

# AI-Enabled Project Control in Oil & Gas Sector & Delivery of Capital Projects

**Manoj Kumar Singh**

ADNOC PMC



# **AI-Enabled Project Control in Oil & Gas Sector**

**1**

**Artificial Intelligence & ML Introduction**

**2**

**Artificial Intelligence in Oil & Gas Sector**

**3**

**AI Powered Project Control - Models & Techniques**

**4**

**Benefits in AI Led Project control & Key Takeaways**

# **Artificial Intelligence - Introduction**

# The Global AI Market

67% of respondents feel that AI will fundamentally change the nature of their business over the one-to-two-year horizon

1

The Global Artificial Intelligence Market Size Value in 2024 was USD 279.22 billion.

2

**ALSO** The global AI market is expected to reach \$1.81 trillion by 2030..

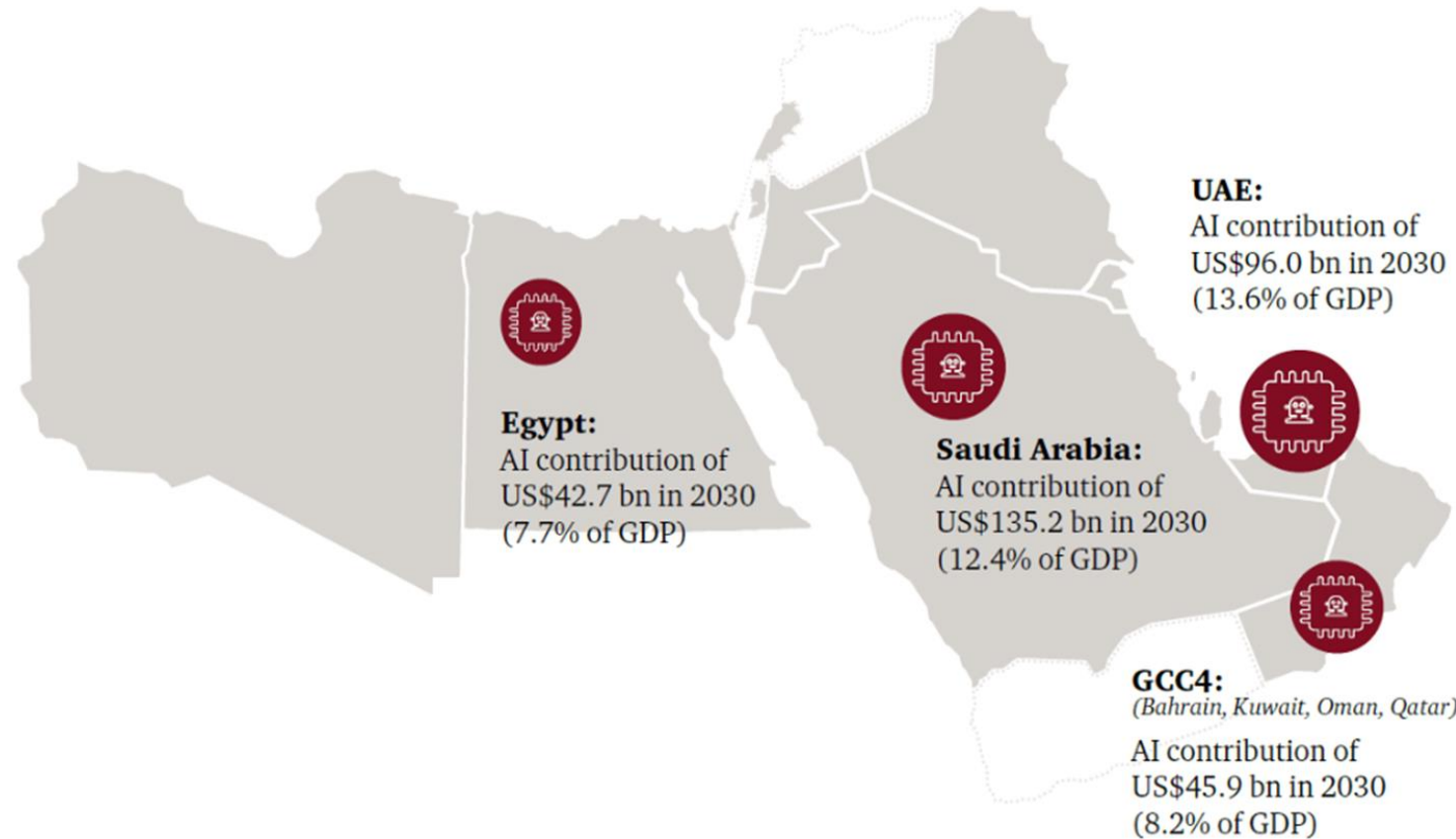
4

3

The Global Artificial Intelligence is Set to grow at 36.6% CAGR from 2024 to 2030



# AI Contribution in Gulf Region







# AI - Artificial Intelligence

Artificial Intelligence (AI) represents a frontier in computer science, aiming to create machines capable of intelligent behavior.

In essence, AI is the science and engineering of making intelligent machines, especially intelligent computer programs

We can consider AI to be a system that perceives its environment and takes actions to maximize its chance of successfully achieving its goals.

The definition of AI is often a topic of debate, but at its core, it involves machines that can perform tasks that typically require human intelligence.



# Brief History of AI

AI as a concept has been around for centuries, with roots in Greek mythology. Modern AI, however, began in the 20th century with the development of the Turing Test by Alan Turing, an attempt to define a standard for a machine to be called “intelligent.” The field of AI research was formally founded at a conference at Dartmouth College in 1956.





# Types of AI

AI can be categorized into two main types:

1. **Narrow AI (or Weak AI):** This type of AI is programmed to perform a narrow task like facial recognition, internet searches, or driving a car. Most of the AI encountered in day-to-day life, from chatbots to virtual assistants like Siri and Alexa, falls under this category.
2. **General AI (or Strong AI):** This is a type of AI that has a broader range and is more akin to human cognition. It can intelligently solve a variety of problems, learn new tasks, and perform a variety of tasks. General AI is still a largely theoretical concept, with no existing examples as of now.





# AI Technologies

Various technologies are used in AI, including:

1. **Machine Learning:** Allowing machines to learn from data.
2. **Natural Language Processing:** Enabling machines to understand and interact with human language.
3. **Robotics:** The field of creating robots that can perform tasks in the physical world.
4. **Neural Networks:** Computer systems modeled on the human brain and nervous system.



# Machine Learning (ML)

- Machine Learning (ML) is a transformative branch of artificial intelligence (AI) that focuses on developing systems that learn from and make decisions based on data. Unlike traditional programming, where humans explicitly define the rules, ML allows a system to learn and evolve based on experience.
- At its core, ML is about teaching computers to learn from and make predictions or decisions based on data. This learning process is automated and improves with experience, without being explicitly programmed for each task. ML is a step towards achieving artificial intelligence.





# Differences Between AI & ML

The fundamental difference between AI and ML lies in their scope and objectives. AI is a broader concept aimed at creating machines capable of performing tasks that would typically require human intelligence. It encompasses anything from basic automation to complex problem-solving

## Real-World Examples

- **AI Examples:** Examples include Apple's Siri for voice recognition and autonomous robots used in manufacturing.
- **ML Examples:** Google's search algorithms, Netflix's recommendation engine, and self-driving car technology primarily use ML techniques.





# AI in Everyday Life

AI is now a part of everyday life and is used in a range of sectors. For example, in healthcare, AI is used to predict patient risk and improve diagnostics. In finance, it's used for algorithmic trading and risk management. In the consumer sector, AI powers personal assistants like Siri and Alexa, as well as recommendation systems used by companies like Netflix and Amazon.

## The Future of AI

The future of AI promises advancements in various fields and the potential to solve complex global challenges. However, it also poses significant challenges and risks that need to be managed responsibly.

# **Artificial Intelligence in Oil & Gas Sector**

# AI in Oil & Gas Sector

The oil and gas industry is a key driver of the global economy. The global oil and gas market size was valued at USD 20.3 Billion in 2024 .

1

The AI In Oil And Gas Market size is estimated at USD 3.54 billion in 2025, expected to grow at a (CAGR) of 14.2% from 2023 to 2030.

2

**HOWEVER,** The global oil & gas market size value expected to reach **USD 72.6 Billion** by 2033 & AI In oil & gas Market size is expected to reach **USD 6.40 billion** by 2030

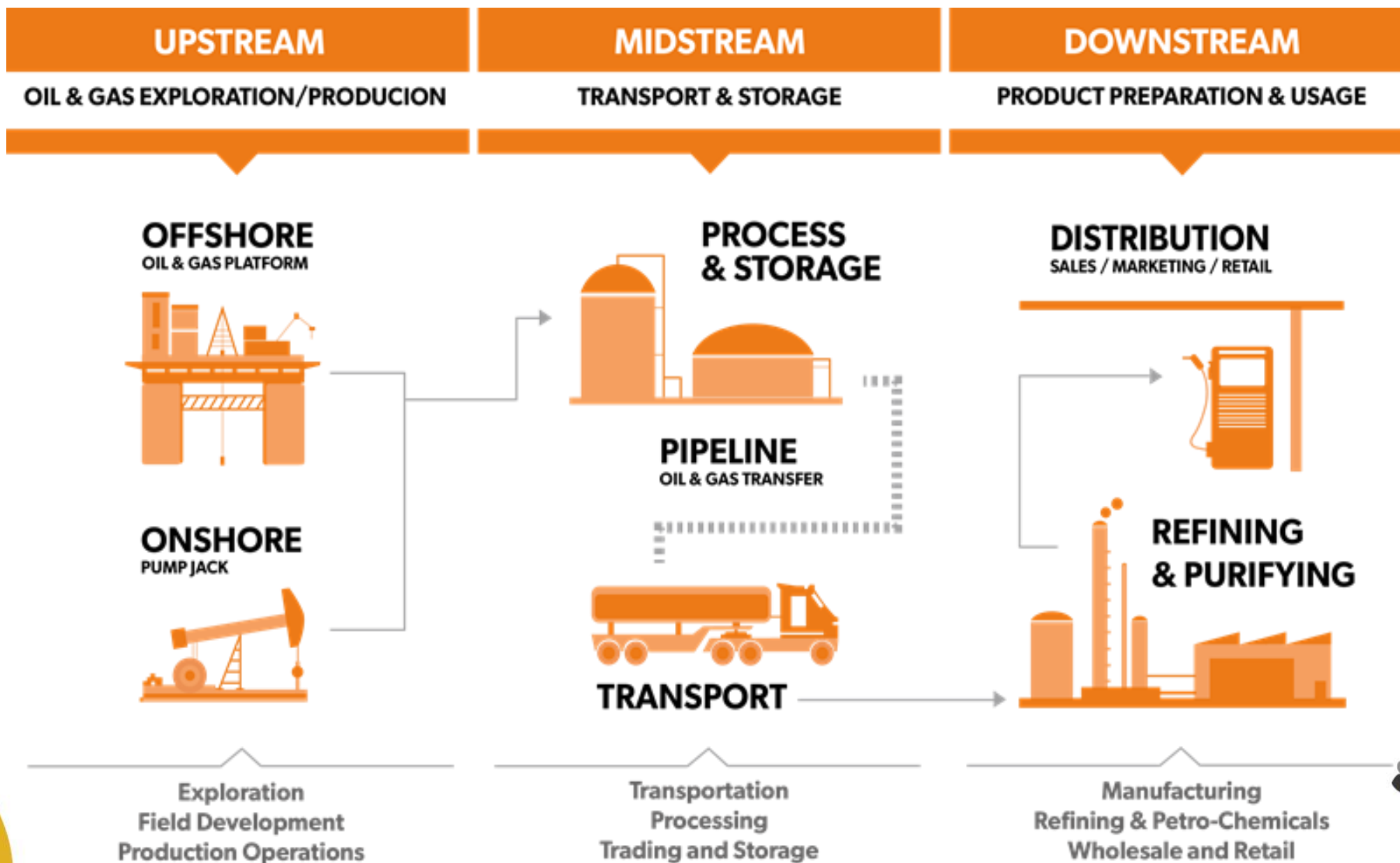
4

3

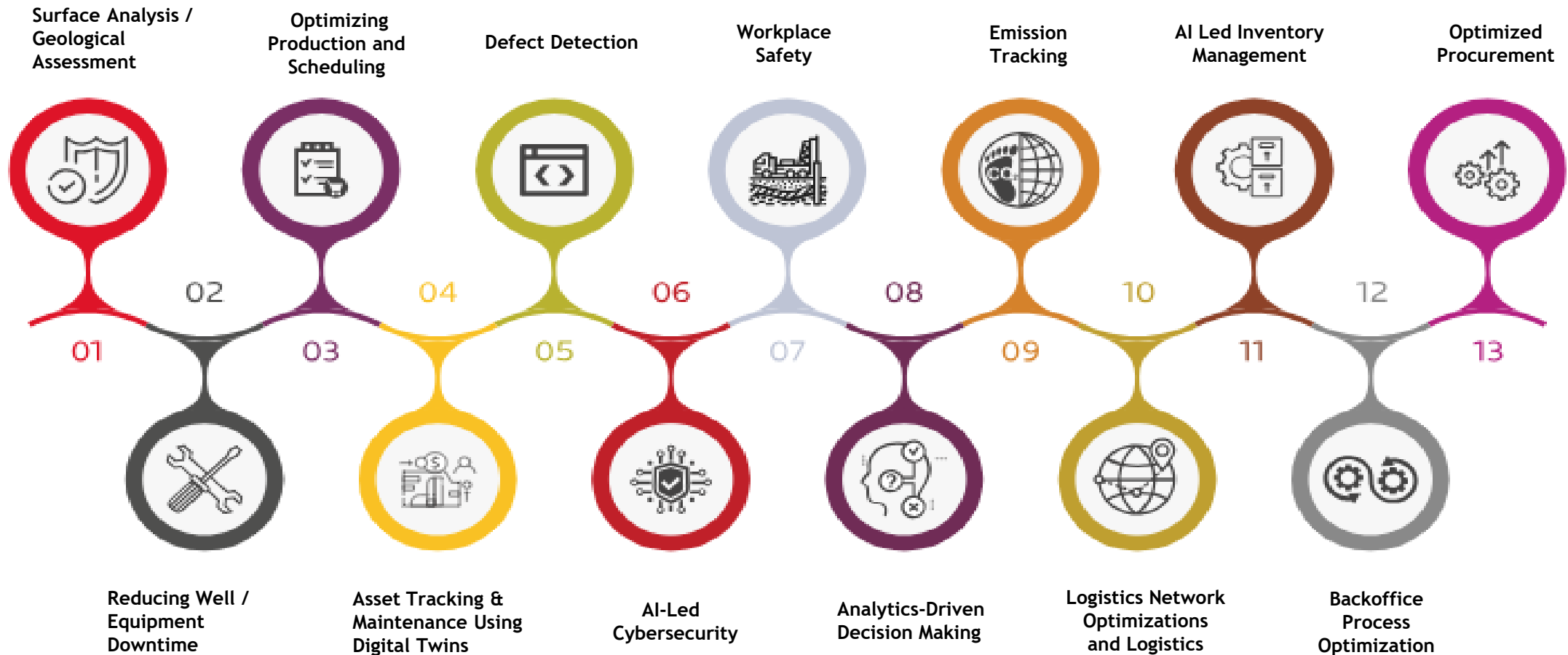
An Ernst & Young survey found 92% of oil and gas companies worldwide are investing in AI or planning to do so in the next 5 years



# Oil & Gas - Stream



# AI applications in Oil and Gas



# AI applications in Oil and Gas

Segment	Operations	Impact	Technologies involved
Upstream	Reservoir exploration	Targeted wells placements	Neural networks, machine learning algorithms, edge AI, generative AI
		Reduced environmental footprint	
		Extended oil field lifecycle	
	Drilling automation	Minimized drilling costs	Predictive analytics and decision trees, digital twins, machine learning
		Increased extraction rates	
	Automated fault detection	Extended equipment lifetime	Computer vision and convolutional neural networks
		Minimized disruptions	
		Reduced expenses	
		Automated maintenance scheduling	
	Field workers' support	Reduced costs	NLP, generative AI
		24/7 availability	
		Enhanced safety	



# AI applications in Oil and Gas

Segment	Operations	Impact	Technologies involved
Midstream	Storage facilities inspection	Accelerated detection	Computer vision, edge AI, generative AI
		Automated safety measures	
	Routes planning	Reduced delivery delays	Optimization algorithms, ML
		Lower fuel usage	
		Enhanced safety	

# AI applications in Oil and Gas

Segment	Operations	Impact	Technologies involved
Downstream	Refinery optimization	Increased output	AI-powered monitoring systems, IoT & smart sensors
		Minimized energy consumption	
		Enhanced safety	
	Quality control	Accelerated compliance	ML algorithms, predictive models, IoT & smart sensors
		Minimized waste	
	Product R&D	Reduced experiment consumables	Generative AI
		Minimized guesswork	
		Greater scope for experimentation	

# AI applications in Oil and Gas

Segment	Operations	Impact	Technologies involved
Cross-stream	Asset maintenance planning	Extended equipment lifetime	Edge AI, predictive algorithms, generative AI
		Minimized disruptions	
		Reduced expenses	
		Automated maintenance scheduling	
	Supply chain optimization	Reduced delivery delays	Optimization algorithms, digital twins, generative AI
		Lower fuel usage	
		Automated risk mitigation	



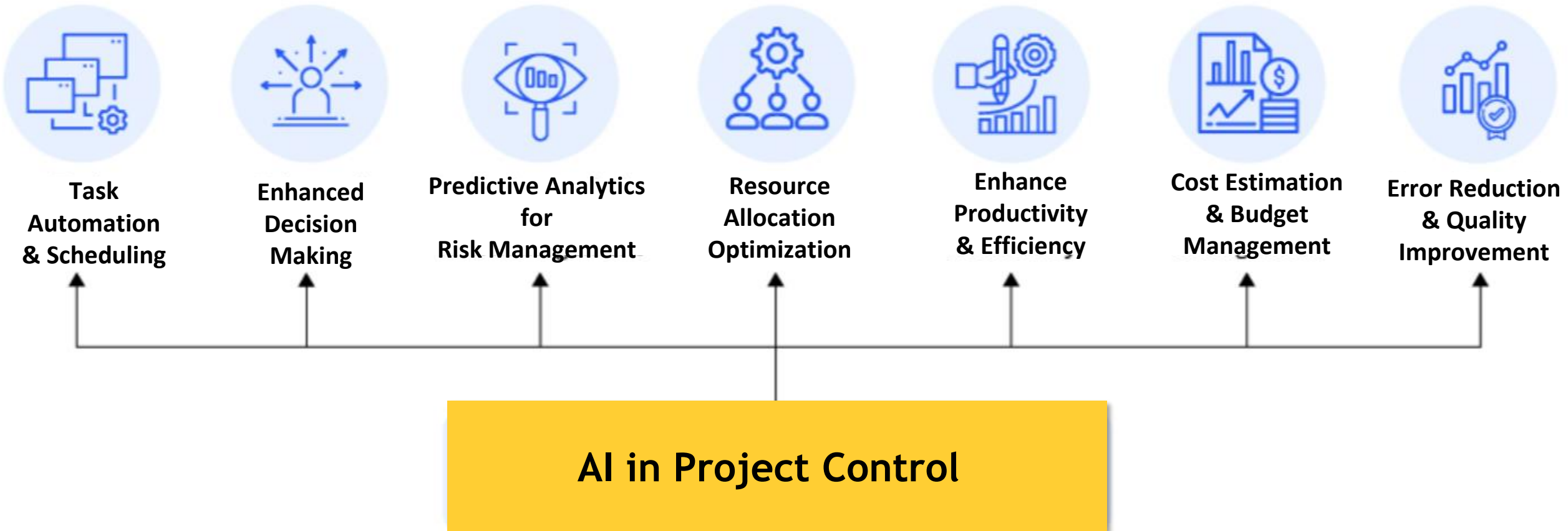
# **AI Powered Project Control**



# AI applications in Project Control

AI has made significant inroads into various fields, including project control. AI can enhance project control by automating repetitive tasks, providing data-driven insights, and improving decision-making. Here are some use cases of AI in project control / management, along with explanations and examples:

# AI applications in Project Control





# Task automation and scheduling

- Task automation and scheduling in project control involves using AI to automate the assignment and scheduling of tasks within a project.
- AI algorithms consider factors like team members' skills, availability, and project priorities to allocate tasks efficiently.
- This ensures that the right resources are allocated to the right tasks, optimizing resource utilization and improving overall project efficiency.
- Additionally, AI can dynamically adjust schedules as project conditions change, helping teams adapt to unforeseen circumstances and meet project deadlines more effectively.





# Enhanced decision making

- AI plays a pivotal role in sorting through vast data volumes to assist project controller's / managers in making informed decisions for efficient project delivery.
- Beyond automating routine tasks, AI comprehends key project performance indicators, fostering innovative thinking and recommendations for complex decision-making.
- **IBM forecasts a \$2 trillion market for data-driven decision-making by 2025.**



# Predictive analytics for risk management

- Predictive analytics for risk management leverages AI to analyze historical project data and external factors, bringing an invaluable layer of foresight to project control /management.
- By incorporating AI's capabilities, project managers gain the ability to forecast potential risks and issues well in advance, significantly enhancing project outcomes.
- McKinsey's research underscores the transformative impact of predictive analytics in project planning. By implementing predictive models, project managers can significantly reduce variations in project schedule dates, ensuring greater adherence to timelines.





# Resource allocation optimization

- Resource allocation optimization in project control leverages AI to intelligently allocate resources, such as personnel, equipment, and materials, to project tasks.
- AI algorithms consider various factors, including skill sets, availability, task dependencies, and project priorities, to ensure that resources are allocated efficiently.
- This use case helps prevent resource bottlenecks, avoid overloading team members, and optimize resource utilization. For instance, in oil & gas project, AI can allocate resource with the most relevant skills to oil & gas discipline , thus improving productivity and project outcomes.



# Enhance productivity & efficiency

- AI boosts productivity and efficiency by automating tasks like sending emails, alerts about project delays, and cost monitoring.
- This automation frees the project team from mundane tasks, allowing them to focus on innovation and improvements.
- AI also analyzes team-generated data, highlighting potential workflow issues..





# Cost estimation and budget management

- Cost estimation and budget management in project control / management involve the application of AI to provide accurate cost estimates and monitor project budgets effectively.
- By analyzing historical spending data, project parameters, and potential risks, AI helps project managers create more precise budget projections.
- For example, an AI-driven cost estimation tool in construction projects can consider variables such as materials, labor, and unforeseen expenses, allowing for better budget planning and risk mitigation strategies to prevent cost overruns.
- **This enhances financial transparency and control throughout the project lifecycle.**



# Error reduction and quality improvement

- Reducing errors and enhancing project quality are critical aspects of successful project control /management, particularly Oil & Gas Projects , where Engineering & Construction quality and defect detection are key indicators of project success.
- AI plays a pivotal role in achieving these goals. One of the significant advantages of AI in project control / management is its ability to predict the number of defects or overall project quality accurately.
- By utilizing AI models and analyzing past project quality data at different stages of projects, AI can identify potential risks and alert project teams. **Additionally, AI helps minimize deviations in cost and schedule by proactively addressing issues.**





# Project forecasting (Latest )

- Project forecasting is a crucial component of project control / management, utilizing AI and historical data analysis to predict and estimate various aspects of a project's future, including completion dates, resource needs, and potential challenges.
- By leveraging machine learning models and historical project data, AI can provide more accurate and data-driven forecasts, allowing project managers to anticipate potential roadblocks and make informed decisions to ensure successful project outcomes.
- These AI use cases in project control can significantly improve efficiency, reduce risks, and enhance decision-making..

# **AI Models & Techniques in Project Control**



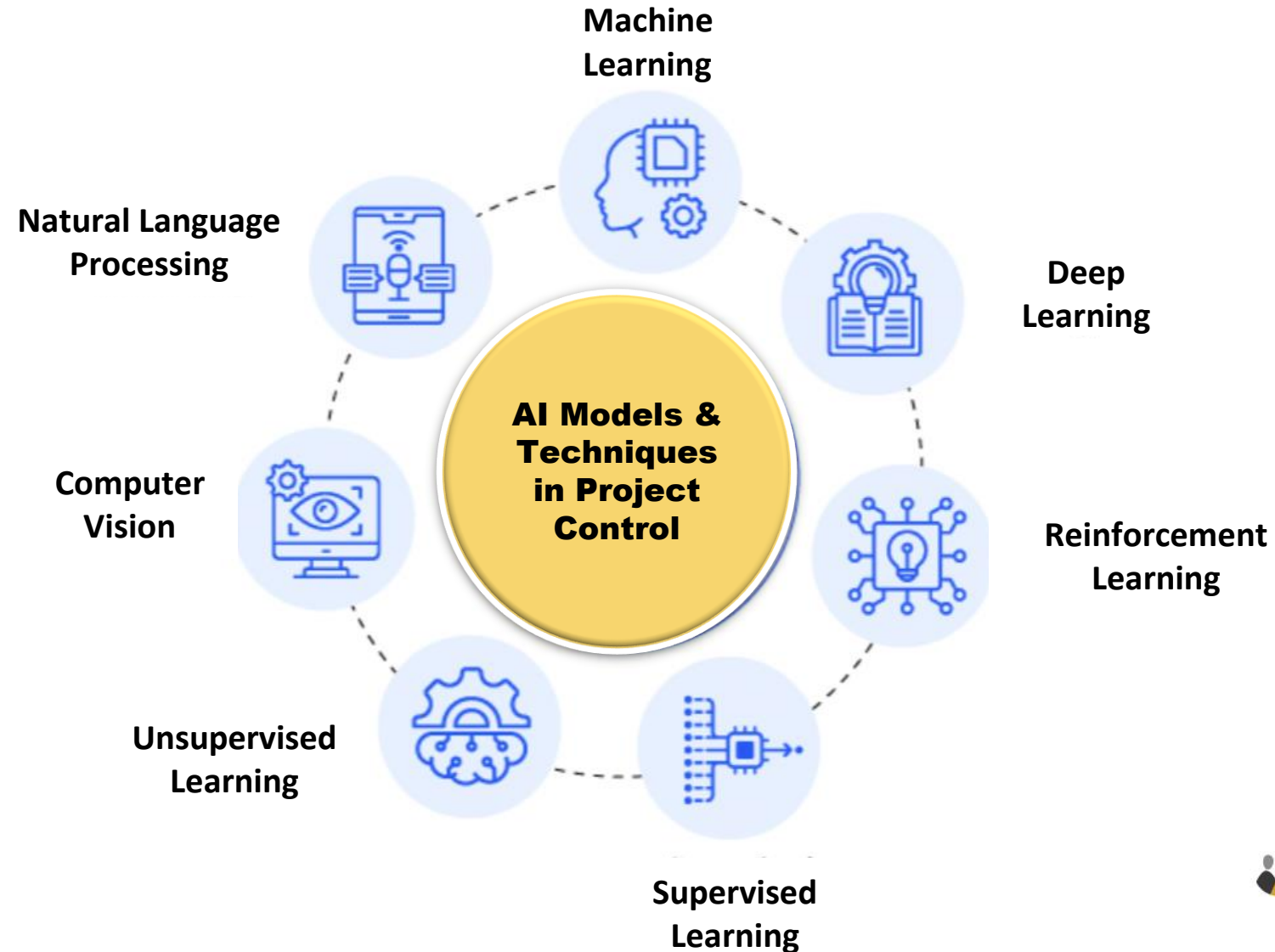
# AI Models & Techniques in Project Control

With a wide range of models and techniques that can be used to automate tasks, AI has redefined project control /management, enhancing efficiency, accuracy, and decision-making throughout the project lifecycle.

**Let's explore some key AI models and techniques that play a pivotal role in project control / management:**



# AI Models & Techniques in Project Control





# AI Models & Techniques in Project Control

## Machine Learning (ML)

- **Regression analysis for project estimation:** Machine Learning regression models are used to predict project timelines, resource requirements, and costs based on historical data. By analysing past project performance, organizations can make more accurate estimates and avoid delays or budget overruns.
- **Classification algorithms for risk assessment:** Machine learning classification algorithms help in identifying and categorizing project risks. These models analyse various factors to assess the likelihood and impact of risks, enabling project managers to prioritize risk mitigation strategies.



# AI Models & Techniques in Project Control

## Deep learning

- Neural networks for pattern recognition: Deep Learning neural networks are employed for recognizing complex patterns and trends within project data. This can help project managers identify anomalies, potential bottlenecks, or areas where process improvements are needed.
- Image recognition for project monitoring: Deep learning models are used to analyze images and videos from project sites, enabling real-time monitoring of construction progress, quality control, and safety compliance. This technology provides valuable insights for decision-making.
- Artificial Neural Networks (ANN): ANNs have several applications in project management, such as predicting cost overruns based on project parameters, automating project activity sequencing, and aiding civil engineering in prediction, optimization, system modeling, and classification. An example includes the replication of past cost trends in highway construction and estimating future cost trends.





# AI Models & Techniques in Project Control

## Reinforcement learning

- **Optimization of project schedules:** Reinforcement learning algorithms can optimize project schedules by continuously learning and adapting to changing conditions. They help in dynamic resource allocation and task sequencing to minimize project duration and costs.
- **Adaptive project management strategies:** Reinforcement learning models can adapt project management strategies based on evolving project conditions. This ensures project managers can make data-driven decisions in response to unexpected challenges.

# AI Models & Techniques in Project Control

## Supervised learning

**Cost estimation for project budgeting:** Supervised learning models are utilized to estimate project budgets accurately. By considering historical project cost data and relevant factors, these models assist in creating budgets that align with project requirements and financial constraints.

## Unsupervised learning

**Creating teams based on common characteristics or communication preferences:** Unsupervised learning techniques help form project teams by clustering individuals with similar skills, expertise, or communication preferences. This ensures better collaboration and synergy among team members.



# AI Models & Techniques in Project Control

## Computer vision

Generative Adversarial Networks (GANs): GANs are used for synthetic data generation, which is particularly valuable for safe project testing. They can create realistic simulations of project scenarios, allowing project managers to assess different situations without the associated risks.

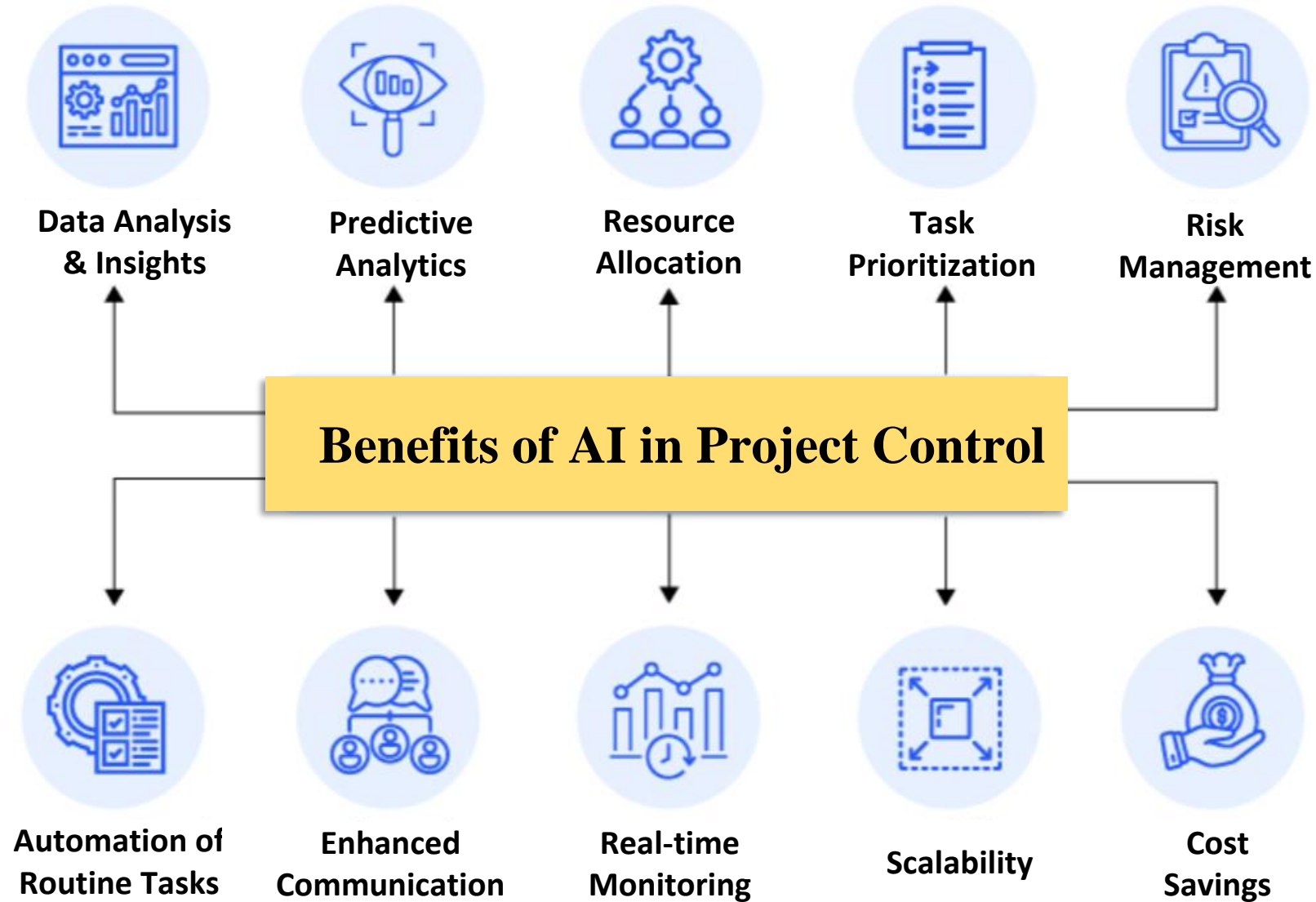
## Natural Language Processing (NLP)

Sentiment analysis for team feedback: NLP models are applied to analyze team communications, such as emails, chat messages, or project status reports. Sentiment analysis helps project managers gauge team morale, identify issues, and take corrective actions promptly.

# **AI Benefits in Project Control**



# AI Benefits in Project Control



# AI Benefits in Project Control

1

**Data analysis and insights:** AI can analyze large volumes of project data, including past project performance, resource allocation, and timelines. This analysis can provide valuable insights into project trends, potential risks, and areas for improvement.

2

**Predictive analytics:** AI can predict potential project delays or issues by analyzing historical data and current project variables. This allows project managers to proactively address problems and adjust project plans to stay on track..

3

**Resource allocation:** AI can optimize resource allocation by considering factors such as team members' skills, availability, and workload. It can help ensure the right resources are assigned to tasks, leading to better resource utilization and cost savings..

4

**Task prioritization:** AI can assist in prioritizing tasks by assessing their importance and urgency. This ensures the timely completion of crucial tasks and the allocation of resources to high-priority items.

5

**Risk management:** AI can recognize potential risks and issues early in the project lifecycle. It can also suggest mitigation strategies and provide recommendations to minimize the impact of risks..

# AI Benefits in Project Control

6

**Automation of routine tasks:** AI can perform automation of repetitive administrative tasks, including functions such as scheduling, data entry, and status reporting. This allows project managers to focus on strategic decision-making and problem-solving.

7

**Enhanced communication:** AI can facilitate communication among project team members by providing chatbots or virtual assistants that can answer common questions, schedule meetings, and provide updates

8

**Real-time monitoring:** AI-driven dashboards and reporting tools offer real-time insight into project advancement, empowering project managers to promptly make informed decisions and address any deviations from the plan.

9

**Scalability:** AI's adaptability allows it to cater to the requirements of both small and large projects, efficiently managing intricate calculations and data analysis tasks across a spectrum of project sizes and complexities

10

**Cost savings:** Through better resource allocation, risk management, and automation, AI can help reduce project costs and enhance the overall return on investment.

# Traditional vs. AI-powered Project Control

Aspect	AI-enabled project management	Traditional project management
Automation	Automates repetitive tasks and processes, reducing manual effort.	Primarily relies on manual task execution.
Data analysis	Analyzes vast datasets for insights, predictions, and decision-making.	Relies on historical data but with limited analytical capabilities.
Risk management	Predicts and mitigates risks in real-time using advanced algorithms.	Identifies risks but may lack real-time analysis and predictive capabilities.
Resource allocation	Optimizes resource allocation based on data and demand, increasing efficiency.	Resource allocation often relies on experience and manual adjustments.
Collaboration	Enhances collaboration with real-time communication and data sharing.	Collaboration often depends on emails and periodic meetings.
Project monitoring	Provides real-time monitoring and alerts, enabling proactive adjustments.	Monitoring relies on periodic status updates and reports.



# Traditional vs. AI-powered Project Control

Aspect	AI-enabled project management	Traditional project management
Decision support	Offers data-driven insights to support decision-making at every stage.	Decisions are based on experience, intuition, and available information.
Predictive analytics	Uses machine learning for predicting project outcomes and potential issues.	Lacks advanced predictive capabilities.
Cost efficiency	Reduces costs by automating tasks, optimizing resources, and minimizing risks.	May incur higher operational costs due to manual processes and inefficiencies.
Adaptability to change	Adapts quickly to changing project dynamics and market conditions.	May struggle to adapt swiftly to unexpected changes.
Project success rate	Tends to improve project success rates by reducing errors and delays.	The success rates can fluctuate based on the proficiency and expertise of project managers.

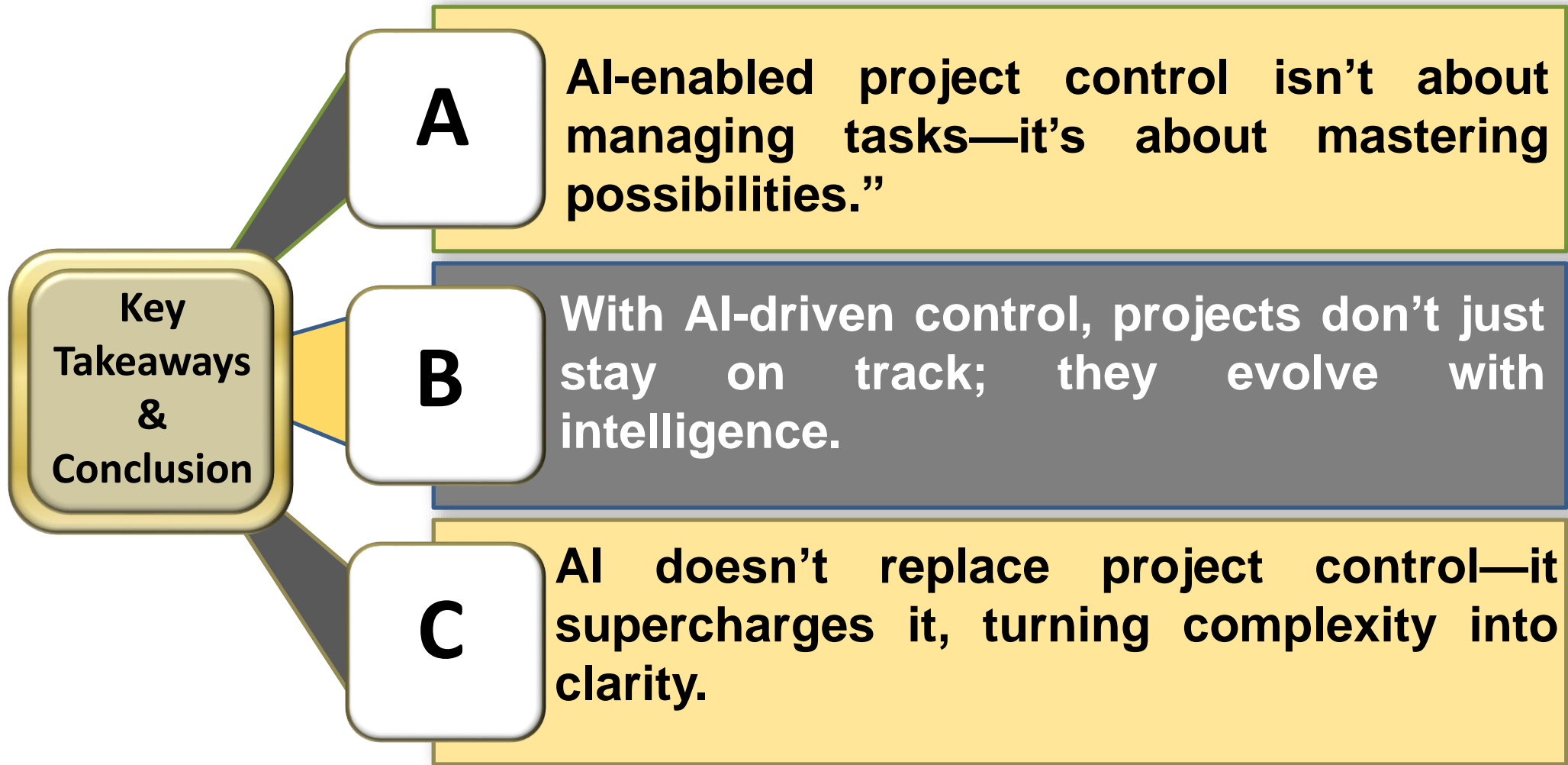
# **Key Takeaways & Conclusion**

# Conclusion

- Considering the advantages and impact of AI and ML, oil and gas companies are now integrating these technologies in their multiple segments. Early adopters are going to gain a competitive advantage over others. AI solutions can help oil and gas businesses to properly utilize their historical data. Sensor-rich oil fields are providing big-data engines a massive amount of data to analyze and deliver real-time alerts.
- The integration of AI in the oil and gas industry keeps field workers connected and keeps a continuous check on their activities. The integration of AI, ML and IoT is transforming the oil field by keeping it connected.



# Key Takeaways & Conclusion



# **Thank you**

# Kent is shortlisted for **Best Use of AI in Operations & Innovator of the Year** at the Oil & Gas Middle East Awards 2025

