

# ROS-INDUSTRIAL ASIA PACIFIC WORKSHOP 2022



## ENABLING LOW-TOUCH ECONOMY WITH AUTONOMOUS ROBOTICS AND AUTOMATION SOLUTIONS

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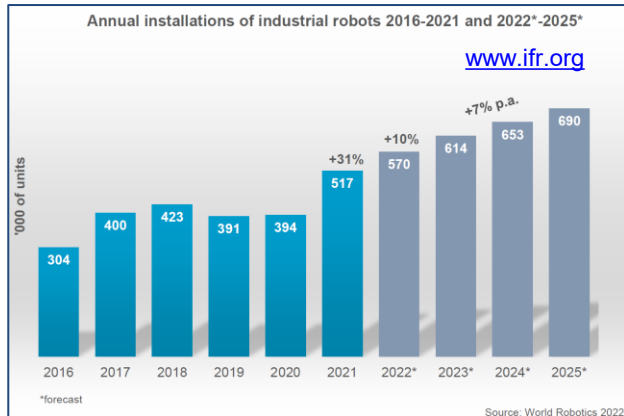
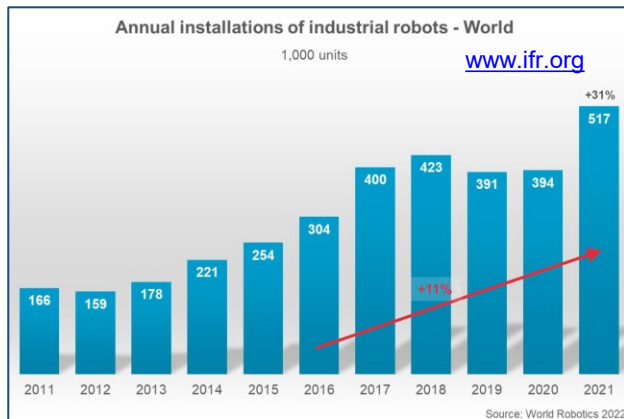
# Outline

1. Key Highlights from IFR Reports
2. Challenges and Opportunities
3. Leveraging Crowd Innovation
4. Towards Full Autonomy in Robotics and Automation
5. New Development to Boost Capabilities of Singapore's robotics Ecosystem





# Over 500,000 New Industrial Robots Were Installed Worldwide in 2021; 31% increase over 2020



## Top 5 End-user Industries

- Electrical/Electronics
- Automotive
- Metal & Machinery
- Plastic and chemical products
- Food

## Top 5 Use Cases

- Handling
- Welding
- Assembling
- Cleanroom
- Dispensing

## Top 5 Markets

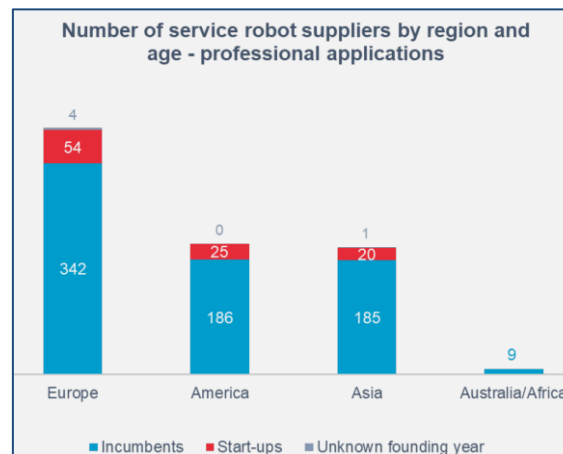
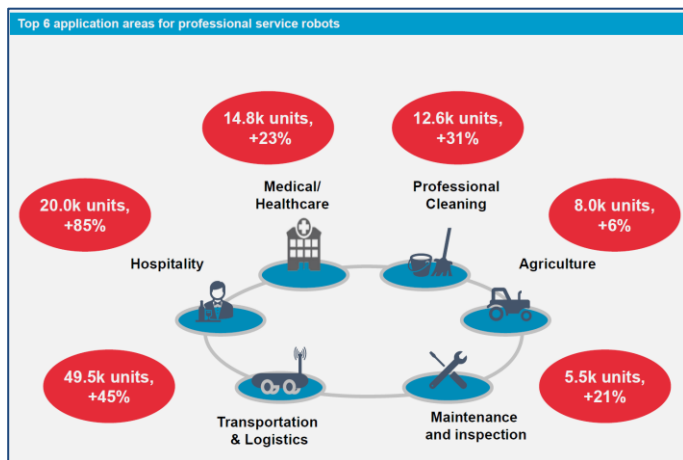
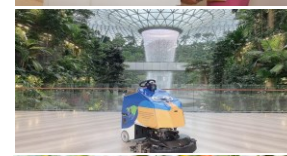
- China
- Japan
- USA
- Rep. of Korea
- Germany



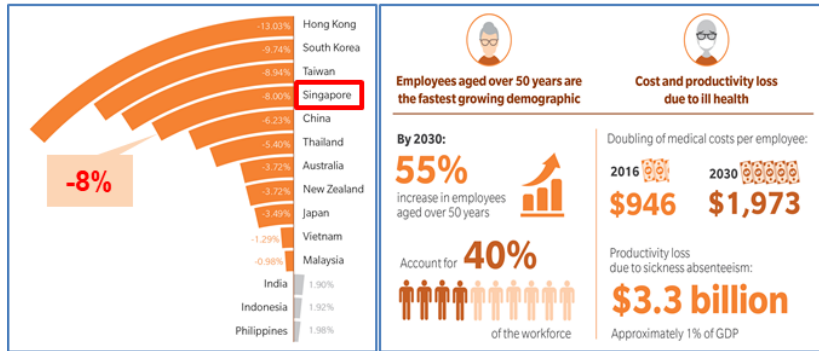


# Over 120,000 New Service Robots Were Installed Worldwide in 2021; 37% increase over 2020

- **Transport and Logistics** account for over **40%** of the new installation
- New vendors/robots are entering the market:
  - More choices, newer technologies, better innovations
  - Could be challenging for end-users: compatibility, interoperability, support, future upgrade
- RMF could help simplify the deployment and better manage heterogenous products, allowing users the flexibility to choose most suitable products



## Changes in Singapore working population (2015-2030)



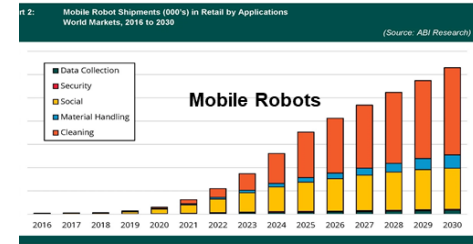
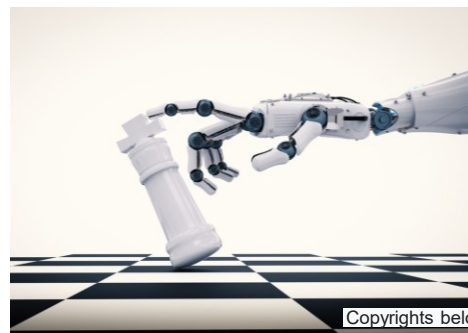
300,000 migrant workers in construction (pre-covid)  
<https://m.facebook.com/SingaporeMatters/photos/is-singapore-prepared-to-have-2500-babies-born-here-every-year-grow-up-to-be-con/2949501531802887/>

## Challenges and Opportunities

- Ageing population
- Heavy-reliance on foreign workers (construction, healthcare, hospitality, cleaning, security, etc.)
- Supply chain disruption
- Geopolitical tensions
- Persistent Covid

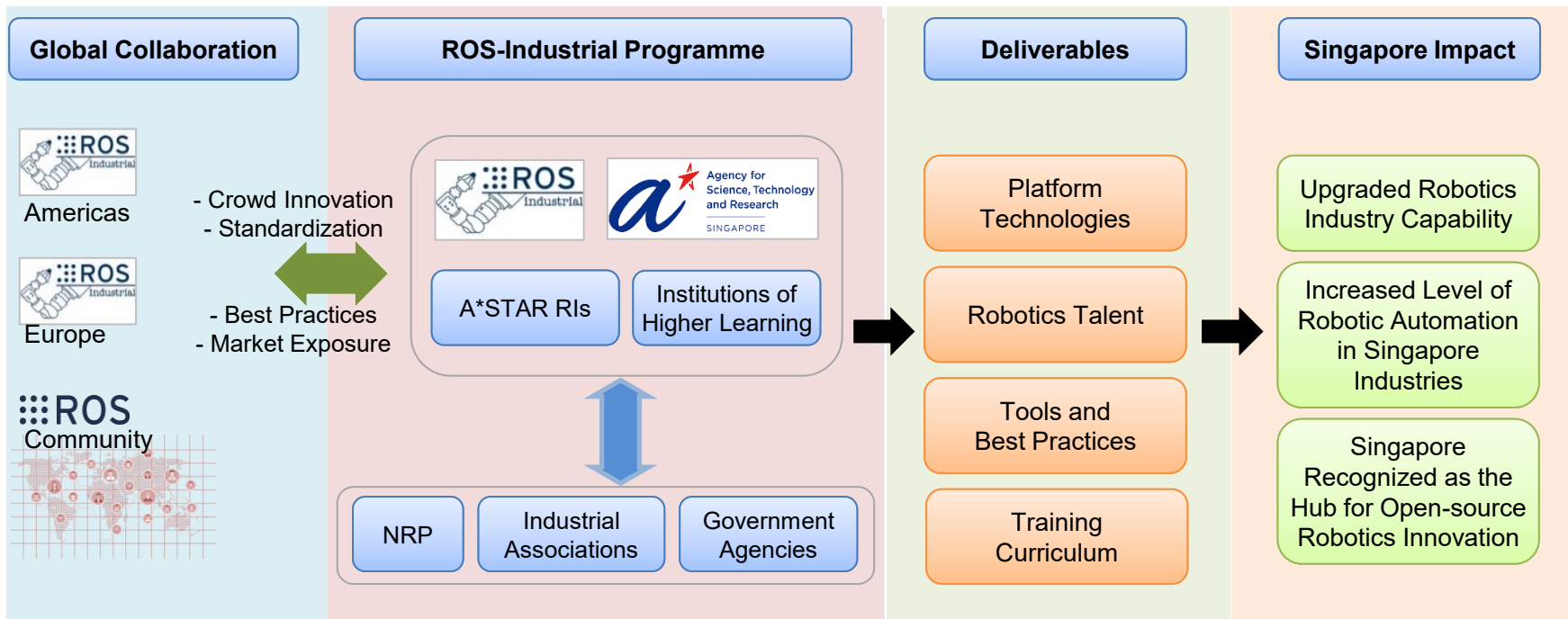
# Challenges and Opportunities

- Manufacturing 2030 vision
- “30 by 30” food security goal
- Growth in online shopping, e-commerce
- Greener and more sustainable Singapore
- Advancement and democratization of robotics technologies
- Talent Development





# Strengthen Singapore Open Innovation in Robotics & Automation with ROS-I Consortium Asia Pacific



**Capability Multiplier:** A platform approach to technology and capability development to drive Singapore robotics ecosystem growth; and to establish Singapore as a regional R&D hub for open-source robotics innovation



# The *Comics* of Future Robots: Towards Full Autonomy



## Collaborative

Robot swarm, robot-human, mutual-understanding, consultative decision and execution



## Open-sourced

ROS, ROS-I, crowd innovation, community learning



## Mobile

Safety & performance, natural navigation, co-localization, all-weather, speed and safety, mobile fleets



## Intelligent

Vision, audio, tactile, learning, self- and ambience-awareness, autonomous learning and decision-making



## Connected

Ubiquitous connectivity, interoperability, Internet-of-robot-things, digital twinning, industrial metaverse (physical-virtual-physical), cloud-empowered, 5G/6G



## Simplified

Low-code/No-code, voice-programming, graphics-programming, learning by demo, AR/VR



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# ADVANCED ROS2-NATIVE PLATFORM TECHNOLOGIES FOR CROSS-SECTORIAL ROBOTICS ADOPTION

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# Newly Lunched Program to Develop ROS2-native Platform Technologies to Drive Multi-sector Robotics Adoption



## Eco-system Collaborative R&D

- Lower the technology adoption barrier
- Increase the success rate of robotics deployment
- Uplift capabilities of the robotics ecosystem

## Strong Support from both Supply and Demand Sides



## Key Work-streams

ROS 2

### Technologies for Robotic Performance Optimization

- Reduce prototype iterations by testing their robotic systems early for more advanced use cases and conditions.
- Enable end users to evaluate the suitability of robot deployments prior to deployment to avoid excessive ramp-up times or commissioning
- Achieve full visibility, de-bottlenecking, and system-level performance optimization of RMF deployments



### Technologies for High Performance Safe Robot Operations

- Enable robots to perform their tasks in the vicinity of humans and obstacles
- Enable robots to perform tasks more quickly in areas with more restricted movement
- Improve performance: from stop-and-go to manipulate-on-the-move



### Technologies for Auto-configurable Generic Robotic Workspaces

- Production systems can be setup in significantly shorter time with automatic workspace high-fidelity creation
- Self-correction reduces downtime or quality issues over time
- Lower TCO using multiple low-cost sensor improvement for higher precision



### Technologies for ROS 2 Native Robot Controller

- ROS2-based controller customizable for any type of X-DOF robotic applications and robots/peripherals





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# THANK YOU

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