



Electronics
Integration
Center

THE PATH TOWARDS AUTONOMOUS AGRICULTURAL MACHINES

AN INDUSTRY AND TECHNOLOGY OVERVIEW

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JCA Electronics



PRESENTATION AGENDA


JCA ELECTRONICS OVERVIEW

- Provide advanced technology control systems to OEMs of Off-highway mobile machines
 - Development of systems from implement controls to autonomous machines
 - Wide variety of applications, primarily agriculture focus
- JCA Products and Services
 - Technology building blocks to facilitate rapid development
 - Engineering team with wide skill set and knowledgeable in latest technologies that apply to the mobile machine industry
 - Electronics and wire harnessing manufacturing




JCA Overview Changing Landscape Autonomous in Ag JCA AFW

AGRICULTURE MARKET DRIVERS




9.5 Billion People by 2050

Higher Food Production is Needed




Reduction of Land Available for Crop Production

Reduction of Available Resources



Less Farm Labour Available

Need to Produce More Output with Less Input



Ag OEMs Pushed for Efficiency

JCA Overview Changing Landscape Autonomous in Ag JCA AFW

AUTONOMOUS IN AGRICULTURE


- Several early prototypes and research projects announced
- No established solutions
- Many major Ag OEMs are currently working on autonomous systems
- Fundamentally different than autonomous on-highway vehicles
- Eliminates the dependence on the tractor
- Re-imagining the shape and form of implements



JCA Overview Changing Landscape Autonomous in Ag JCA AFW

JCA AUTONOMOUS FRAMEWORK (AFW)

- JCA AFW is a set of technologies that can provide the common components to autonomous off-highway systems
- Lower barriers for OEMs to create customized autonomous machine by:
 - Reducing complexity
 - Reducing development effort
- Targeting Level 4 Autonomous (Supervised Autonomy)
 - Can be applied to highly automated applications (Level 1 through Level 3) as well



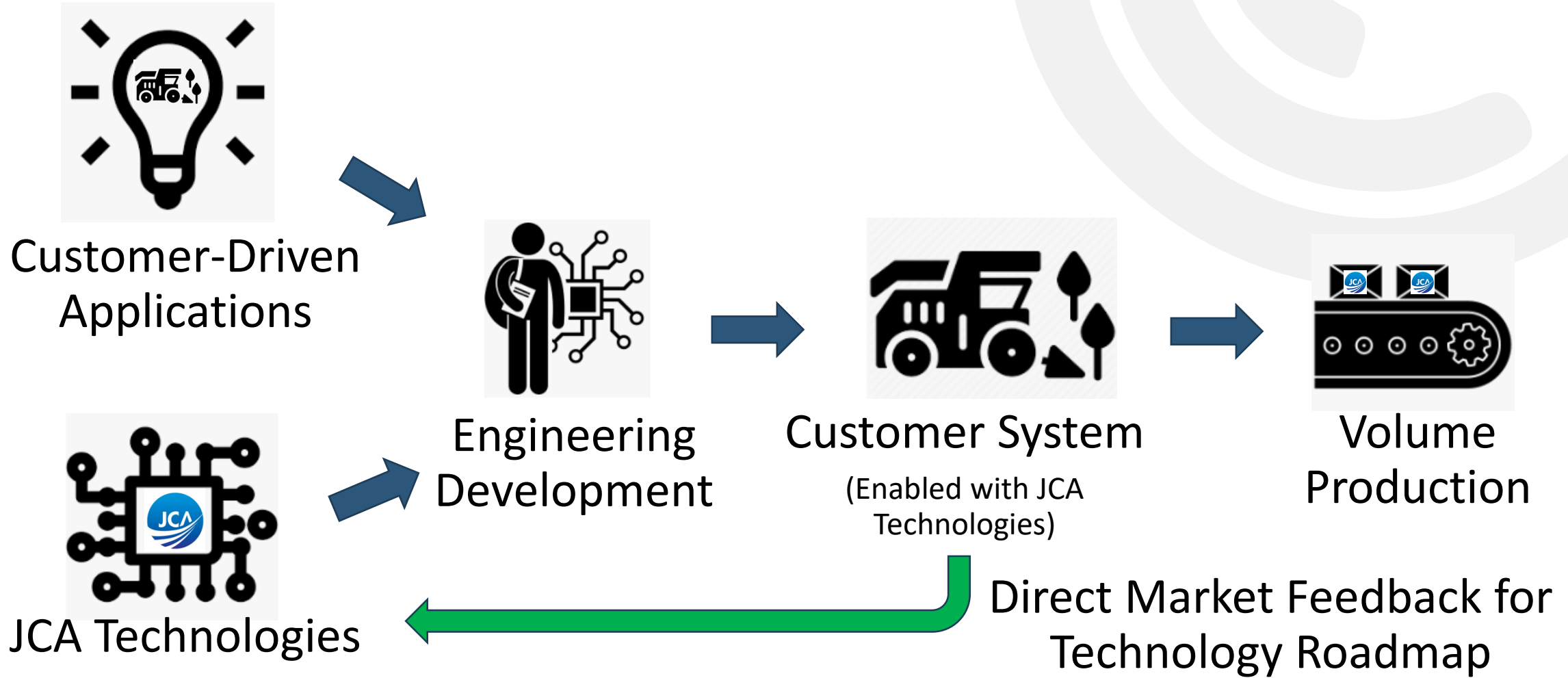
JCA Overview Changing Landscape Autonomous in Ag JCA AFW

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JCA ELECTRONICS OVERVIEW



JCA TECHNOLOGY DEVELOPMENT FOCUS AREAS

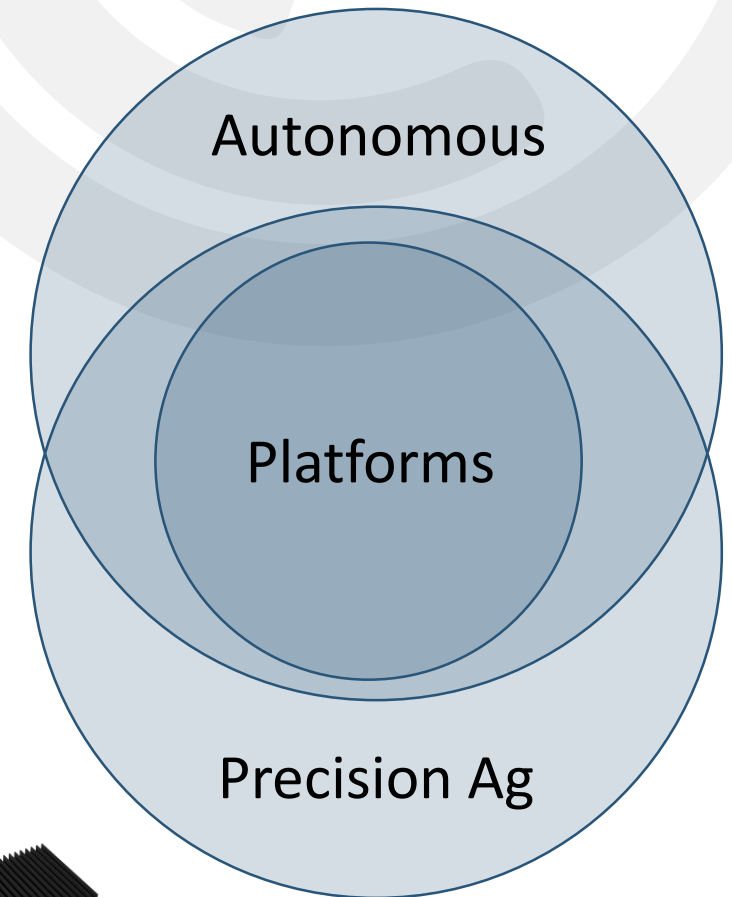
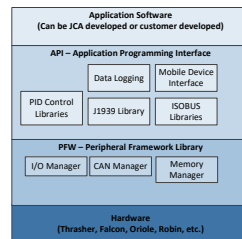
Autonomous Technologies



Precision Ag Technologies



Platforms



AGRICULTURE MARKET DRIVERS



9.5 Billion People
by 2050

**Higher Food
Production is
Needed**



Reduction of
Land Available for
Crop Production

**Reduction of Available
Resources**



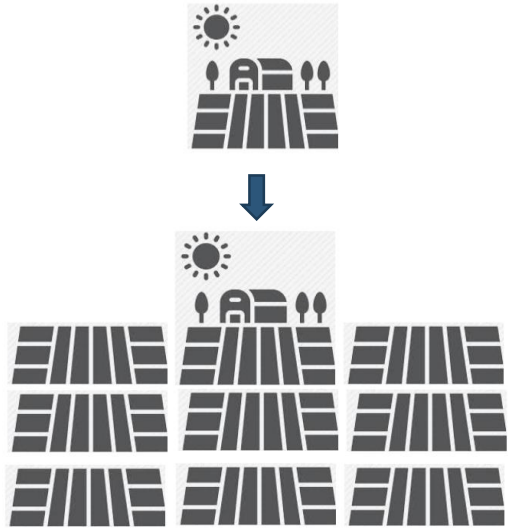
Less Farm Labour
Available



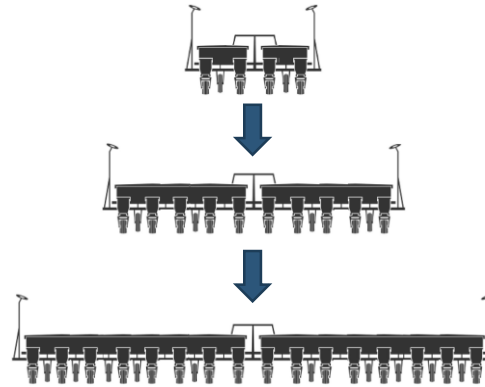
Ag OEMs Pushed
for Efficiency

**Need to Produce
More Output
with Less Input**

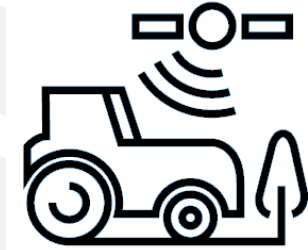
AGRICULTURAL PRODUCTION EFFICIENCY TRENDS



Larger Farming Operations



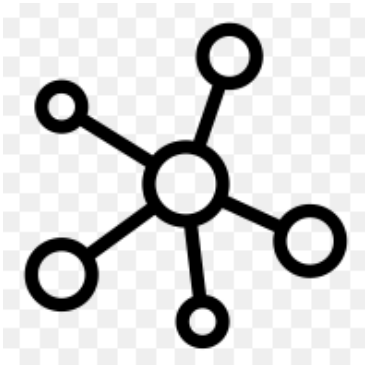
Larger Equipment



Adoption of Precision Ag Technologies

Going Larger Increases Complexity and has Scalability Challenges

GENERAL TECHNOLOGY TRENDS



Connectivity
(IoT)



Data Analytics



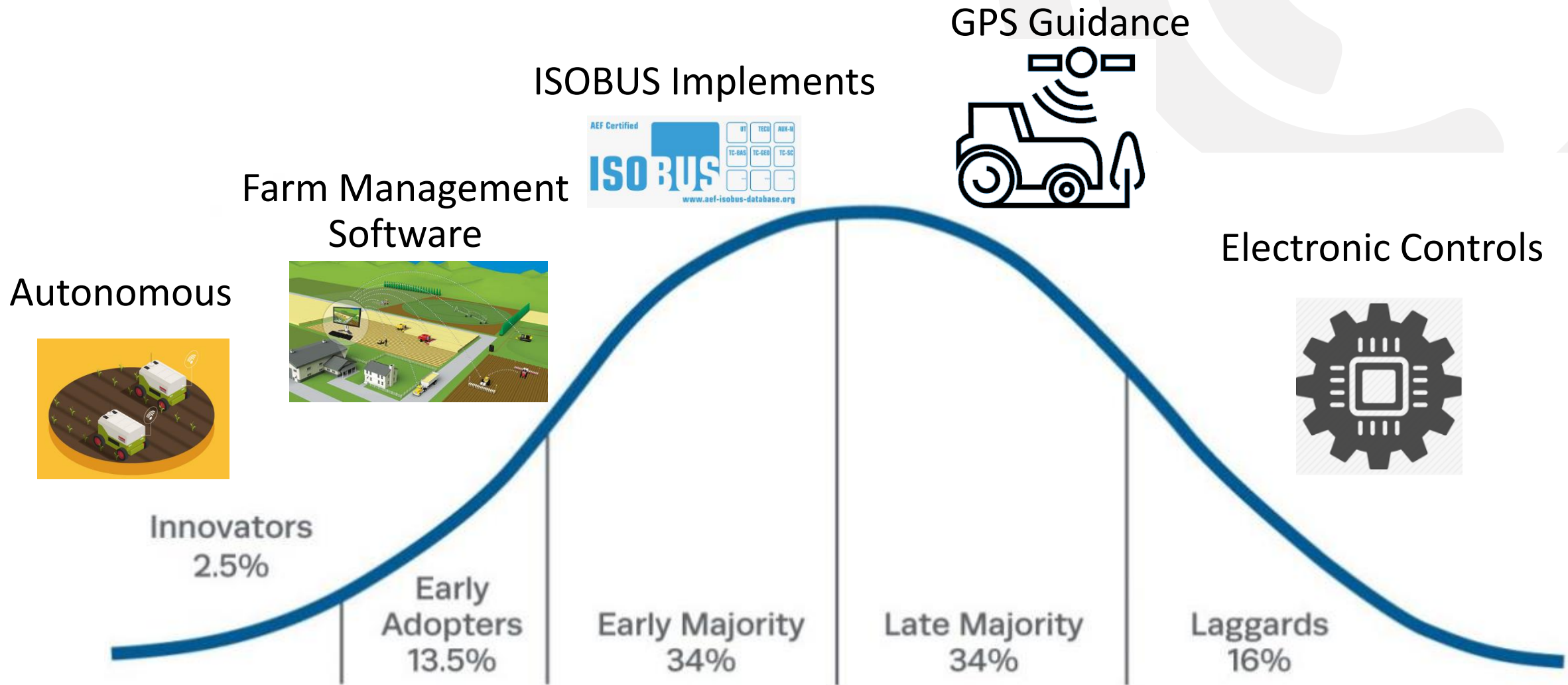
Robotics



Autonomous
Vehicle
Technology

As these technologies mature, they are being applied to problems across off-highway mobile machine systems

ADOPTION OF TECH IN AG



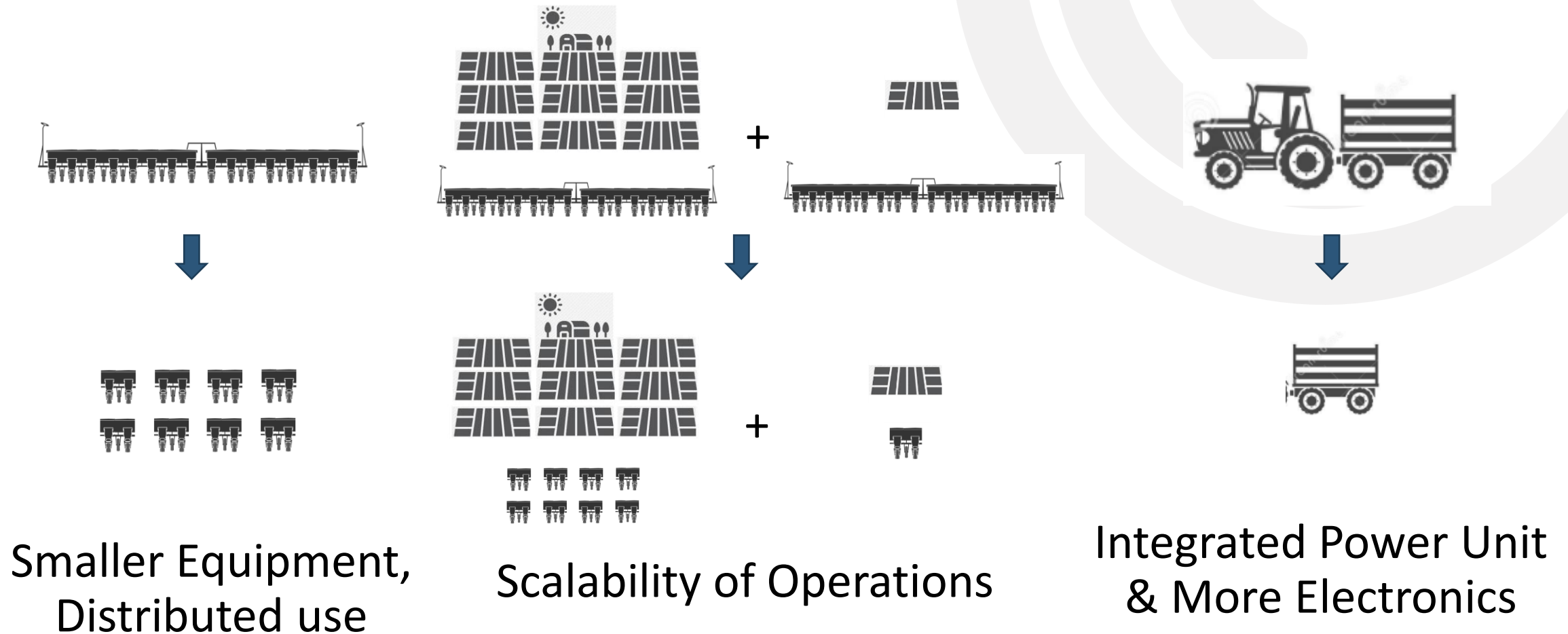


AUTONOMOUS IN AGRICULTURE

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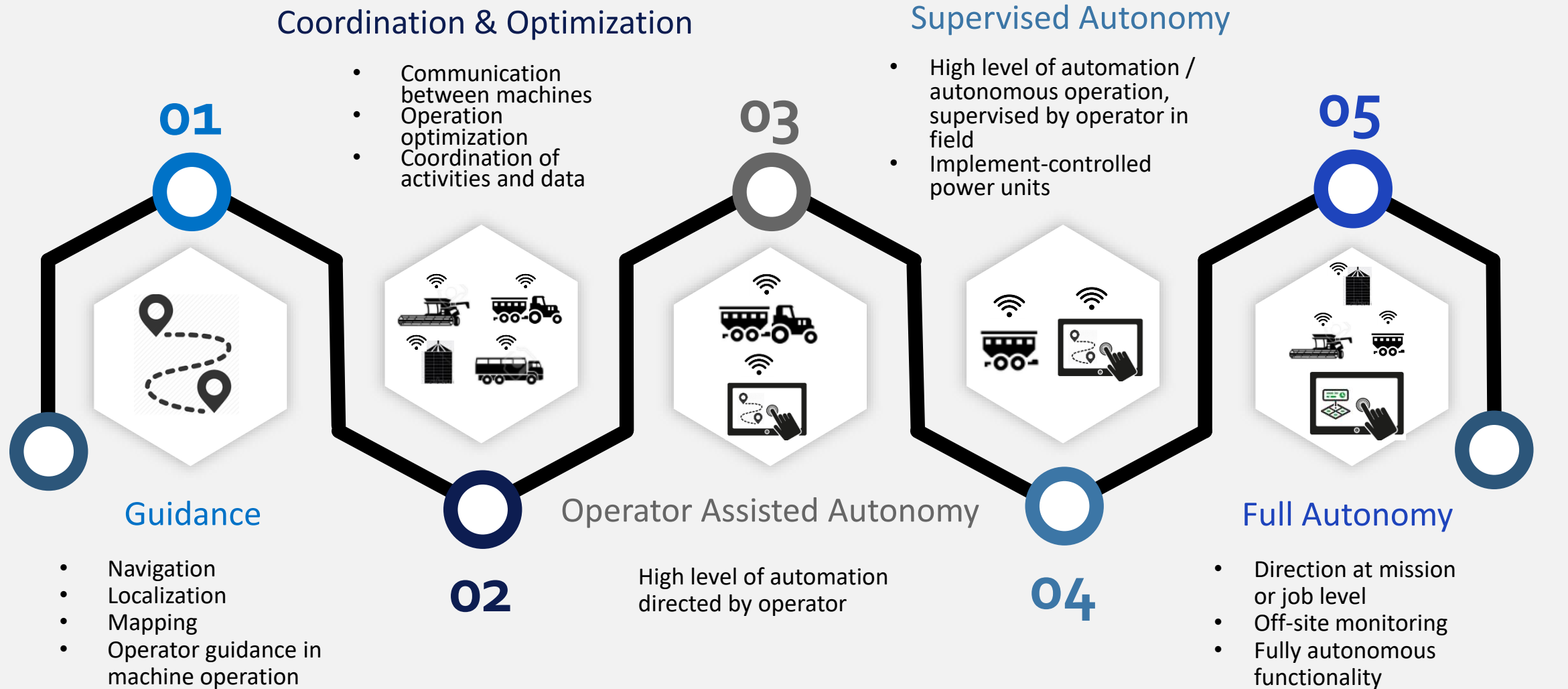


IMPACT OF LEVEL 4 AUTONOMOUS IN AGRICULTURE



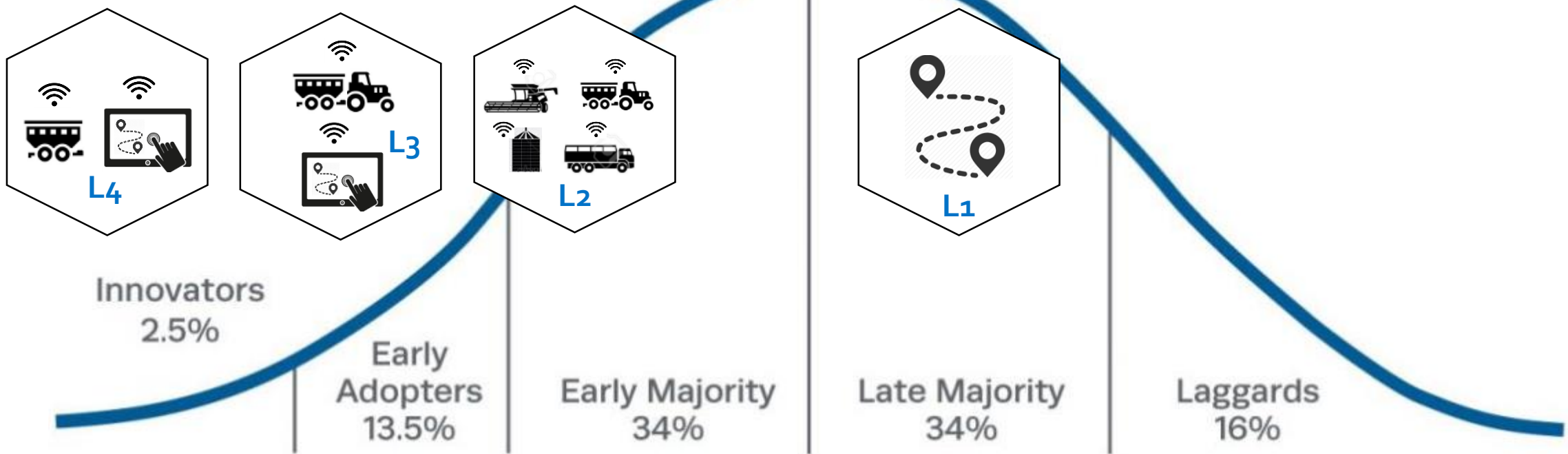
Most significant market change since the introduction of the tractor

Autonomy in Agriculture



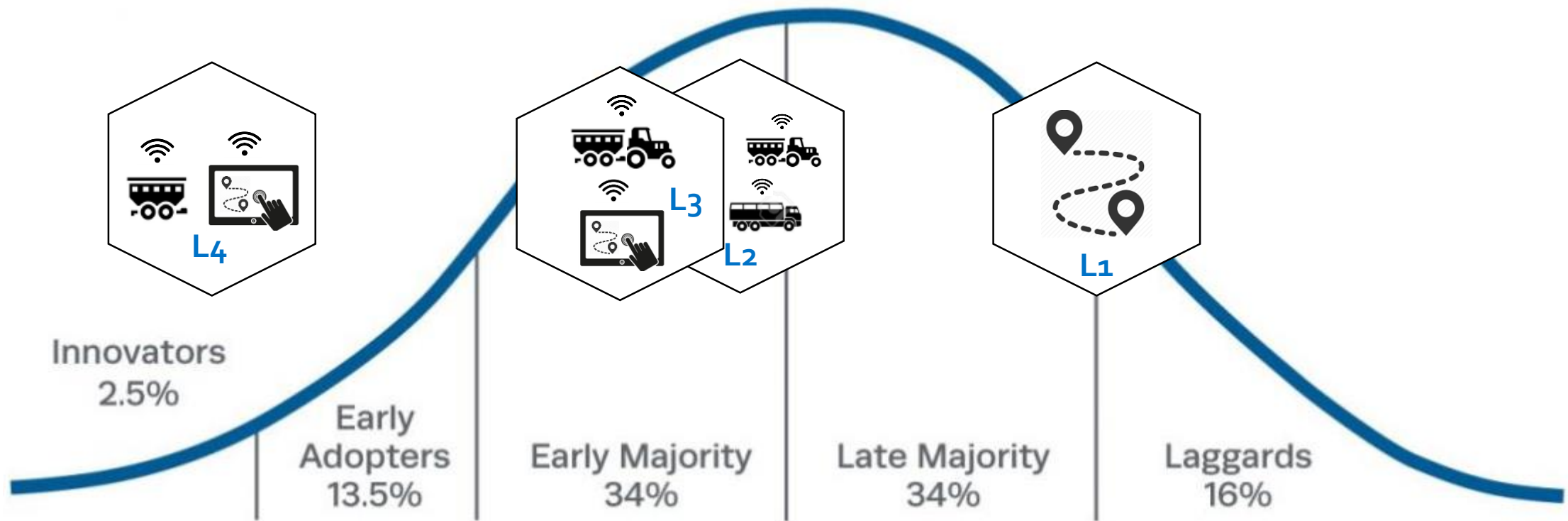
FORECAST OF ADOPTION OF AG AUTONOMY LEVELS

2019



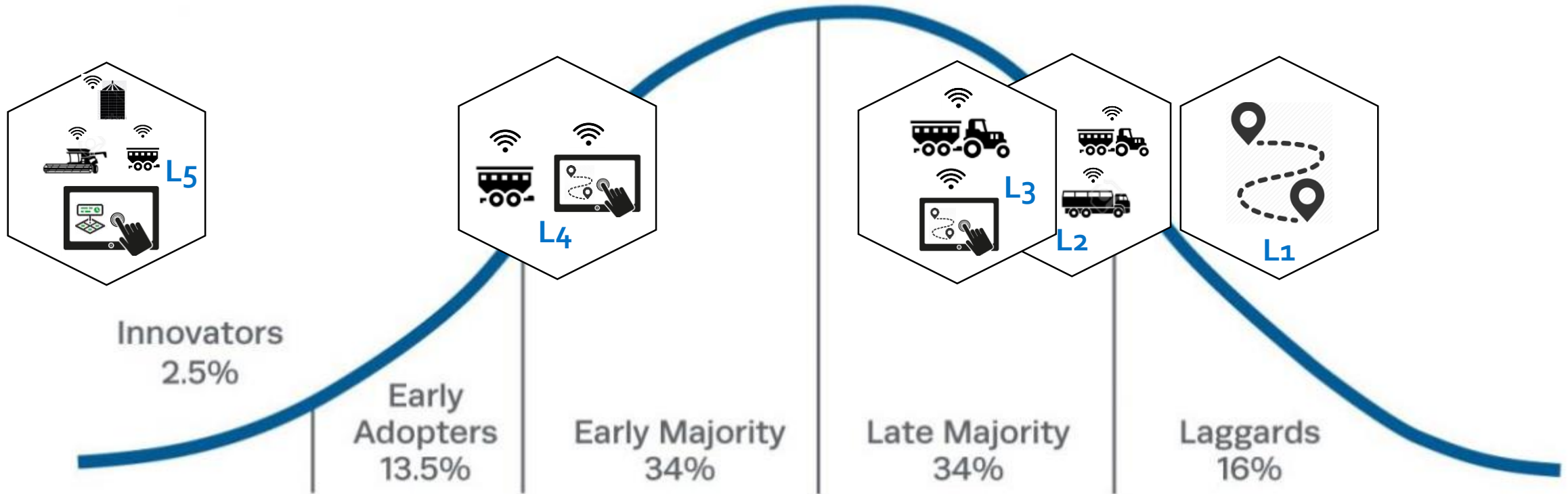
FORECAST OF ADOPTION OF AG AUTONOMY LEVELS

2021



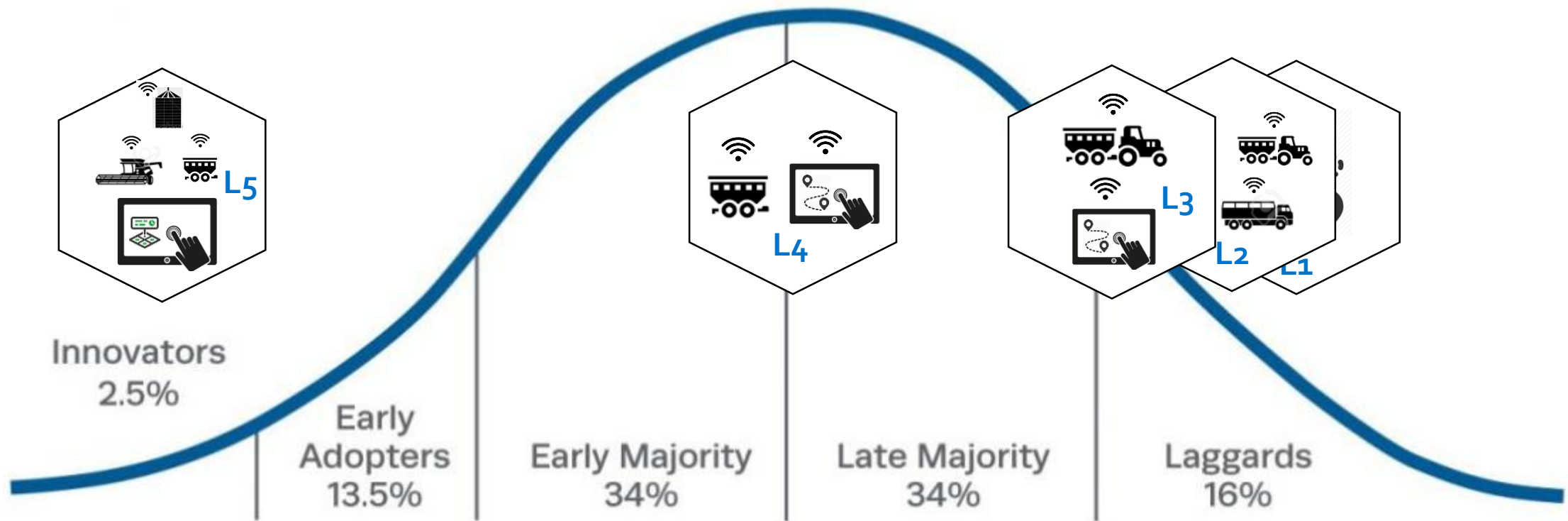
FORECAST OF ADOPTION OF AG AUTONOMY LEVELS

2024

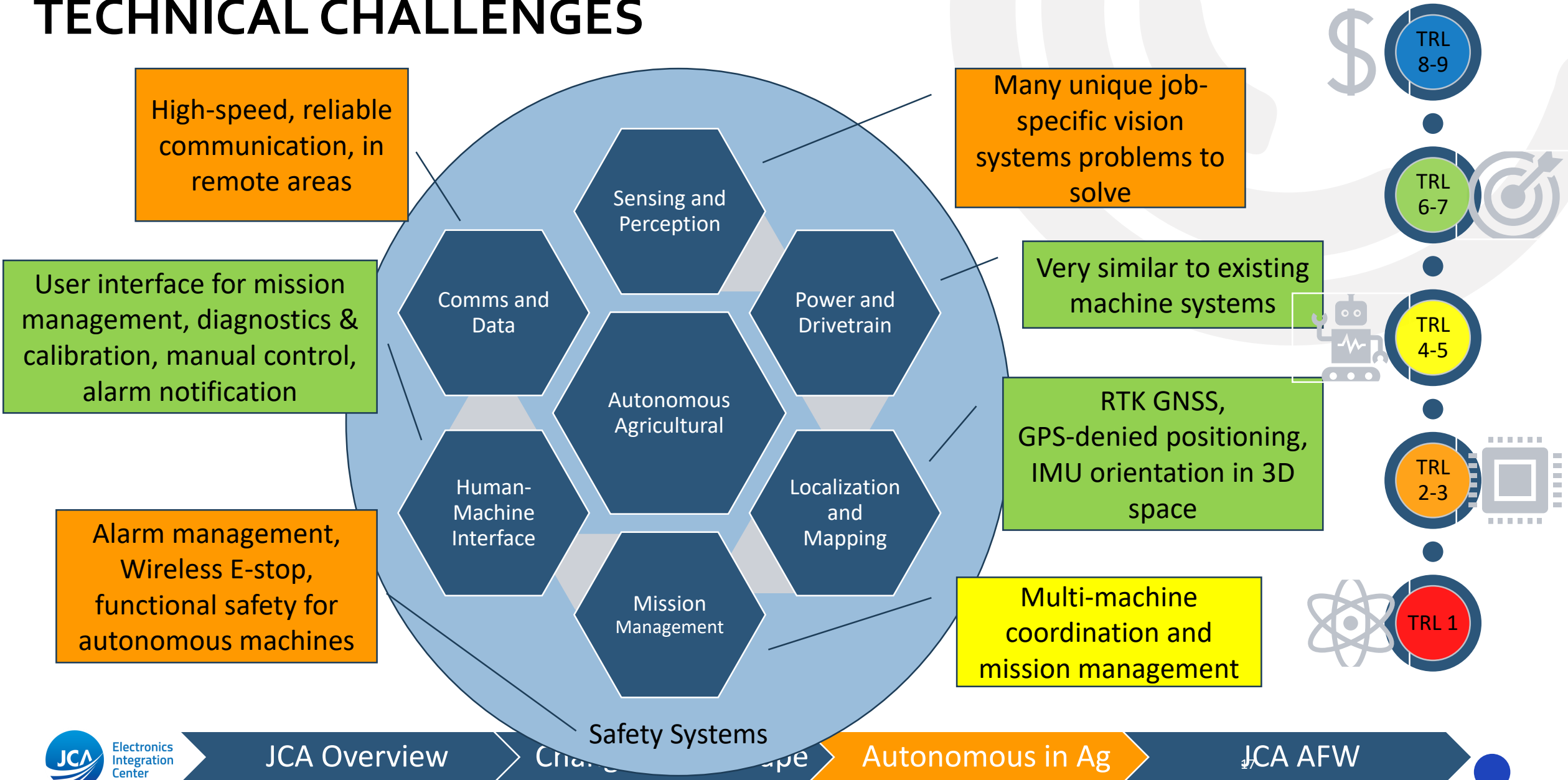


FORECAST OF ADOPTION OF AG AUTONOMY LEVELS

2028

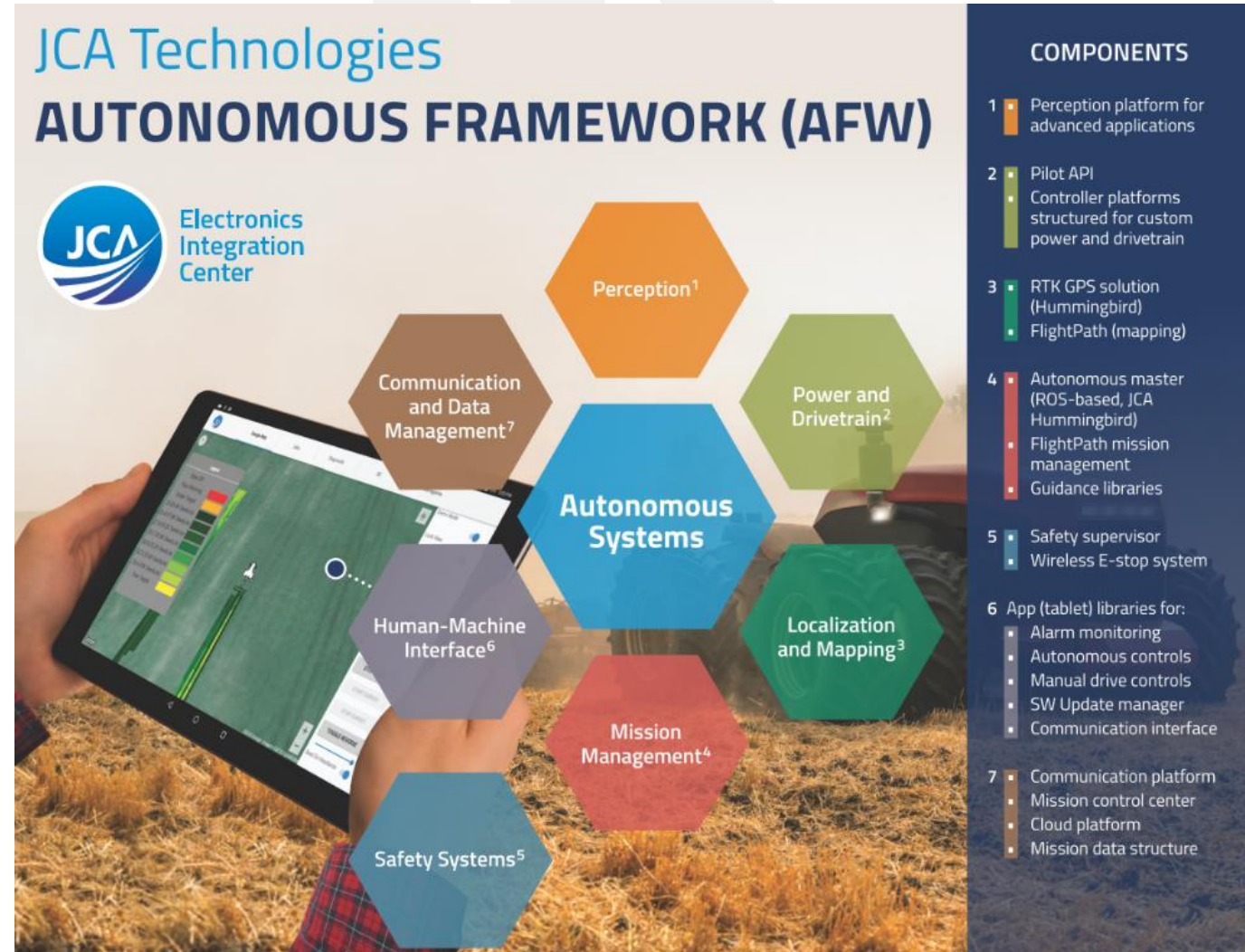


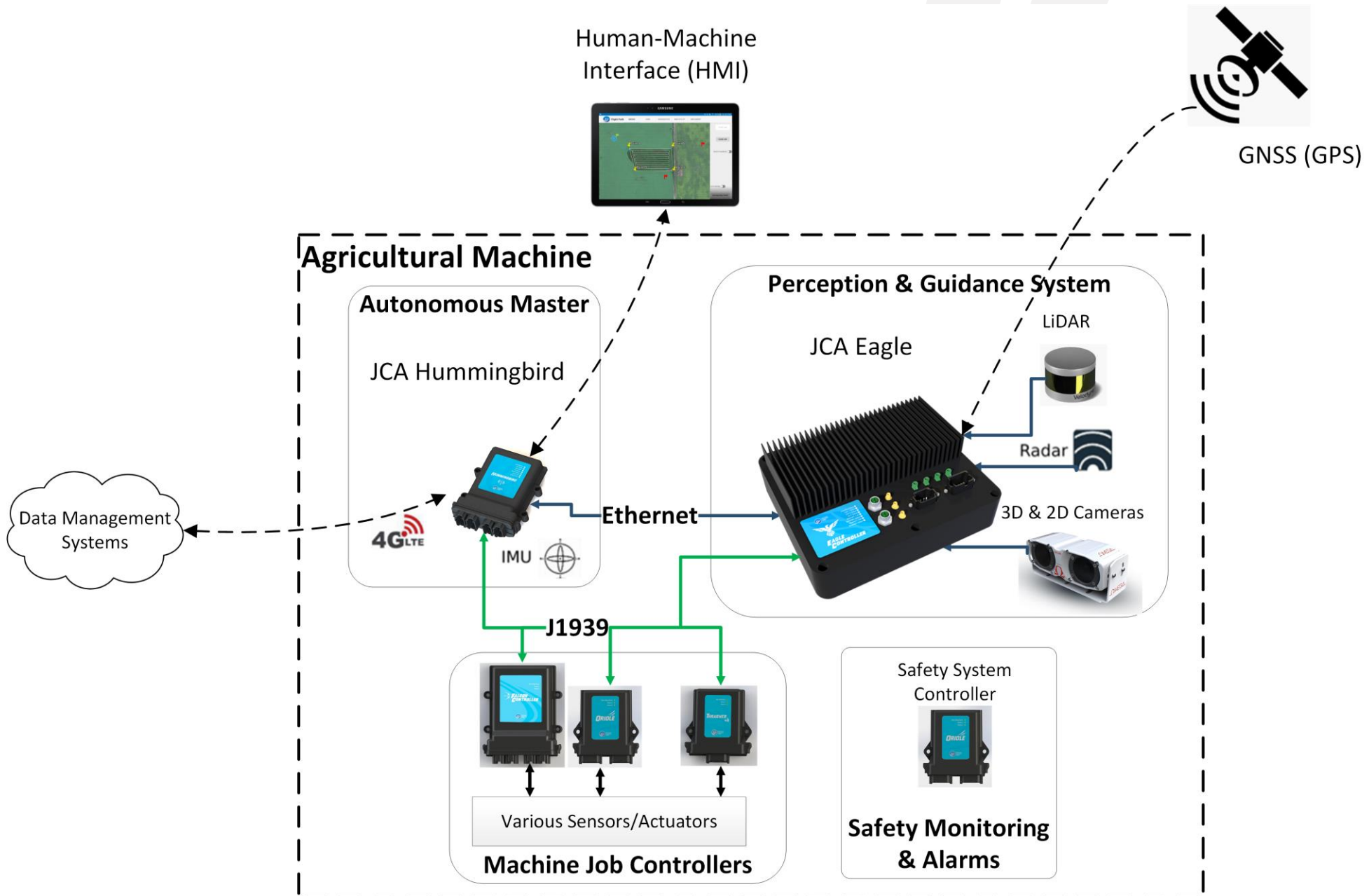
TECHNICAL CHALLENGES



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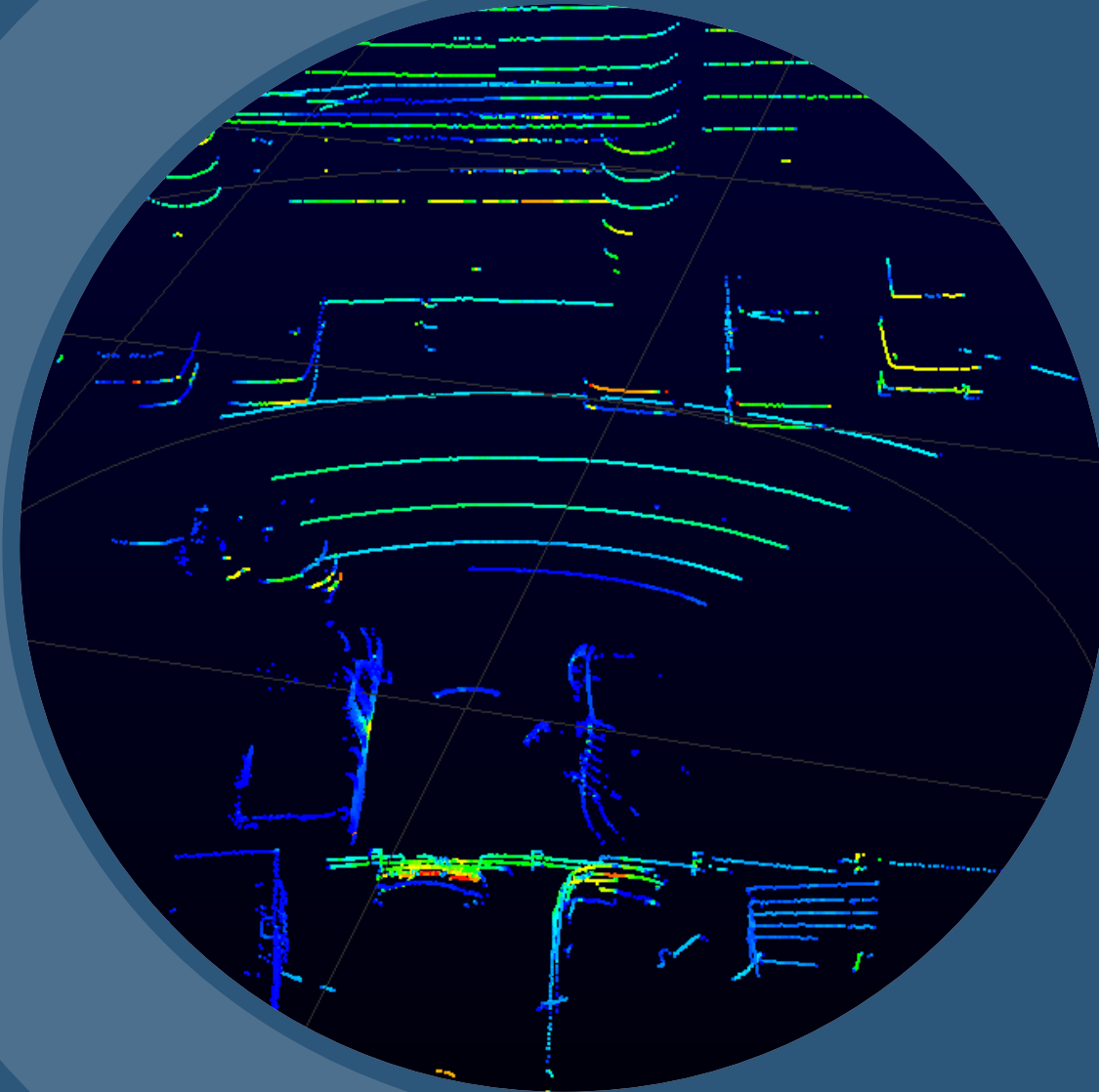


CONCLUSION

- Autonomous in ag offers a path for scalable efficiency improvements
- Technologies are available to solve the key problems
- On-highway and Off-highway use similar technologies, but are solving fundamentally different problems
- Integration of these technologies for a robust & reliable operation is the near-term challenge
- JCA's Autonomous Framework provides the technology infrastructure for common areas to lower the barrier for OEM to develop unique autonomous machines



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THANK YOU



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