

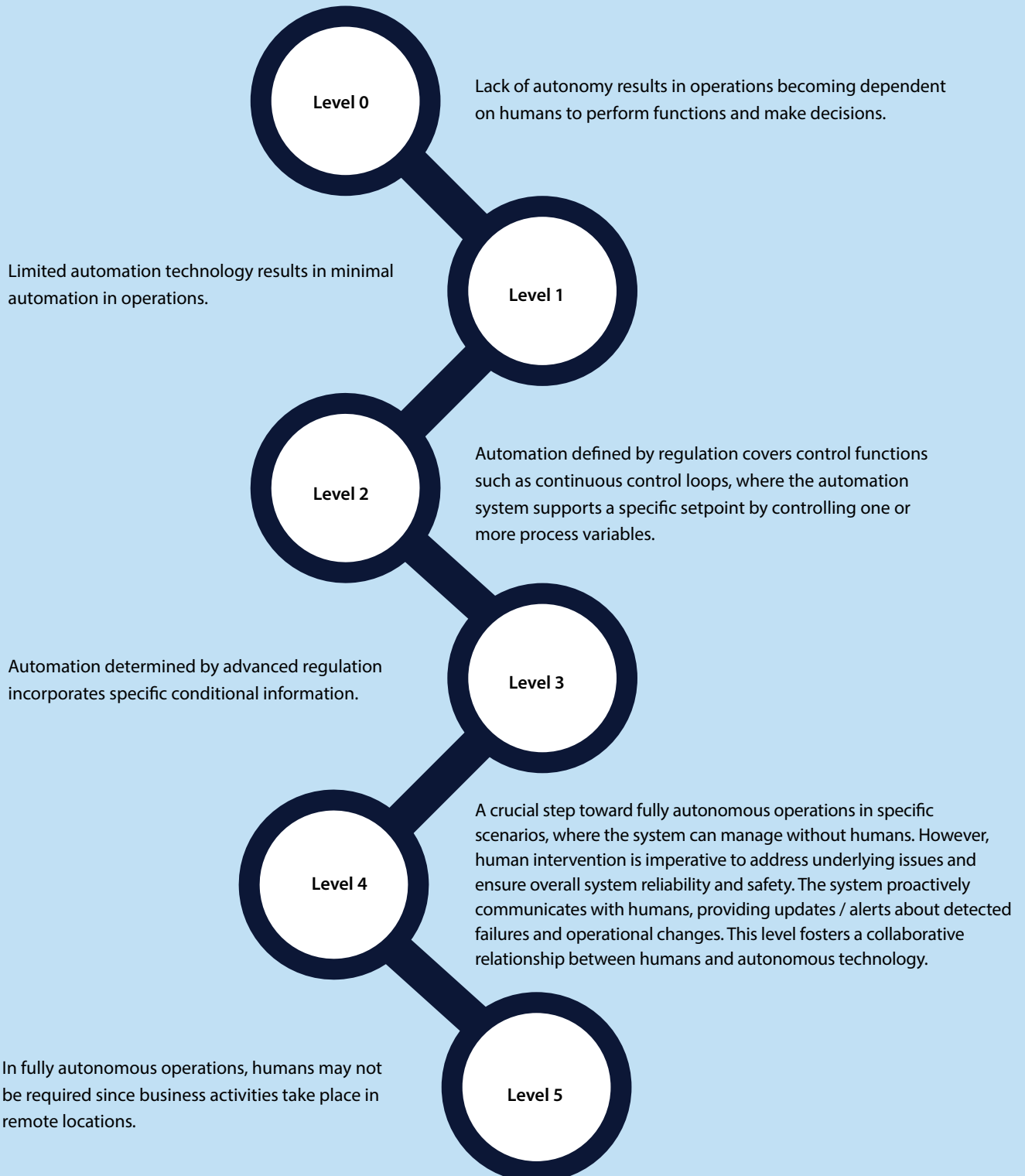
NAVIGATING THE SHIFTS OF AUTONOMOUS TRUCK OPERATIONS IN MINING

Artificial Intelligence (AI) is at the vanguard of the evolution of autonomous vehicles. The automotive AI market is projected to register a net value of ~US\$ 11k million by 2025, growing at a compound annual growth rate (CAGR) of ~38.5%.

The State of Autonomous Operations in Vehicles

Autonomous operations require plants that operate without human intervention by capitalizing on advanced digital technologies. In this ecosystem, the plant addresses challenges and adapts to changes across the business and industrial landscape while maintaining optimal efficiency and profitability.

Levels of Autonomous Operations:



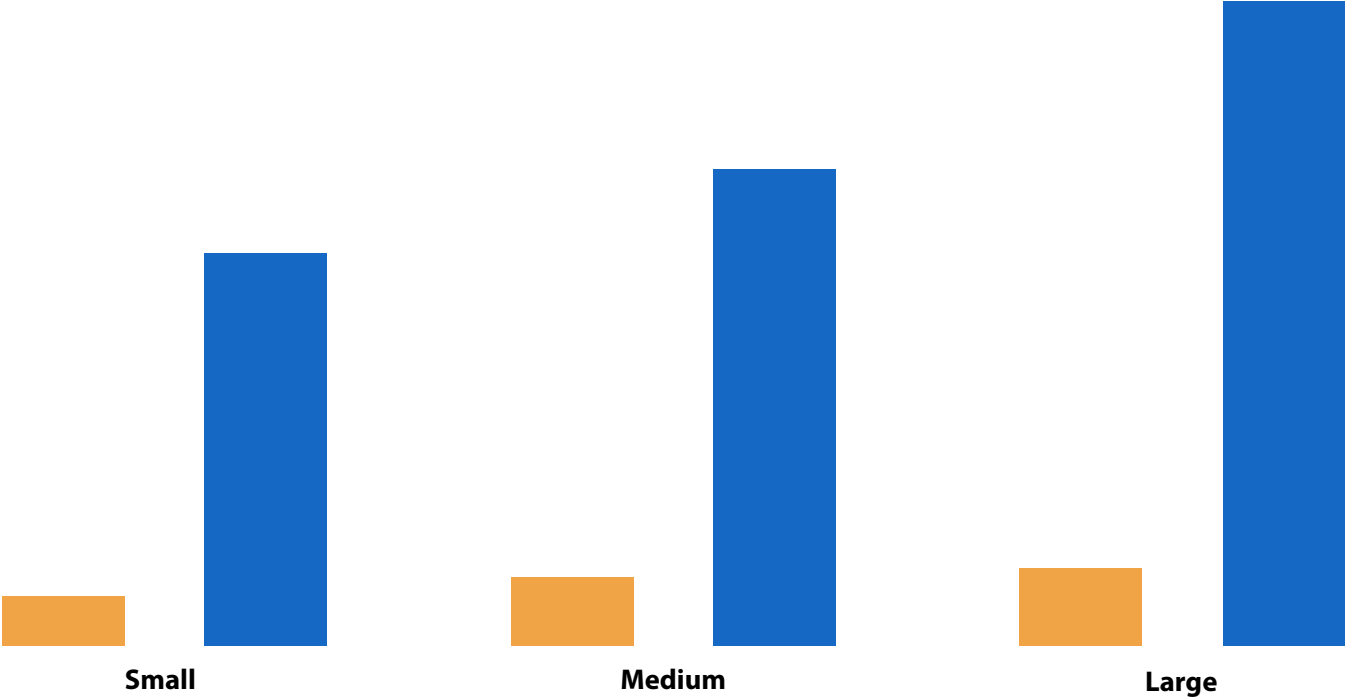
Application of Autonomous Operations

Autonomous off-highway vehicles, specifically autonomous mining trucks have gone mainstream in terms of adoption. The global autonomous mining truck market size was valued at US\$ 6.8 billion in 2022, and is projected to register US\$ 10.3 billion by 2030, growing at a CAGR of 24.2% from 2023 to 2030.

AUTONOMOUS MINING TRUCK MARKET

BY SIZE

2025 2035



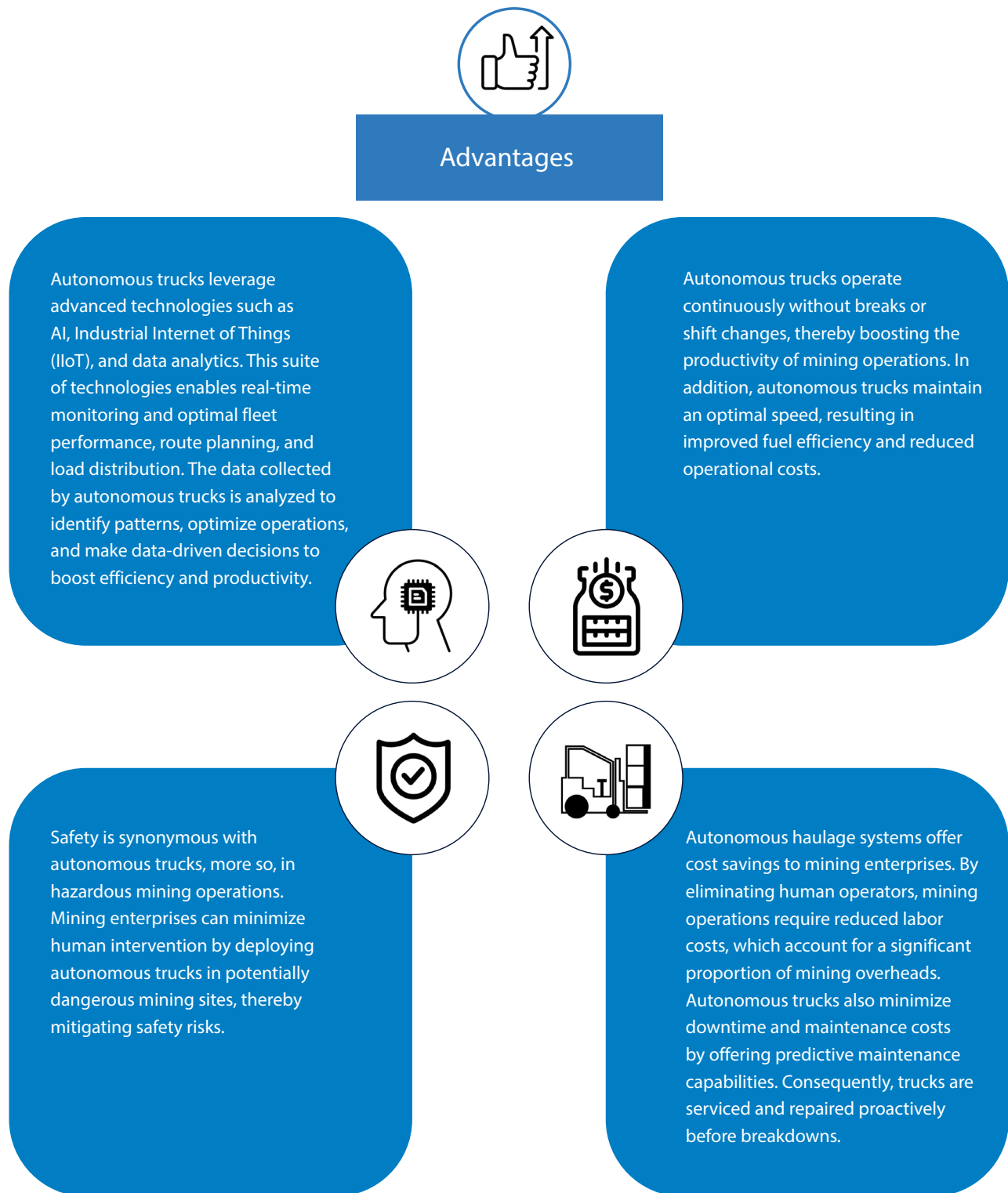
Large segment is projected as the most lucrative segment

Source: *Autonomous Mining Truck by Size, Propulsion, Level of Autonomy*,
Type: *Global Opportunity Analysis and Industry Forecast, 2025-2035*



The Advent of Autonomous Trucks in Mining

Autonomous mining trucks are gaining traction in mining due to their intrinsic benefits for mining enterprises. The implementation of autonomous haulage systems enables the mining ecosystem to address challenges such as limited resources, fluctuating commodity prices, and safety issues.



The adoption of autonomous trucks in mining represents a significant advance in the mining business. These vehicles offer end-to-end automation covering mining, loading, and hauling processes. By incorporating autonomous haulage systems, mining enterprises achieve indefinite operations, improved efficiency, enhanced safety, and significant cost savings, thereby contributing to the bottom line.

Several manufacturers are taking the lead in developing autonomous solutions for mining:

Caterpillar has invested in the development of autonomous vehicles for decades, and has ~ 500+ autonomous mining trucks in operation worldwide.



Scania is testing autonomous trucks for mining applications, from monitoring vehicles in the control room to setting a truck's itinerary on a mobile phone.



Volvo's autonomous transport solution at the Brønnøy Kalk mine integrates autonomous Volvo FH trucks in a challenging mining site. It demonstrates transformative autonomous technology, which provides actionable insights into future prospects of mining and transportation.



Sandvik's AutoMine® Fleet is an advanced automation system redefining safety standards and enhancing operational efficiency in mining. Its seamless integration of advanced features such as OptiMine® connectivity and an upgraded Access Control System enables optimized, cost-effective, and safer mining practices.



Komatsu electric drive mining trucks combines with innovative autonomous haulage technology to drive mining operations. With mining enterprises having business imperatives of enhanced productivity, reduced costs, and improved safety, this is a pivotal step toward sustainable mining practices.



Hitachi Construction Machinery has pioneered ICT and IoT technology for autonomous operation solutions for mining. By introducing long-distance remote control for hydraulic excavators and developing a dump truck Autonomous Haulage System, Hitachi boosts productivity and enhances safety.



The Technology and Infrastructure Imperative

Developing technology and infrastructure to support the development of a fully autonomous trucking system requires significant advancements in AI driving technology and the establishment of new infrastructure. The pre-requisites to achieve the end state include:



5G Technology: A 5G network is a must for seamless connectivity and monitoring of autonomous vehicles.

Edge Computing and Cloud Storage: Autonomous vehicles generate a huge amount of data daily. Edge computing with cloud storage is required to process and distill insights.



Dynamic Routing Tools: These tools optimize truck capacity and navigate diverse traffic and weather conditions.

Data and IT Infrastructure: A huge amount of data and a complex IT infrastructure are required to support autonomous trucking systems. Significantly, a robust cybersecurity policy should be implemented to safeguard enterprise IT and prevent unauthorized access.



The State of Autonomous Operations in Mining

Global manufacturers are developing trucks with Level 2 autonomy, which offers limited capabilities. Research indicates that Level 5 autonomous driving, which represents full autonomy, will result in only 25% savings compared to anticipated total savings.

How can Infosys help?

The autonomous operations market is expected to grow at a high rate. Infosys can help truck manufacturers realize the full potential of autonomous operations through technology interventions:



Integration of sensors:

Infosys integrates advanced sensors such as LiDAR, radar, and cameras into trucks. In addition, we develop sensor fusion techniques to harvest accurate and reliable data from autonomous systems.



Data analytics and machine learning:

Autonomous trucks share massive amounts of data via sensors, cameras, and other sources. Infosys uses machine learning and AI techniques to analyze this data, which helps improve the performance and safety of autonomous systems.



Cybersecurity:

Autonomous trucks are driven by software systems and wireless connectivity. Infosys helps manufacturers safeguard these systems, protect them from potential cyber threats, and ensure the safety of vehicles and cargo by implementing robust cybersecurity solutions.



Simulation and testing:

Infosys develops simulation environments for manufacturers to test autonomous truck systems in various scenarios and conditions. Our approach identifies potential issues and allows refinement of algorithms prior to real-world deployment.



Regulatory compliance:

Autonomous trucks need to adhere to several regulations and standards. Infosys partners with manufacturers to align programs with regulations for industrial safety.



Remote monitoring and maintenance:

Infosys develops solutions for remote monitoring and predictive asset maintenance. Our solutions allow manufacturers to monitor the health and performance of autonomous trucks in real time, which reduces downtime and maximizes asset utilization.



Conclusion

Shifts in autonomous vehicles technology will diminish the need for human drivers. However, integrating human-operated machines with autonomous vehicles poses other challenges. While accidents are inevitable, mining benefits from autonomous technology in heavy equipment. It enhances operational efficiency and reduces costs.

The adoption of autonomous technology in transportation, specifically in long-haul operations, is set to go mainstream. Businesses in transportation need to adapt to the new industrial order. In addition, businesses should invest in reskilling their workforce to navigate the evolving transportation landscape. By investing in reskilling, businesses can ensure sustainability and maximize the benefits of autonomous technology.

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About the Author



Rajiv Puri

VP - Manufacturing Strategy, Solutions & Partnerships, Infosys

Member of World Economic Forum's Advanced Manufacturing & Value Chains Group

Member of Aerospace Industries Association's Product Lifecycle Committee

Contributor



Shruti Badal

Client Solution Lead, Manufacturing Value Design Team

For more information, contact askus@infosys.com



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