readily find a flaw in a little, complicated item — for instance, a mobile. The connected AI system may alert human employees of this defect before the thing pops up at the hands of a miserable customer.
Accelerate Product Development	Some makers are turning to AI systems to help in quicker product development, as is true with drug manufacturers.	AI can assess information from experimentation or production procedures. Producers can use insights obtained from the information analysis to decrease the time necessary to produce pharmaceuticals, lower prices and streamline replication procedures.
Predictive Maintenance	Tracks service/maintenance requirements for machines	Infrared imagers to monitor aspects of equipments, such as temperature, help in preventing overheating. This predictive maintenance system helps plants avoid overusing essential equipment.

Source: nexttech.com, McKinsey, Forbes, ControlEngineering, SemiEngineering

Digital twin and predictive maintenance are among the most adopted use cases with high value potential.

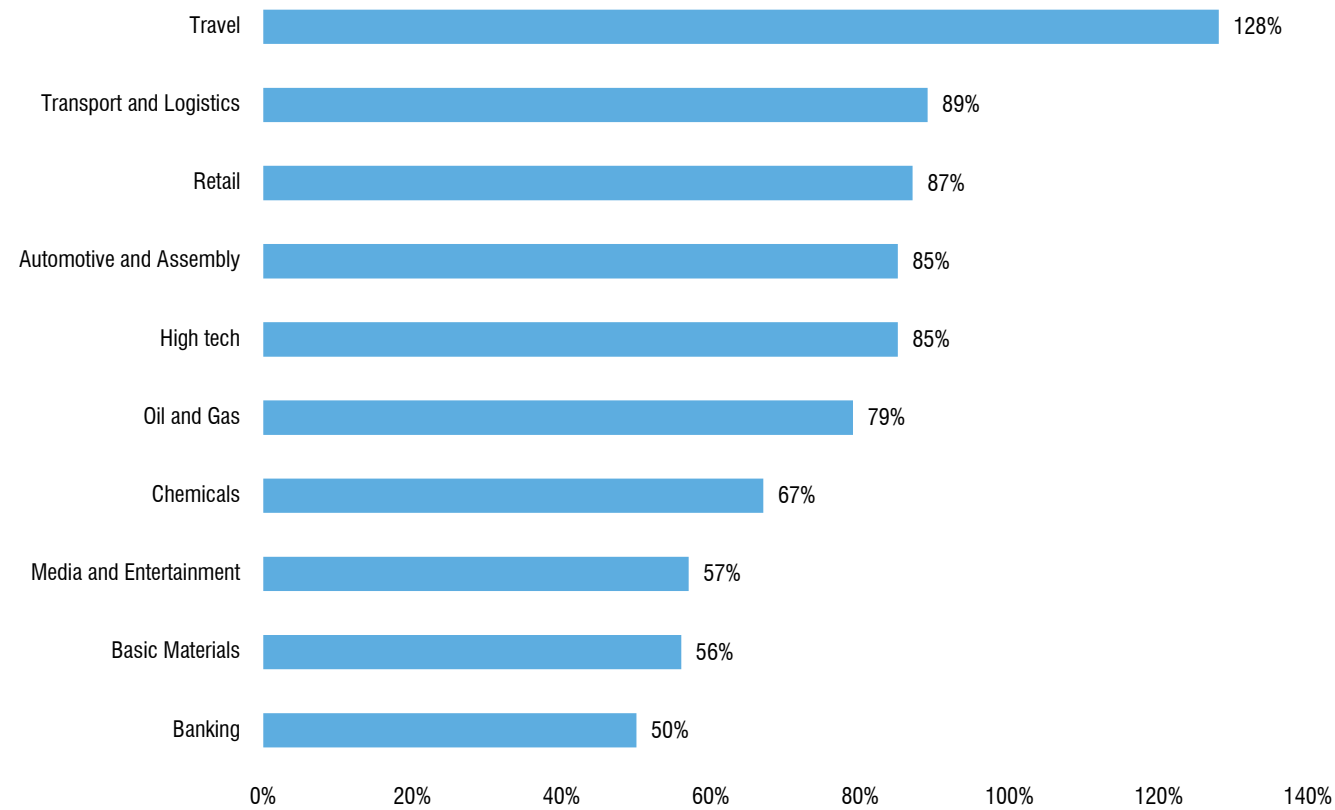## Adoption Rate and Value Potential of Different Use Cases

Use case		Adoption Rate	Value Potential (1-no;5-high)
Transform Products	Digital Twin	62%	4.5
	R&D Lab Acceleration	44%	4.2
	Product Intelligence	43%	4.0
	Market Insights and Social Monitoring	43%	4.0

Use case		Adoption Rate	Value Potential (1-no;5-high)
Engage Customers	Chatbots	66%	3.3
	Demand Planning and Forecasting	37%	3.8
	Automated Marketing	31%	3.5
	Profitable Field Service	29%	4.1
Optimize Operations	Predictive Maintenance	68%	4.0
	Supply Chain Transparency and Predictability	34%	4.1
	Predictive Inventory Management	32%	3.9
	Sustainable Operations	30%	4.1
Enable Employees/ Support	Cybersecurity – Intrusion Identification	66%	4.1
	Autonomous Processes	66%	4.1
	Tailored Management Analytics	26%	3.9
	Fraud Detection	31%	4.0

Source: EY; Note: Adoption rate refers to % of survey respondents who have adopted a particular use case; Survey of 86 manufacturing companies across Europe. Value Potential is indicative of the potential qualitative impact on revenue.

While incremental value of AI over other analytics techniques is highest in travel, others like transport, retail and automotive and assembly line sector are also set to reap significant value from AI. AI has potential to create value of about USD 350bn annually.
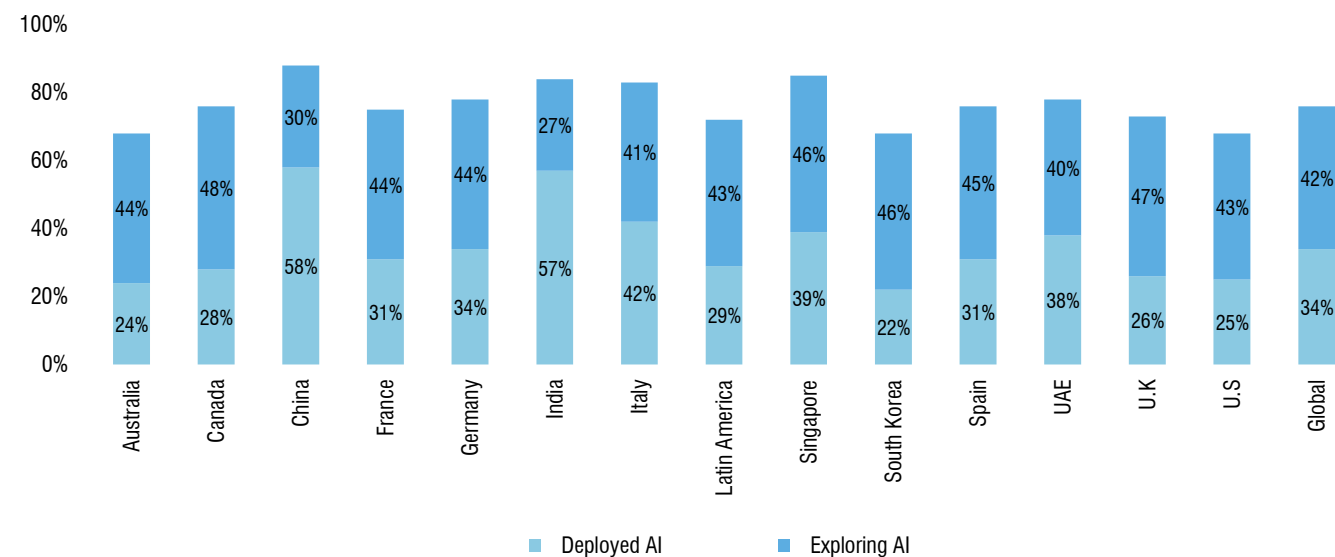
Incremental Value of AI over Other Analytics Techniques (%)

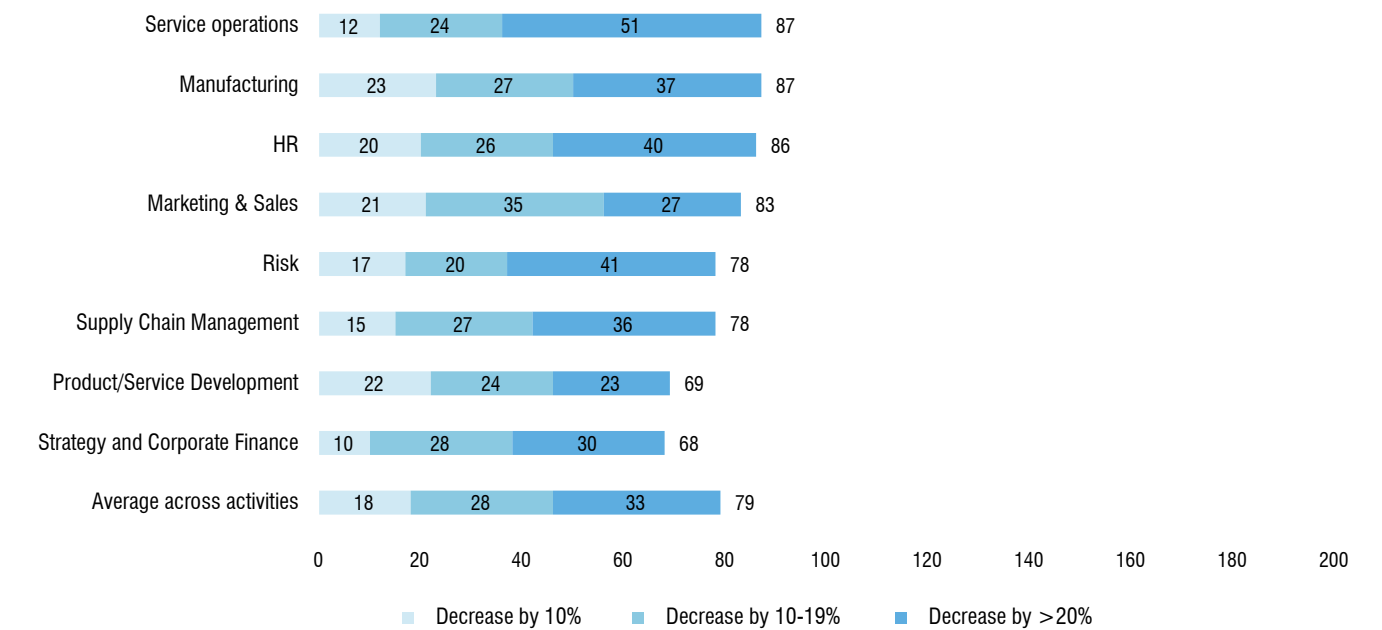| Industry	Value
Travel	128%
Transport and Logistics	89%
Retail	87%
Automotive and Assembly	85%
High tech	85%
Oil and Gas	79%
Chemicals	67%
Media and Entertainment	57%
Basic Materials	56%
Banking	50%

Source: McKinsey

Globally, AI adoption is growing steadily and is up four percentage points in 2022 compared to 2021. Chinese and Indian companies are leading the way, with nearly 60% of IT professionals in those countries saying their organization already actively uses AI, a much higher rate of adoption than in markets like South Korea. Limited AI skills, expertise or knowledge, high price, lack of tools or platforms to develop models, projects are too complex or difficult to integrate and scale, and too much data complexity are some barriers for AI adoption.

Global AI Adoption Rates

Country	Deployed AI	Exploring AI
Australia	24%	44%
Canada	28%	48%
China	58%	30%
France	31%	44%
Germany	34%	44%
India	57%	27%
Italy	42%	41%
Latin America	29%	43%
Singapore	39%	46%
South Korea	22%	46%
Spain	31%	45%
UAE	38%	40%
U.K	26%	47%
U.S	25%	43%
Global	34%	42%

Source: IBM AI Adoption Index 2022; Note: Based on online survey of 7,502 business decision makers across the countries in the graph

Decline in Cost with AI Adoption Across Functions (% of Respondents)

Function	Decrease by 10%	Decrease by 10-19%	Decrease by >20%	Total
Service operations	12	24	51	87
Manufacturing	23	27	37	87
HR	20	26	40	86
Marketing & Sales	21	35	27	83
Risk	17	20	41	78
Supply Chain Management	15	27	36	78
Product/Service Development	22	24	23	69
Strategy and Corporate Finance	10	28	30	68
Average across activities	18	28	33	79

■ Decrease by 10% ■ Decrease by 10-19% ■ Decrease by >20%

Source: McKinsey; Note: For FY 2020; Online survey conducted in 2021 of 1,843 participants representing the full range of regions, industries, company sizes, functional specialties, and tenures.

Global VC Funding in AI

VC investments in AI have grown drastically in 2021. Of the funding in 2021, U.S constituted USD 107bn while China had attracted USD 49bn. Over the years, U.S and China are leading this wave of investments. While European Union, U.K and Japan have increased investments, they lag behind the two dominant players.
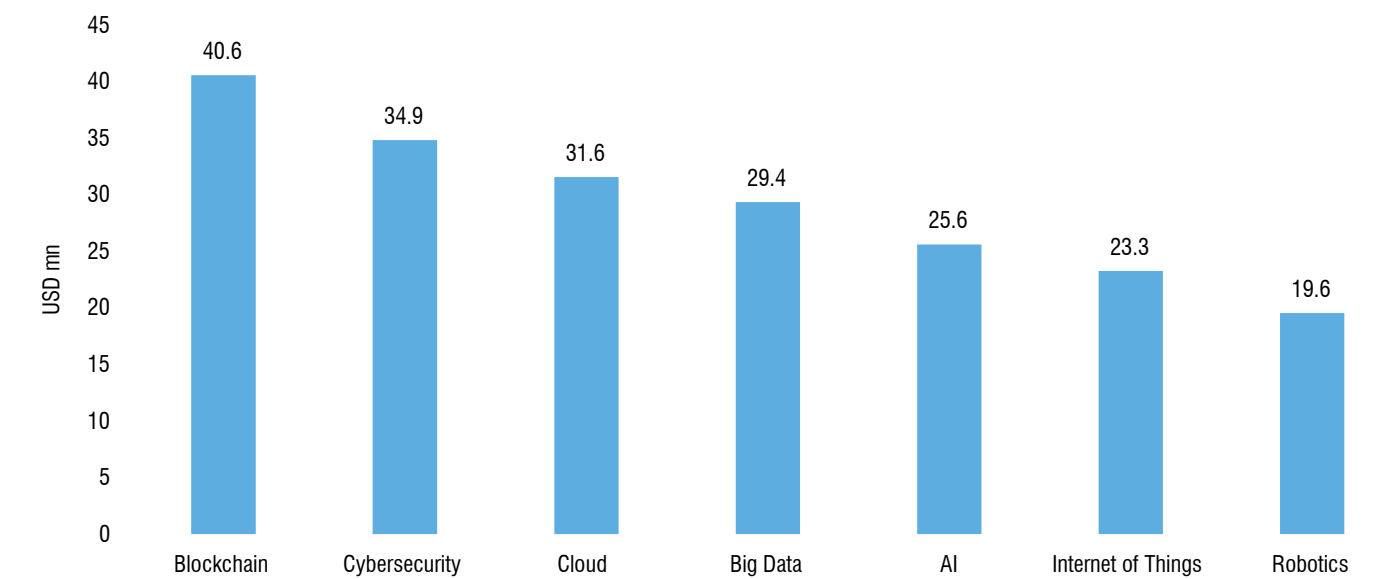
Global VC Investments in AI (2012-2021)
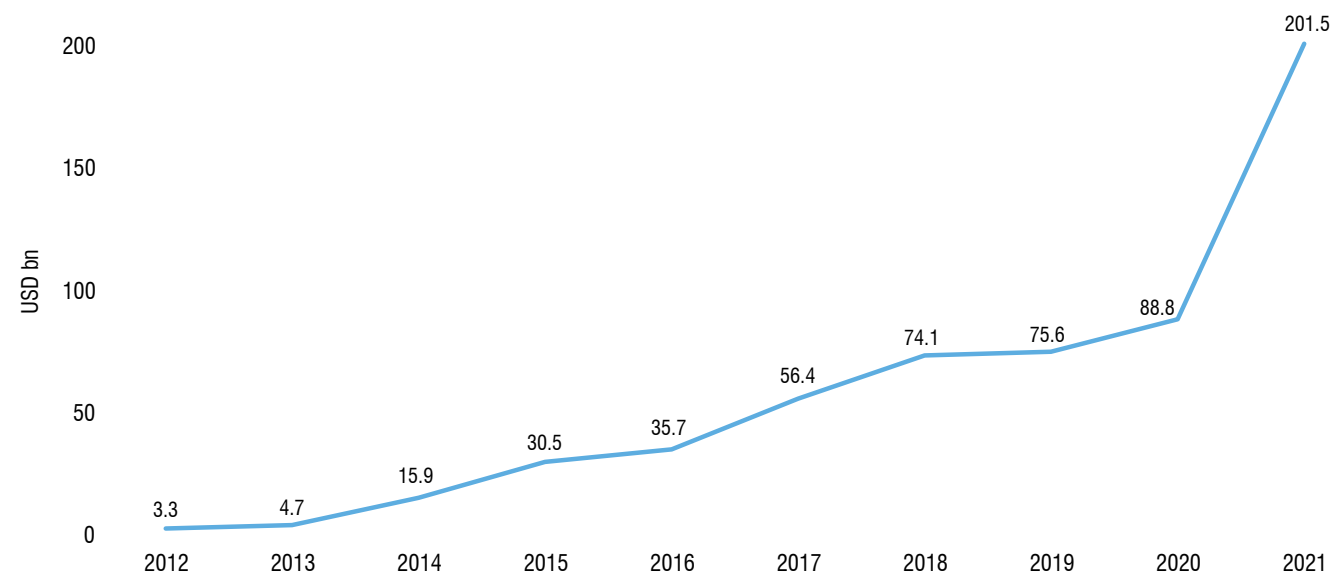
Source: OECD

AI had attracted investments from 6,786 VC investors during 2021, which is the highest among all the technology themes.

## Average Deal Size of Global VC Funding for Select Disruptive Technologies (2021)

Source: Global Data

AI in Middle East

In terms of value of impact of AI, KSA leads other GCC countries. The annual growth in the contribution of AI is expected to range between 20-34% per year across Middle East, with the fastest growth in the UAE at 33.5% followed by Saudi Arabia at 31.3%.

Impact Potential of AI by GCC Country
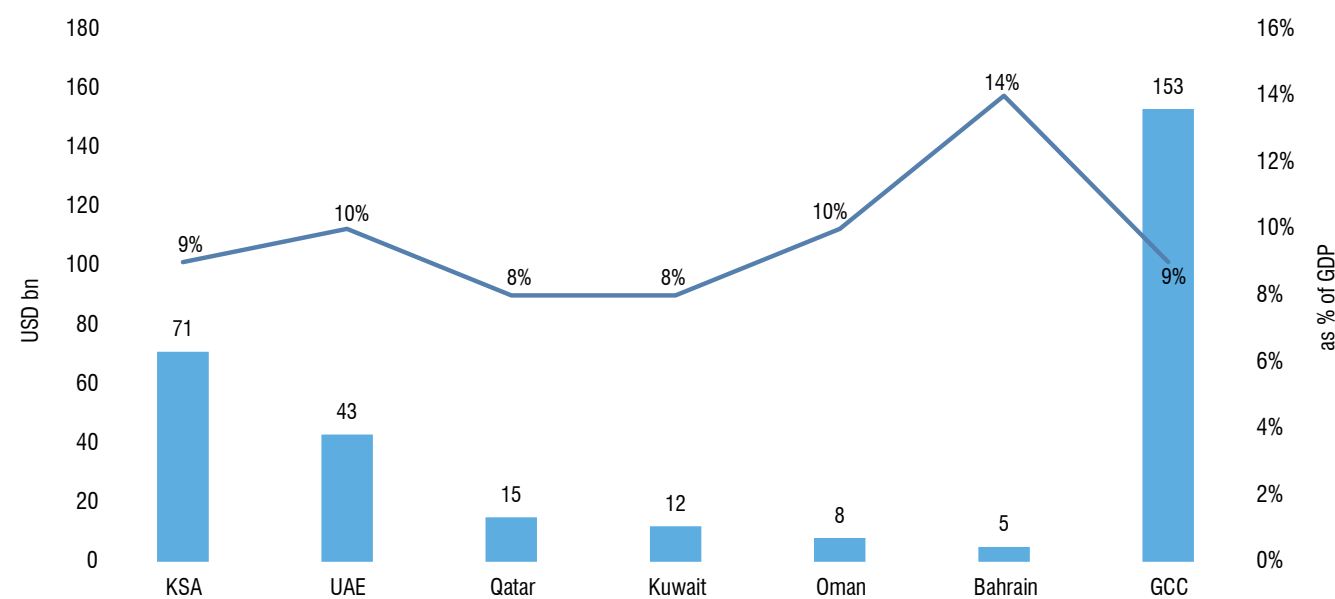
Source: McKinsey

According to a study by McKinsey, AI could play a transformative role in public sector and manufacturing, with an impact potential of 12% and 15% of GDP, respectively. In the manufacturing sector, predictive maintenance, advanced robotics and data-driven supply chain optimization could help tap significant value.

Top 3 Sectors by AI's Impact Potential in GCC

GCC Country	Adoption Rate
Bahrain	Manufacturing, Public Sector, Logistics and Transport
Oman	Public Sector, Manufacturing, Oil and Gas mining
UAE	Manufacturing, Public Sector, Oil and Gas mining
KSA	Oil and Gas mining, Public Sector, Manufacturing
Kuwait	Oil and Gas mining, Manufacturing, Healthcare
Qatar	Oil and Gas mining, Public Sector, Manufacturing and Wholesale & Retail

Source: McKinsey

Potential Contribution of AI to Industry by 2030

Industry	Absolute Contribution in 2030(USD bn)	Contribution of AI to Middle East GDP by industry
Construction and Manufacturing	99	12.4%
Energy, Utilities and Resources	78	6.3%
Public Sector (Including Health and Education)	59	18.6%
Financial, Professional, Administrative Services	38	13.6%
Retail, Wholesale Trade, Consumer Goods, Accomodation and Food Services	23	19%
Transport and Logistics	12	15.2%
Technology, Media, Telecommunications	10	14%

Source: PwC

AI in Saudi Arabia
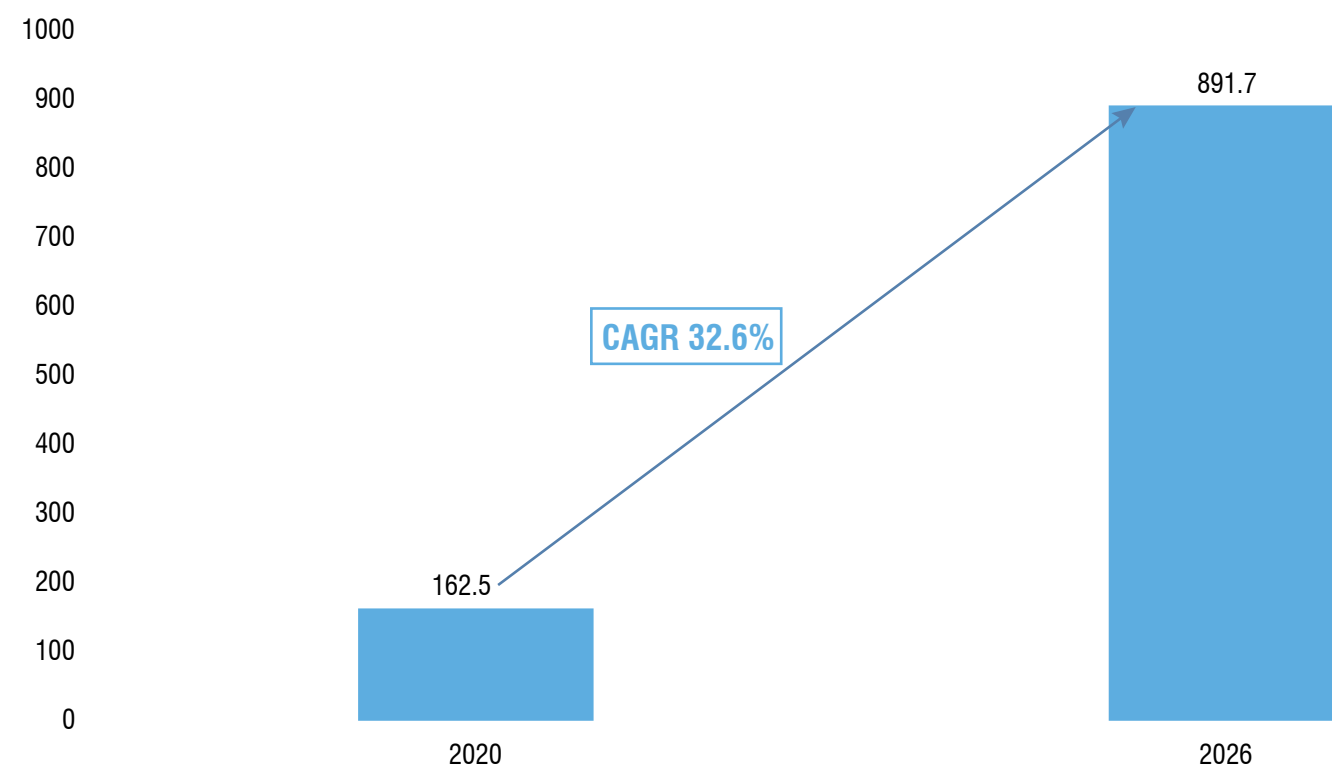
AI in Saudi Arabia is set to grow at a rapid pace supported by government initiatives. Investment powerhouses such as the Public Investment Fund (PIF) and the Vision Fund, large scale tech-oriented transformation programs provide strong foundation for growth of AI in the country.
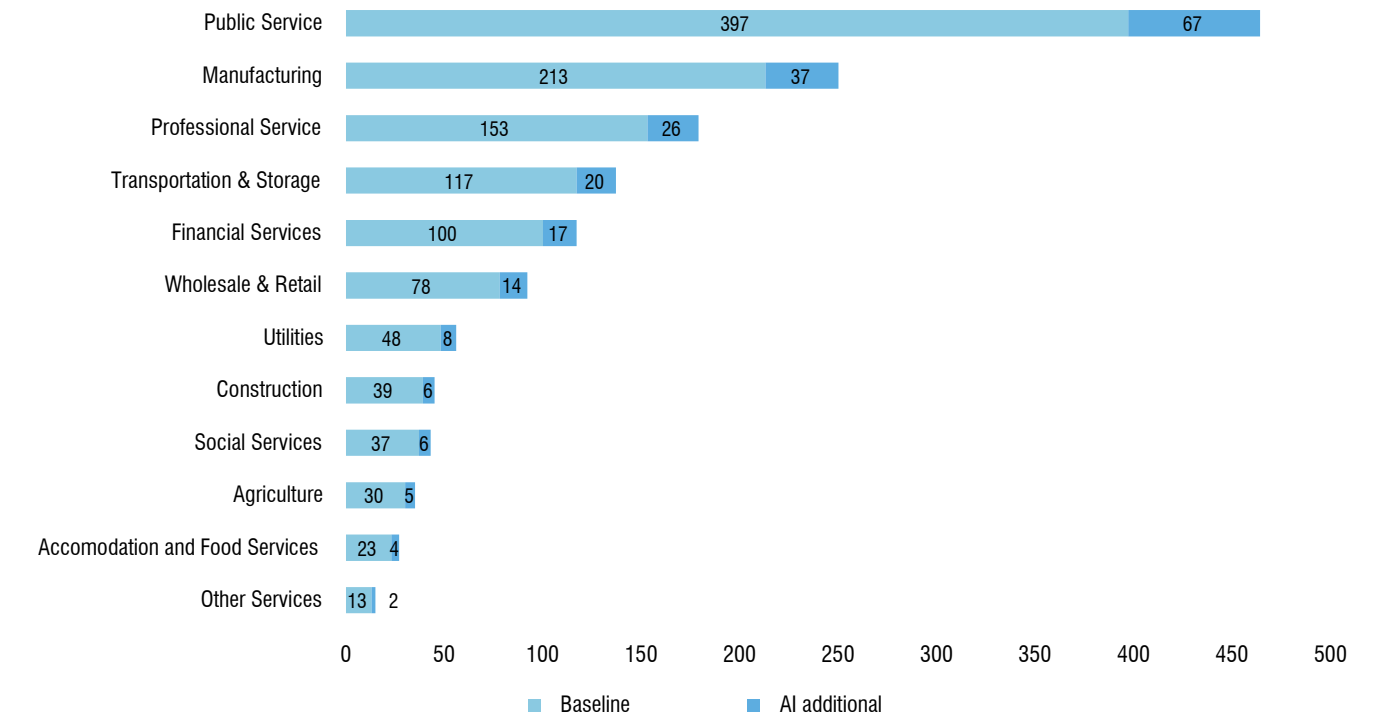
Saudi Big Data and AI Market (2020 vs 2026)

CAGR 32.6%

- 2020: 162.5
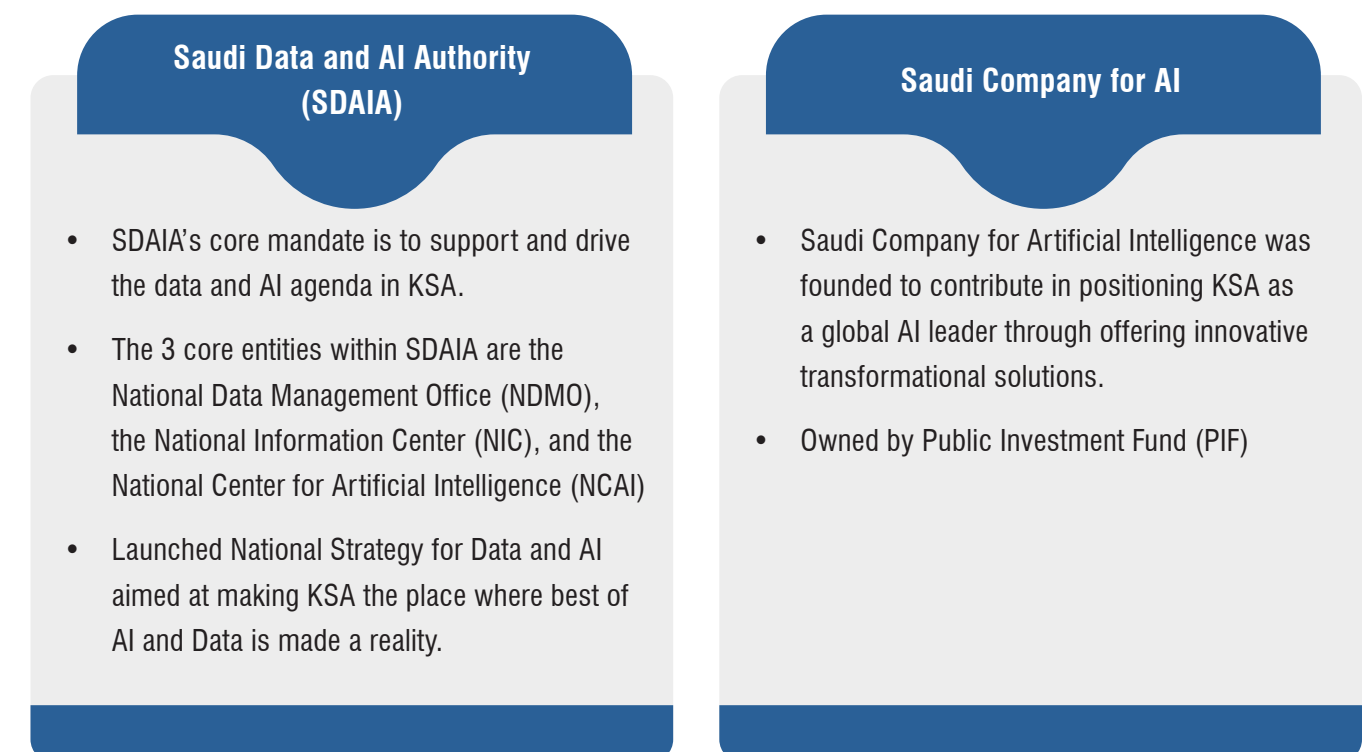- 2026: 891.7

Source: ReportLinker

AI can add up to 1.1 percentage points to Saudi Arabia's economic growth rate by 2035. The potential GVA of AI's augmented growth is estimated to be USD 215bn for Saudi Arabia. Manufacturing and Public Services look set to benefit the most from AI in the country.

Estimated AI's Impact on Industries in Saudi Arabia by GVA Output in 2035 (USD bn)

Industry	Baseline	AI additional
Public Service	397	67
Manufacturing	213	37
Professional Service	153	26
Transportation & Storage	117	20
Financial Services	100	17
Wholesale & Retail	78	14
Utilities	48	8
Construction	39	6
Social Services	37	6
Agriculture	30	5
Accomodation and Food Services	23	4
Other Services	13	2

Source: Accenture

AI Ecosystem in Saudi Arabia

Saudi Data and AI Authority (SDAIA)

- SDAIA's core mandate is to support and drive the data and AI agenda in KSA.
- The 3 core entities within SDAIA are the National Data Management Office (NDMO), the National Information Center (NIC), and the National Center for Artificial Intelligence (NCAI)
- Launched National Strategy for Data and AI aimed at making KSA the place where best of AI and Data is made a reality.

Saudi Company for AI

- Saudi Company for Artificial Intelligence was founded to contribute in positioning KSA as a global AI leader through offering innovative transformational solutions.
- Owned by Public Investment Fund (PIF)
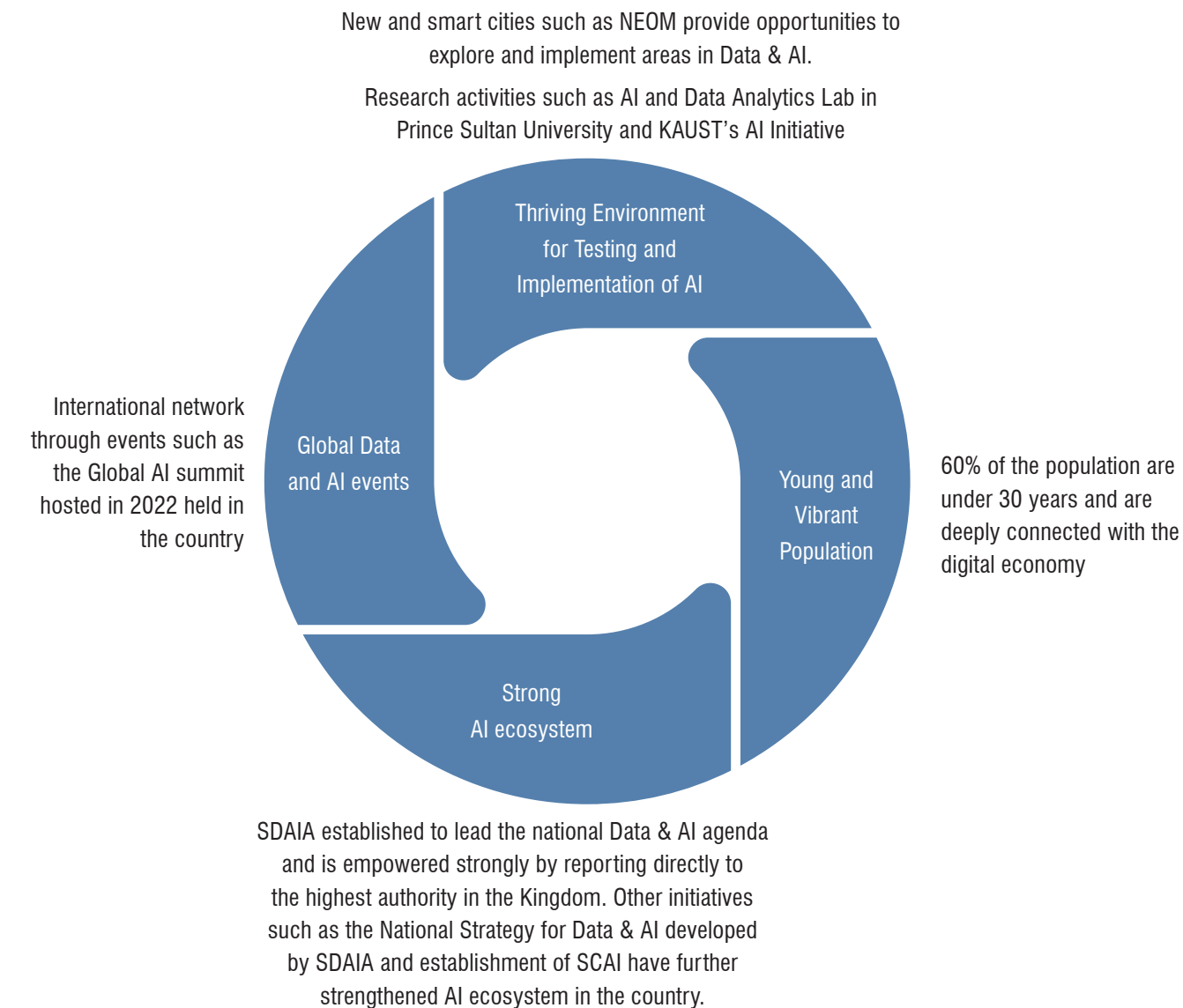
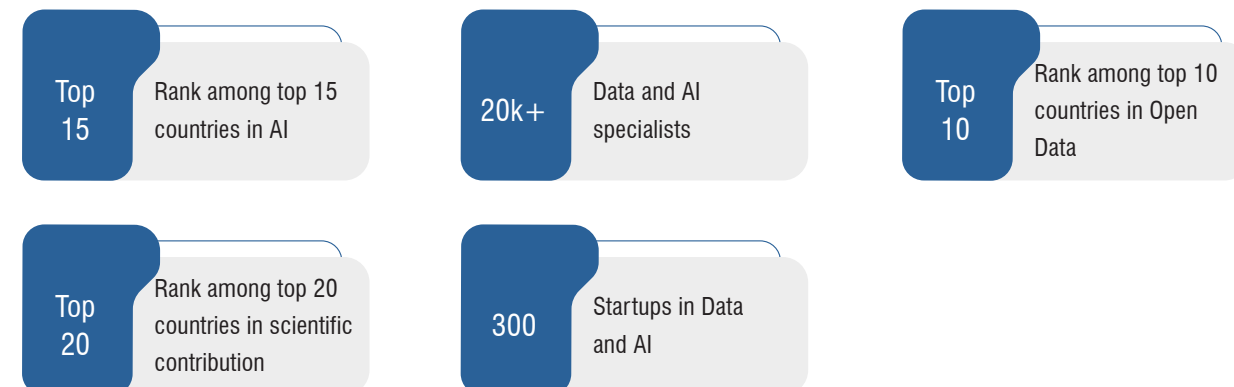*Source: National Strategy for Data and AI*

Multiple factors favour growth of AI in the country. According to Saudi Arabia's Crown Prince, everything in NEOM, the planned megacity, will have a link with artificial intelligence and the Internet of things. In a global first, Saudi Arabia has granted citizenship to Sophia, a humanoid robot created by Hong Kong company Hanson Robotics

Growth Drivers for AI in Saudi Arabia

New and smart cities such as NEOM provide opportunities to explore and implement areas in Data & AI.

Research activities such as AI and Data Analytics Lab in Prince Sultan University and KAUST's AI Initiative

Thriving Environment for Testing and Implementation of AI

International network through events such as the Global AI summit hosted in 2022 held in the country

Global Data and AI events

Young and Vibrant Population

60% of the population are under 30 years and are deeply connected with the digital economy

Strong AI ecosystem

SDAIA established to lead the national Data & AI agenda and is empowered strongly by reporting directly to the highest authority in the Kingdom. Other initiatives such as the National Strategy for Data & AI developed by SDAIA and establishment of SCAI have further strengthened AI ecosystem in the country.

Source: National Strategy for Data and AI

Objectives and Targets of National Strategy for Data and AI

Top 15	Rank among top 15 countries in AI
20k+	Data and AI specialists
Top 10	Rank among top 10 countries in Open Data
Top 20	Rank among top 20 countries in scientific contribution
300	Startups in Data and AI

Source: National Strategy for Data and AI

AI startups are thriving in Saudi Arabia. Startups that have raised funds recently include Mozn that raised USD 10mn in Series A funding, led by Raed Ventures and Hazen.ai that received follow-on investment from Wa'ed, the entrepreneurship arm of Aramco in February 2021.

AI Startups in Saudi Arabia

Source: Traxcn

Spotlight: Rutilea

Rutilea provides solutions to optimise and automate manufacturing processes using AI. The solutions are aimed at improving efficiency, reduce operating cost and create revenue opportunities. Rutilea is one among Riyadh Valley Company's investment portfolio companies

Founded in – 2018

Headquarters – Japan

Products and Services

Optimization with Digital Twin

Work Schedule Optimization System

Eliminates equipment stoppages, shortens workers' travel routes, and prevents premature maintenance, etc., by calculating optimized work schedules according to operating conditions

Work Monitoring System

Provides a platform for classifying and determining the correct order of current tasks based on pre-registered work processes, and for viewing and analyzing statistical information such as histograms related to work time

Automation with AI

AI Automated Cutting Tool Inspection Equipment

An inspection equipment that automatically carries, inspects, and sorts cutting tools

ImagePro

A machine vision development IDE that allows you to build image processing applications with no code
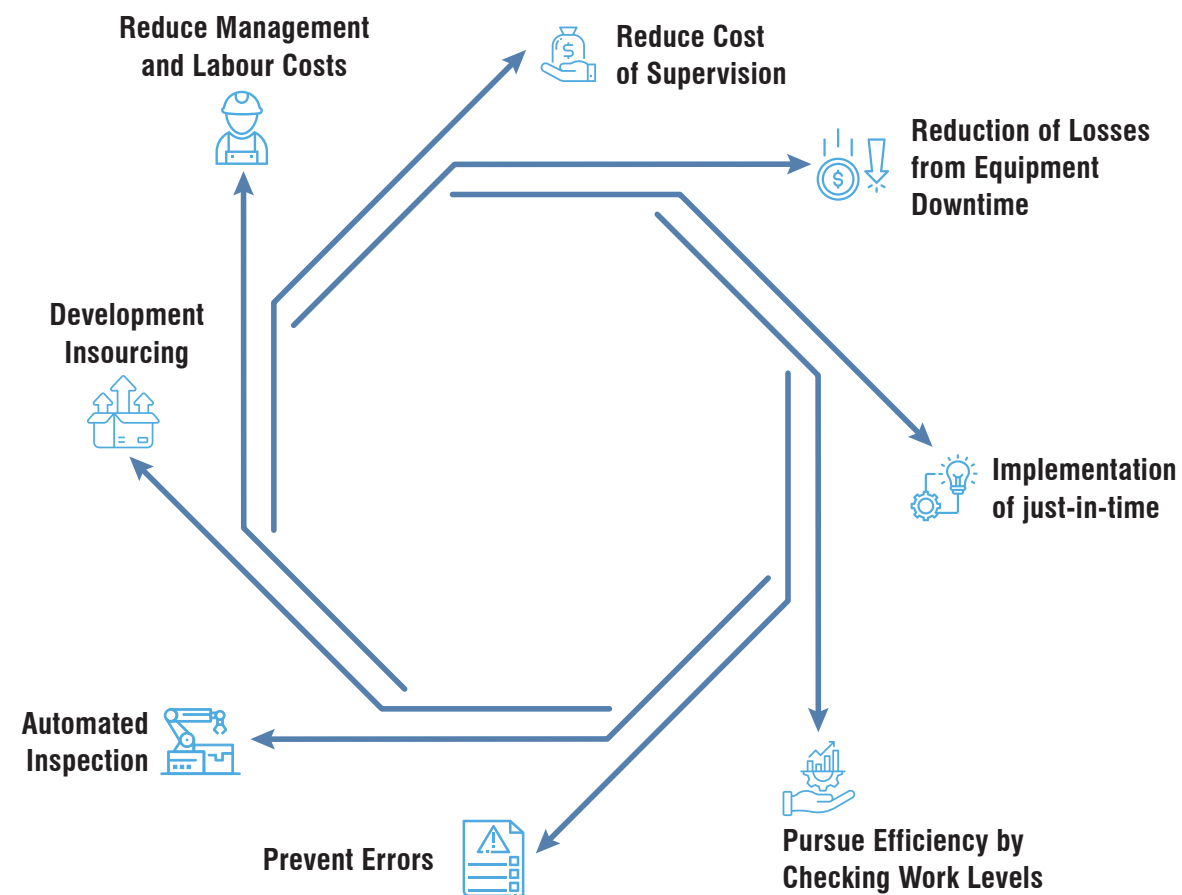
Photometric Stereo Imaging Equipment

An imaging equipment that captures and visualizes features that are invisible or difficult to see with ordinary imaging equipment

Engineering Service

Highly specialized engineers with a proven track record in implementing solutions for major companies propose solutions that fit the customer's needs

Source: Rutilea

Benefits

Reduce Management
and Labour Costs

Reduce Cost
of Supervision

Reduction of Losses
from Equipment
Downtime

Development
Insourcing

Implementation
of just-in-time

Automated
Inspection

Prevent Errors

Pursue Efficiency by
Checking Work Levels

Source: Rutilea

Clients

Automotive

TOYOTA
HINO
SUBARU
LEXUS
SUZUKI
mazda

Auto Parts Suppliers & Industrial Machinery

AISIN
DENSO
Crafting the Core
MITSUBISHI
JTEKT
株式会社ジェイテクト

Electrical Appliances & Electronic Components

Panasonic
FUJIFILM
GS YUASA
KYOCERA

Heavy machinally

KOMATSU
NACHI
NACHI-FUJIKOSHI CORP.
Kubota
For Earth, For Life
YANMAR

Source: Rutilea

Case

Goal

To reduce the labor costs and workload of workers for the maintenance of the large number of tools used in factories every day by implementing automatic inspection equipment that combines AI and robots.

Solution

Development of an automated equipment that took pictures of the blade surface of a cutting tool from the front and side to detect the presence or absence of scratches and chips on the cutting edge. Unmanned operation was also implemented by using robots for transporting, positioning, judging, and subsequent sorting to the device.
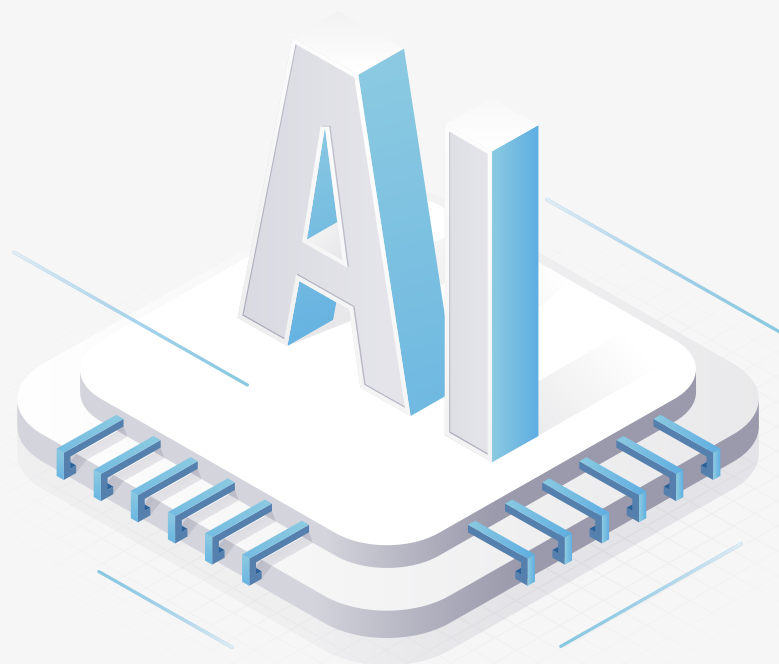
Result

Equipment realized a reduction of 700,000 yen/month in labor costs and high judgment accuracy. Since the images are automatically created, they could be easily rechecked by the human eye.

Source: Rutilea

Conclusion

AI has a prominent role to play across industries and functions. It offers significant benefits by enabling revenue growth and cost reduction. For manufacturing in particular, AI can aid in process automation, on-demand manufacturing by predicting market trends and increase level of quality inspection. As an evolving technology, AI's implementation poses some challenges such as legacy equipment that lack interoperability, limited AI skills, high cost of implementation, data complexity etc. Ensuring positive people and cultural attitude towards AI is also important to enable successful implementation of AI.

Companies are overcoming these challenges with adoption rates in AI showing a positive trend in recent years. AI adoption differs across companies, geographies and industries, with larger companies and those operating in automotive and financial sector being more likely to adopt AI. Of the countries, China and India are leading AI adoption.[6] The outlook for AI adoption also remains strong with two-thirds respondents in a McKinsey survey 1,843 participants across the world indicating their companies' investment in AI would continue to grow in next two-three years. While VC investments have grown steeply in recent years, M&A activity in the space is also seeing an uptrend, clocking 825 M&A deals in 2021.[7]

Regionally, AI could be an enabler for diversification away from oil and has potential to add substantial gains to GDP. Locally, government initiatives and targets provide a strong support system for growth of AI in Saudi Arabia. Successful fund raising by local companies also highlight the segment's potential in the country.
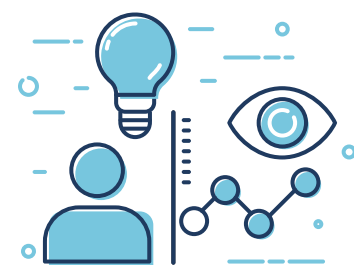
[6] IBM
[7] Meridian Capital

شـركة وادي الرياض
Riyadh Valley Co

Riyadh Valley Company

Riyadh Valley Company established in 2010 by Royal Decree No.116 dated 13/4/1431 AH to be the investment arm of King Saud University in the fields of Knowledge Economy and the university strategic projects.

Vision

To be the regional leader in knowledge-based investment and technology.

Mission

Riyadh Valley Company is a strategic investor, focused on leveraging the local capabilities, investing locally and globally in growth - stage businesses to create financial and strategic returns that will support the future of economic development in the Kingdom.

Investment Sectors:

Venture Capital Investments

- Healthcare Investment
- FinTech
- Renewable energy& Sustainable Recourses
- Education
- Information & Communication Technology
- Logistics and Trasportation

Strategic Investments

- Innovation and R&D Projects
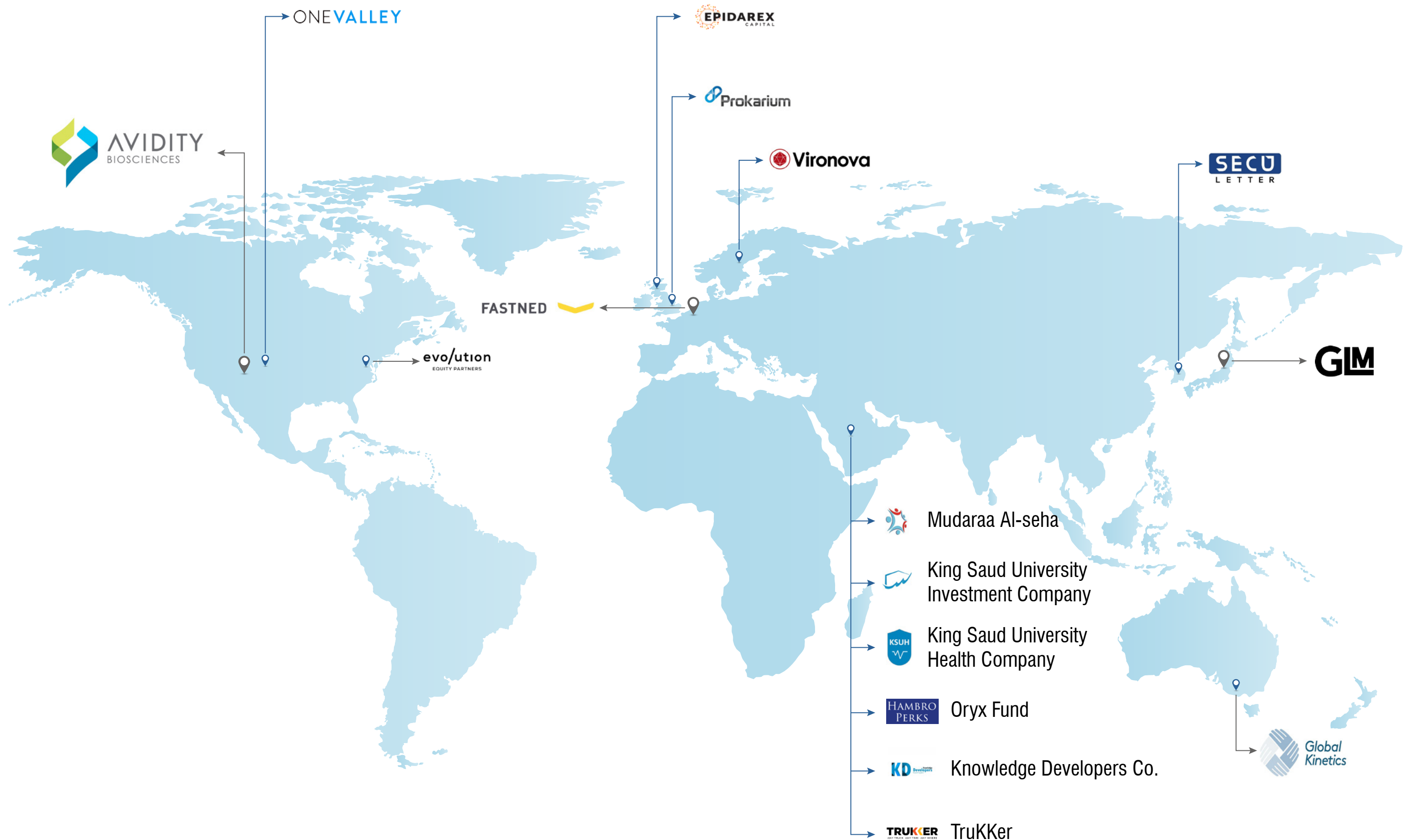- Commercial Projects
- Educational Projects
- Residential Projects
- Healthcare Projects
- Mixed-use Projects

Venture Capital Investment Portfolio

ONEVALLEY

EPIDAREX CAPITAL

Prokarium

AVIDITY BIOSCIENCES

Vironova

SECU LETTER

FASTNED

evolution EQUITY PARTNERS

GLM

Mudaraa Al-seha

King Saud University Investment Company

King Saud University Health Company

Oryx Fund

Knowledge Developers Co.

TruKKer

Global Kinetics

Real Estates Investment Portfolio

Sudair Pharma Company Project

Research center and company offices for Sudair Pharma Company

ELM Information Security Company Project

Innovation Center project for Elm information security company

Al-sorooh Al-Mubarakah Company Project

Mixed-use project contains office complex, Mall, Restaurants, cafes, and walkway for visitors

Obeikan Company Project

Commercial project contains various stores near the Common First Year building

Four Directions Company Project

Commercial and office project contains office buildings and multi-use halls

Retail Real Estate Company Project

Social-Entertaining and sports project

Derma Clinic Company Project

Medical-Commercial project contains several medical clinics, medical products stores, and pharmacies

Dur Alkuttab Company Project

Educational project for Primary Schools

Derma Clinic Company Project (Residential)

Residential project for Derma Medical Clinics

City Lights Real Estate Company Project

Entertainment-Commercial project contains screens on the building and architectural blocks, in addition to areas for live shows

Arrowad For Higher Education Company Project

Educational complex, Arrowad colleges University campus in Riyadh

Omnia Real Estate Development Company Project

Commercial project contains various shops

NMR Real Estate Company Project

Mixed-use project includes a hotel, restaurants and cafes

Hamad Bin Mohammed Bin Saedan & Partners Investment Company Project

The project serves King Saud University Campus residents. It includes large areas where events that reflect Saudi culture are held

Unified Real Estate Development Project

Cultural-Entertainment project that includes Luxury restaurants, Cafes, Cinemas and green spaces

University Boulevard

Commercial-Entertainment project gives visitors a different experience, and it includes Restaurants and cafes

Sahat Al-Ardh Company Project

A commercial project contains various shops

Riyadh Valley Company

Kingdom of Saudi Arabia, Riyadh – King Saud University, Innovation Tower

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