Singapore Institute of Manufacturing Technology

SIMTech

INNOVATION & TECHNOLOGY CONFERENCE 2023

Innovation Through Advanced Manufacturing Research & Technologies

Digitalisation Innovation
Day 2, 27 July

INNOVATION & TECHNOLOGY
CONFERENCE 2023
Innovation Through Advanced Manufacturing
Research & Technologies

Driving Digitalisation, Automation & Value Chain Innovation in Singapore's Manufacturing Industry

Mr Rick Yeo
Director
Manufacturing Productivity Technology Centre,
SIMTech

Singapore Manufacturing Sectors

SINGAPORE ADVANCED MANUFACTURING

"Singapore Manufacturing 2030 vision" is a 10-year plan for Singapore manufacturing to grow 50% by 2030.

- The **manufacturing sector** contributes about **21 per cent** of the total GDP, hiring about **450,000 workers**, or around **12 per cent of the workforce**.
- 'Singapore needs to **innovate** in order to raise the global competitiveness of its manufacturing sector, so that more Singaporeans is keen to work in the sector as the **proportion of low-wage foreign workers is reduced'** Mr Chan said.
- To remain competitive and continue its growth trajectory in **Industry 4.0,** the manufacturing sector has to embrace **digitalization and automation Innovation** in the industry and increasing output through technology adoption.
- **Advanced manufacturing**, **artificial intelligence, and internet of things (IoT)** are three important transformative trends that are expected to power the manufacturing sector forward.

10-year plan for Singapore manufacturing to grow 50% by 2030: Chan Chun Sing | The Straits Times

Driving Digitalization , Automation and Value Chain Innovation in Singapore Manufacturing Industry

SIMTech Manufacturing Productivity Technology Centre (MPTC) was launched in 2011

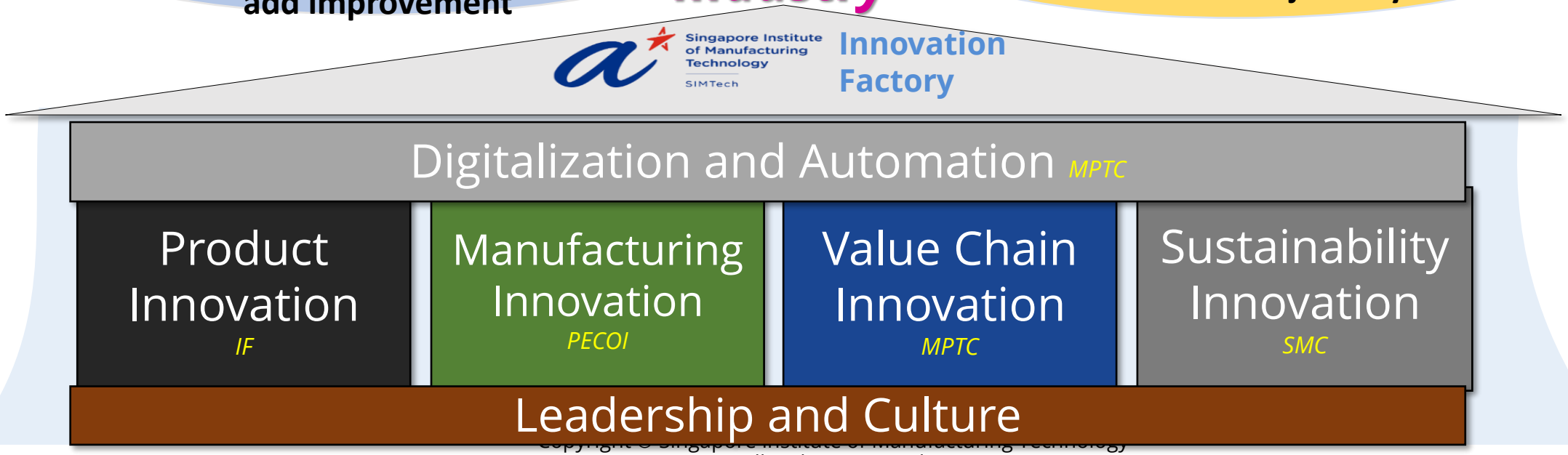
- Completed > 4099 TAP projects
- Helped > 1000 SME to improve their productivity by > 20%

Mission

To spur industries towards innovating with digital & automation technologies to drive continuous productivity & value add improvement

Vision

The innovation partner of industry for their Automation , Digitalization and Value Chain transformation journeys



CREATING GROWTH, ENHANCING LIVES

SIMTech's Technologies for SMART Manufacturing & Beyond

CREATING GROWTH, ENHANCING LIVES

Towards Smarter, Greener & More Connected Manufacturing

Application Areas

Smart Factory
(NPI, Line Systemisation & Digitalisation, Data & Infrastructure Mgmt, Vertical Integration)

Robust Shopfloor
(Smart & Predictive Tracking & Execution, Predictive/Prescriptive Maintenance & Quality)

Resilient Enterprise Value Chain
(Adaptive multi-resource real-time Planning & Scheduling, Predictive Decision Support, Operations Track & Trace, Value-chain platforms)

Digital & Automation Transformation

Key Competencies and Strengths

Connectivity
(IIoT, Brownfield, Cyber-Physical)

E2E Immutability
(Tracking, Traceability, Smart Contracts)

Simulation & Modelling
(Event-driven, large-scale)

Machine Learning
(Imbalanced/Few Shot, Semi-/ Unsupervised/Online)

Optimisation
(Data-driven multi-objective transfer, Robust)

Automation
(Robotics ,Optics Mechatronics, Image processing)

Operations Research & Software / System (Micro-services, UI/UX, Integration, PLC, Cyber-security)

SIMTech

Adopt Digitalization & Automation Innovation Approach towards I4.0

CREATING GROWTH, ENHANCING LIVES

Model factory@SIMTech

Our Approach

Helping industry to kick-start i4.0 implementation with Public-Private Partnership and Whole of Government approach

Find Partners & Technologies

SIMTech Technologies

- Offers an array of tested and modular solutions for companies to adopt easily in a cost-effective manner

Technology Partners

- To help you scale-up or go international, we have our technology partners

Digitalization , Automation & Value Chain Innovation - IDEA Framework

CREATING GROWTH, ENHANCING LIVES

Identification

Infuse knowledge via **Training & Road mapping**

- Create a systematic approach for **digital & automation and value chain** transformation road mapping
- **Identify** company **pain-point,** digital and automation **technology GAP** to drive Company growth

Development

Develop digital, automation & value chain solution pathway via various **CIP programs.**

- **Develop** customized solutions pathway
- Carry out tech assessment
- Analysis project costing, ROI and Support company EDG grant application

Engineering

Engineer solutions pathway **implementation** to produce desired results

- **Engineer** the customized solution **implementation**
- Review cost benefit analysis after implementation

Application

Accelerate **application adoption** of SIMTech Technology solutions via **System Integrators**.

- Update industry with Latest technology & application using **Model Factory 2.0**
- Focus on applying **data analytics & AI** in the next phase of technology adoption

Digital Transformation Innovation ™

CIP to drive Tech solution pathway Development

Fong's Engineering & Manufacturing

Identifying key problem statement & evaluating various digital & automation solutions via skills Future Approved Hands-On Training Courses (*Learn-Practice-Implement*)

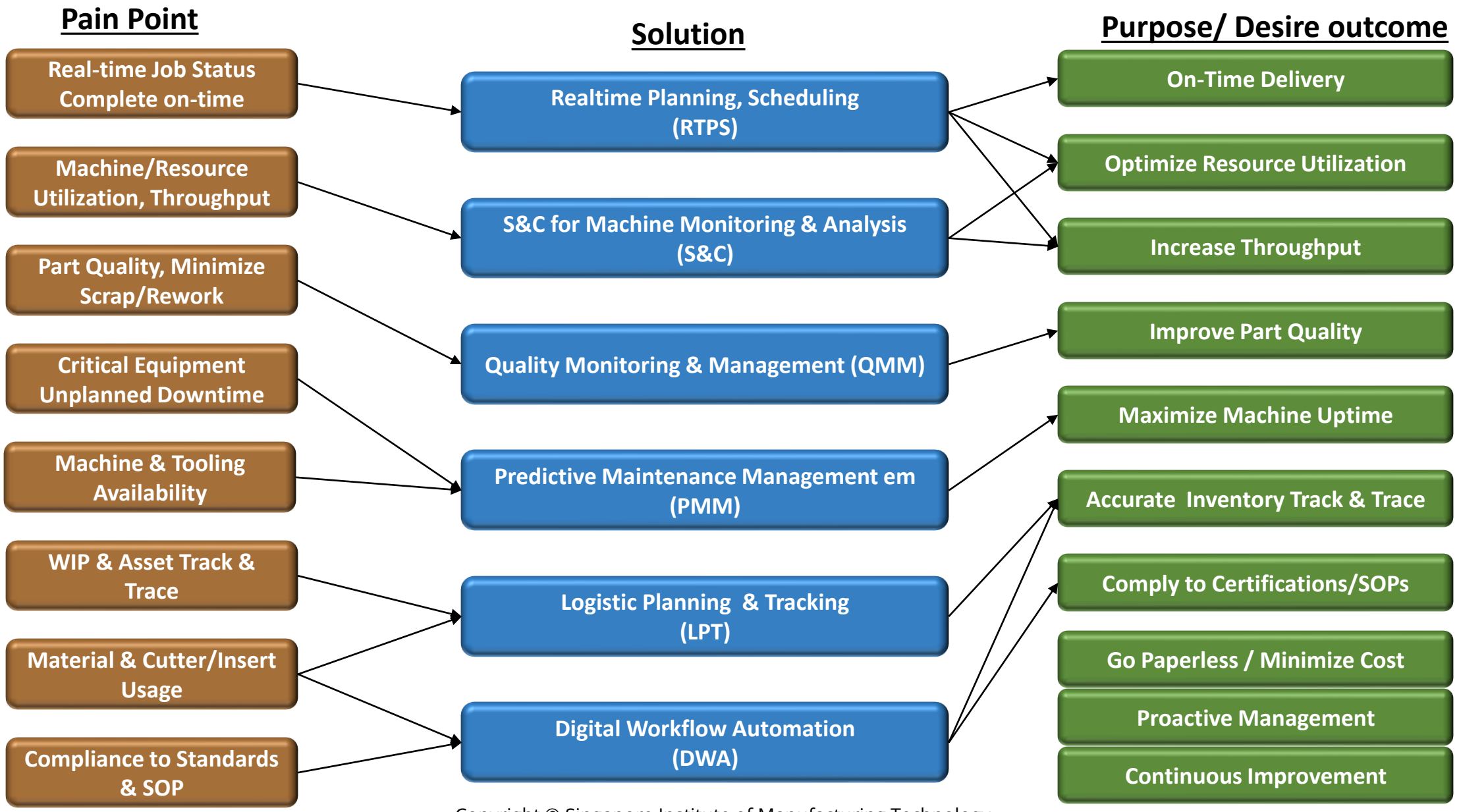
#	Course Title	Full Course Fee / pax ($)	Course Duration (hour)	Technological Areas
1	OMNI Programme	6,000	40	Operations Innovation
2	Digital Transformation & Innovation (CU1 / CU2)	6,000	40	
3	Production Planning & Scheduling	2,400	24	Smart Manufacturing
4	Factory Performance Improvement through Operations Modelling and Simulation	4,000	40	
5	Connectivity for Visibility and Decision Making in Smart Factories	2,400	24	
6	Manpower Scheduling	1,600	16	
7	Industrial Artificial Intelligence for Manufacturing	4,000	40	
8	Implement Manufacturing Data Mining Techniques	4,000	40	Robust shopfloor
9	Data-driven Predictive Maintenance and Optimal Plan	4,000	40	
10	Real-time OEE for Industry 4.0	5,000	40	
11	Improve Quality Monitoring and Management Through Digitalisation	1,600	16	
12	Machine Learning for Supply Chain Analytics & Operations Management	5,000	40	Resilient supply chain
13	Inventory Management for Smart Manufacturing & Services	4,000	40	
16	Digitalisation of business process workflow	1,600	16	
17	Apply Robotics for Manufacturing Automation	4,000	42	Automation
18	Automation Components & Systems	4,000	42	
19	Control in Automation Systems	4,000	42	
20	Automation Design & Simulation	4,000	42	
21	Project Management	4,000	30	

Skill Future Funding is available for All Singaporean or PR in both SME, LLE and MNC

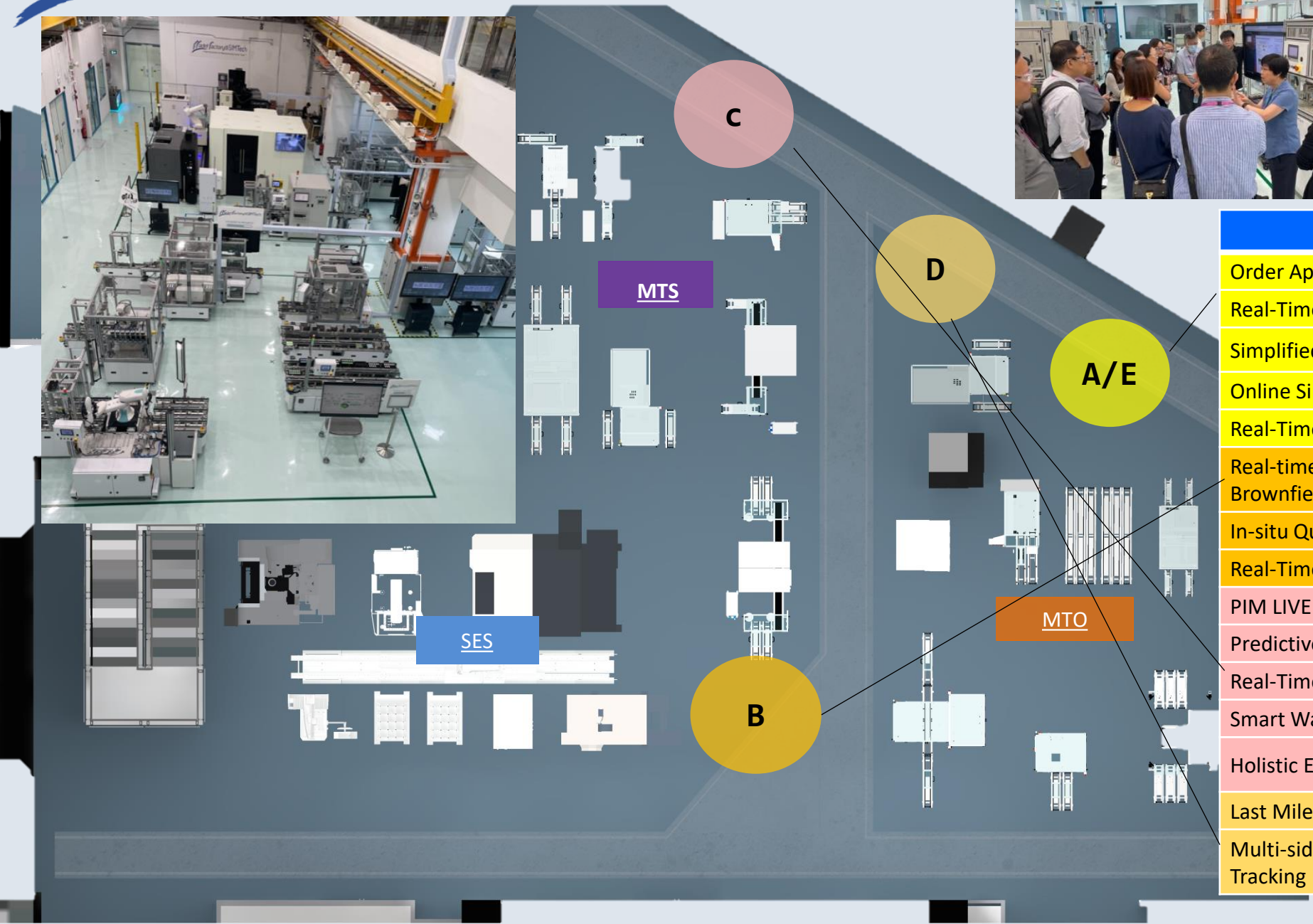
Funding quantum is between 70% to 90%

CREATING GROWTH, ENHANCING LIVES

Identifying key Pain Point and evaluating digital and automation solutions



Showcase of Various SIMTech Digital Technology Solution



Demonstrator	Scenario	Area
Order App	Integrated CPPS Disruption - Raw Material Shortage	A
Real-Time Scheduling		
Simplified Inventory Planning		
Online Simulation	Pervasive Nerve Centre	E
Real-Time Dashboard		
Real-time OEE Brownfield Connectivity	Integrated CPPS Disruption - Quality Prediction	B
In-situ Quality Management		
Real-Time Scheduling		
PIM LIVE Video	Integrated CPPS Disruption - PIM	C
Predictive Maintenance		
Real-Time Scheduling		
Smart Waste Management	Eco-Efficient Resource Management	
Holistic Energy Management		
Last Mile Logistics	Timely Supply Chain	D
Multi-side Order Allocation and Tracking		

MPTC Major Industry Initiatives in CY23

Driving Industry Digital, Automation & Value Chain Innovation via CIP programs

MPTC Manufacturing Productivity Technology Centre
Enhancing Manufacturing Productivity

CREATING GROWTH, ENHANCING LIVES

Broad engagement through - CIP program

(i) Platform Solution for SMEs & LLE 1

(ii) Develop IP/solution & license to multiple SMEs 1 2

- Automation of manual process via Robotic Manipulator 1
- Automate inspection via Intelligent Optical Inspection 1
- Enhancing SME Mfg capability via CPPS digital solutions 2
- Traction Motor & Drive Supply Chain Development 3
- Driving value chain innovation in SME via supply chain digital solutions 3

1. Uplifting SMEs' Competitiveness via Automation innovation
2. Advancing Manufacturing Research – Digital Innovation
3. Enhancing Local Manufacturing Ecosystem via Value chain innovation

Deep Engagement through Joint-Labs & Public Sector Engagements

Joint program

RACER MEDICAL DEVICE
Racer Technology Pte Ltd

Research Collaboration Agreement RCA

ong.

Alcon

Development of a b2b aggregator platform for SMEs

Joint lab

KoolLogix

PHILIPS

DOU YEE TECHNOLOGIES
ENGINEERED CONSISTENCY

for Industry

Local Supply Chain Development for Electric Drive Train
CIP on E-TraM OTP – Value Chain Innovation

CREATING GROWTH, ENHANCING LIVES

Objective:

- Develop **local Eco-system** for **Electric Drive Train** to support Singapore Electrification industry
- Drive **IP Creation in electric Drive Train** Technology in area of **Power Density, Energy Efficiency & Thermal Management** to enable Singapore to be R&D Hub for Drive Train technology

Value Capture:

- "Asia-Pacific E- Scooter is expected to grow 3X in next 7 years to reach USD 1905.25 Billion by 2027.
- Develop **local Eco-system for Electric Drive Train** to support the rapid growth of 2-3 wheelers in Asia
- Develop **capability, talent & business opportunity in Electric Drive train** for local Industry

Timeline :

2022: Secure IAF-PP Funding to support 23 researchers from A*STAR, & other IHL to develop IPs in E-TraM

2023: Launch CIP on E-Tram OTP to grow local eco-system

2024: Joint-lab with Key Partners

CIP Launched with 10 Key partners

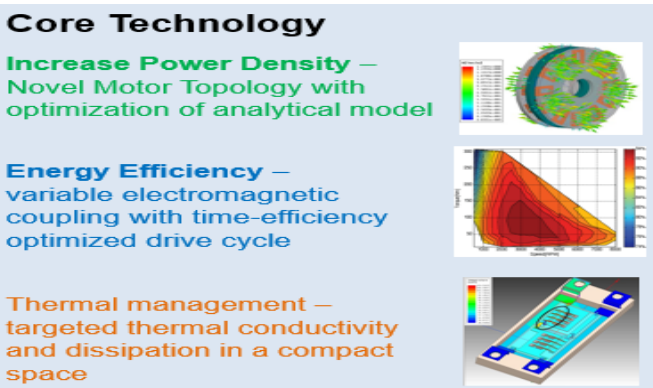
2 & 3 Wheels EV

ION MOBILITY GIKEN

Other form of EV

Akribis

IAF-PP Funding to develop IP in Core Tech



Demand Driver

Identifies interest in technology

Provides solution to customer

Traction Motor / Electromagnetic Actuator

Motor Control Unit (MCU) Vehicular Control Unit (VCU)

Drive Electronics Power Converter/Inverter

Traction motor & components

Nidec Akribis MMI NEO SANWA INTEC PROTERIAL

Drive Electronics & MCU

BorgWarner Infineon

Upgrades capabilities

Technology Provider

Singapore Institute of Manufacturing Technology SIMTech

Electric Drive Train component supplier

Drive I4.0 Transformation via Cyber Physical Production System (CPPS) - Digitalization Innovation CIP program

MPTC Manufacturing Productivity Technology Centre
Enhancing Manufacturing Productivity

CREATING GROWTH, ENHANCING LIVES

Key Technology

- Industry Lack of Integrated & large-scale decision support making capability for inventory planning, production scheduling and resource planning to improve productivity , reduce lead time and enhanced quality
- SIMTech has acquired Govt Grant to develop intelligent and contextual decision support capabilities for Cyber-Physical Production System (CPPS)

Initiative Objective:

- Drive **adoption of CPPS Technology** to increase productivity & capability of Singapore manufacturing industry to intensify I4.0 Transformation
- **Attract & train talents** via knowledge transfer in I4.0 Technologies

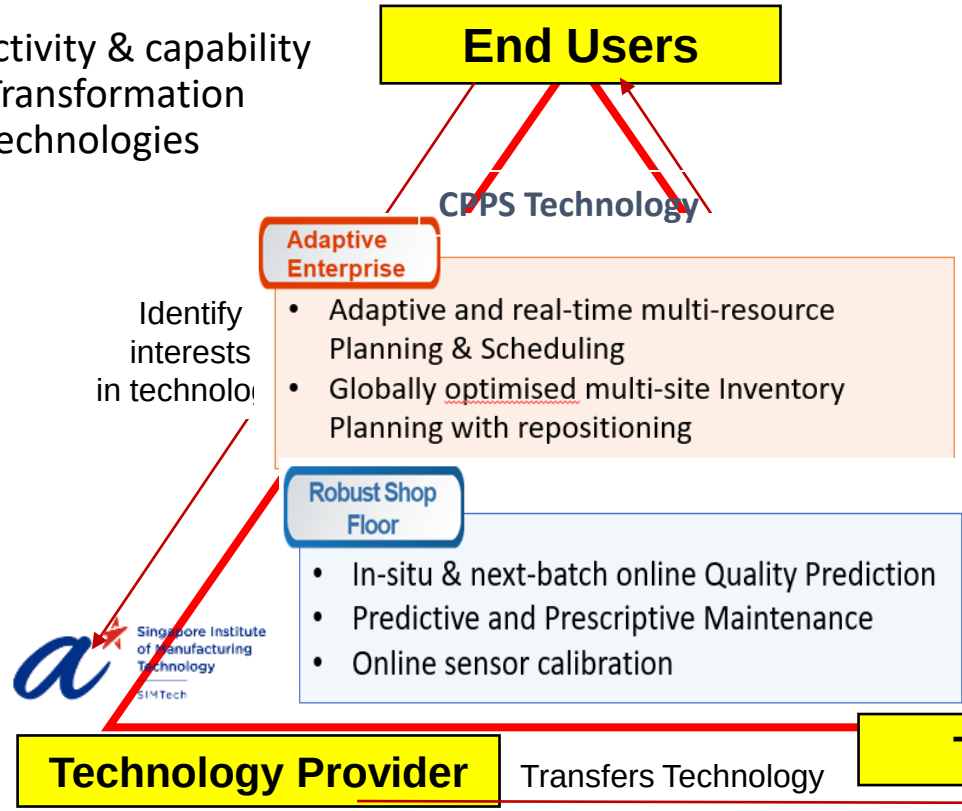
Value Capture:

- ↑ People I4.0 skill of 30% - 50%
- ↑ Job creation & increase operations of ≥ 20%
- ↑ Productivity gains of ≥ 20%

Timeline:

Phase 1: **Training program** to Identify and address Industry pain-points – Quality, Leadtime, cost
Phase 2: Carry out POC for CPPS technology via MF
Phase 3: Drive CPPS adoption via industry projects

Agilent Technologies, Alcon, ASMPT enabling the digital world, Fong's, BD, muRata Innovator in Electronics, PHILIPS, ST Engineering Aerospace, Dou Yee Technologies Engineered Consistency, ACOT Precision Engineering Pte Ltd, Flo-Line Hydraulics, ST Engineering Aerospace, Givaudan, Eastmen Engineering & Trading Pte Ltd, Shimano, ST Aerospace, ASM Pacific Technology



System Integrators: INNO A.R.K, TUNITY, iPlast 4.0, AATO, ASTrio Pte Ltd, SOFTGRID

SPETA

Improve Industry Value Chain Resilience via Supply Chain Digital Solution – Drive Value Chain Innovation

MPTC Manufacturing Productivity Technology Centre
Enhancing Manufacturing Productivity

CREATING GROWTH, ENHANCING LIVES

Initiative Objective:

- Improve **Enterprise Value Chain Resilience** via **Adaptive multi-resource real-time Planning & Scheduling, Predictive Decision Support, Operations Track & Trace, Value-chain platforms**
- Enhance **integration of supply chain digital solutions** in Local companies to improve their **operations, planning and monitoring** capabilities across their **supply chain**

Value Capture:

- ↑ Productivity ≥ 20% in companies supply chain management
- Building foundation for Digital Transformation of companies across their supply Chain

Timeline:

CIP program to drive SC Digital tech adoption

. Phase 1: Introduce effective master classes as POC

. Phase 3: Develop SI to drive adoption

. Phase 3: Customize digital pathway for various industry

Logistic Industry

Food Manufacturing

End-users

Seminar for Digitalization of Logistics/Wholesale/Food industry on 7th Aug 23

Identify interests in technology

Provides solution to customer

Last mile logistic

Logistic Tracking Planning

Digital Workflow - End to End order fulfilment

Technology Provider

Tech Partners &TAC

Singapore Institute of Manufacturing Technology
SIMTech

SFMA
新加坡食品厂商联合会
Singapore Food Manufacturers' Association

TUNITY

AATO

INNO A.R.K

SINGAPORE LOGISTICS ASSOCIATION

CIP on Robotic Manipulation for Automation Innovation

(To replace manual process such as paint removal, polishing and deburring)

MPTC Manufacturing Productivity Technology Centre
Enhancing Manufacturing Productivity

CREATING GROWTH, ENHANCING LIVES

Objective:

- Develop **automatic robotic manipulation** solution based on force-controlled end-effector platform technology.
- **Automate** low-value-adding manual surface finishing processes, such as polishing, deburring, scarfing, with **automatic robotic manipulation solution**

Value Capture:

Enable Industry to acquire capabilities to robotic manipulation for auto deburring and polishing process.

- ↑ Productivity ≥ 30% in companies through adoption of SIMTech Robotic manipulation to replace manual processes

Activities:

Phase 1: **uplift knowledge** in Robotic manipulation to replace manual surface finishing via training

Phase 2: Initiate **Tech evaluation** via project with SIMTech with various government grant and support

Phase 3: Drive **full tech implementation** via Projects
Or joint lab with SIMTech & SI

MedTech Aerospace Precision Eng

Fong's · Pratt & Whitney · GE Aerospace · ST Aerospace · SAM · ST Engineering · SHINE PRECISION · SPI · TQC Precision Engineering Pte Ltd Your Engineering Needs Made Possible

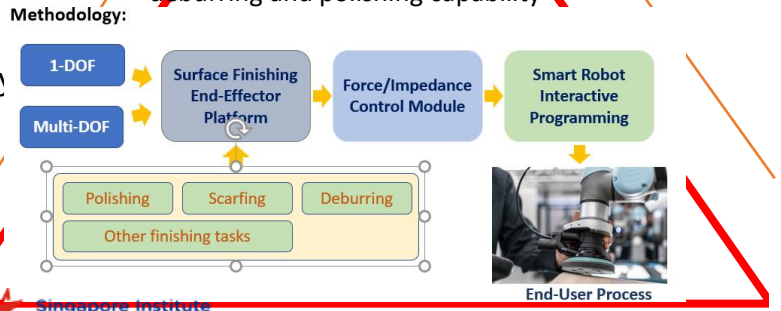
Demand Driver

INNOWAVETECH Powered by AI, Driven by Innovation

End Effector and toolpath for Auto deburring and polishing capability

Provide Solutions to customers

Identify interests in technology



Singapore Institute of Manufacturing Technology
SIMTech

TDS Technology Group · CARESTOR · ISDNHoldings LIMITED · FLEXSPEED TECHNOLOGY PTE LTD Solutions Beyond Expectations

Technology Provider

Transfers technology / Upgrades capabilities

System Integrator (SI)

CIP on Automated Optical & X-ray Inspection System – Automation Innovation (to replace low value- add manual inspection in the industry)

MPTC Manufacturing Productivity Technology Centre
Enhancing Manufacturing Productivity

CREATING GROWTH, ENHANCING LIVES

Objective:

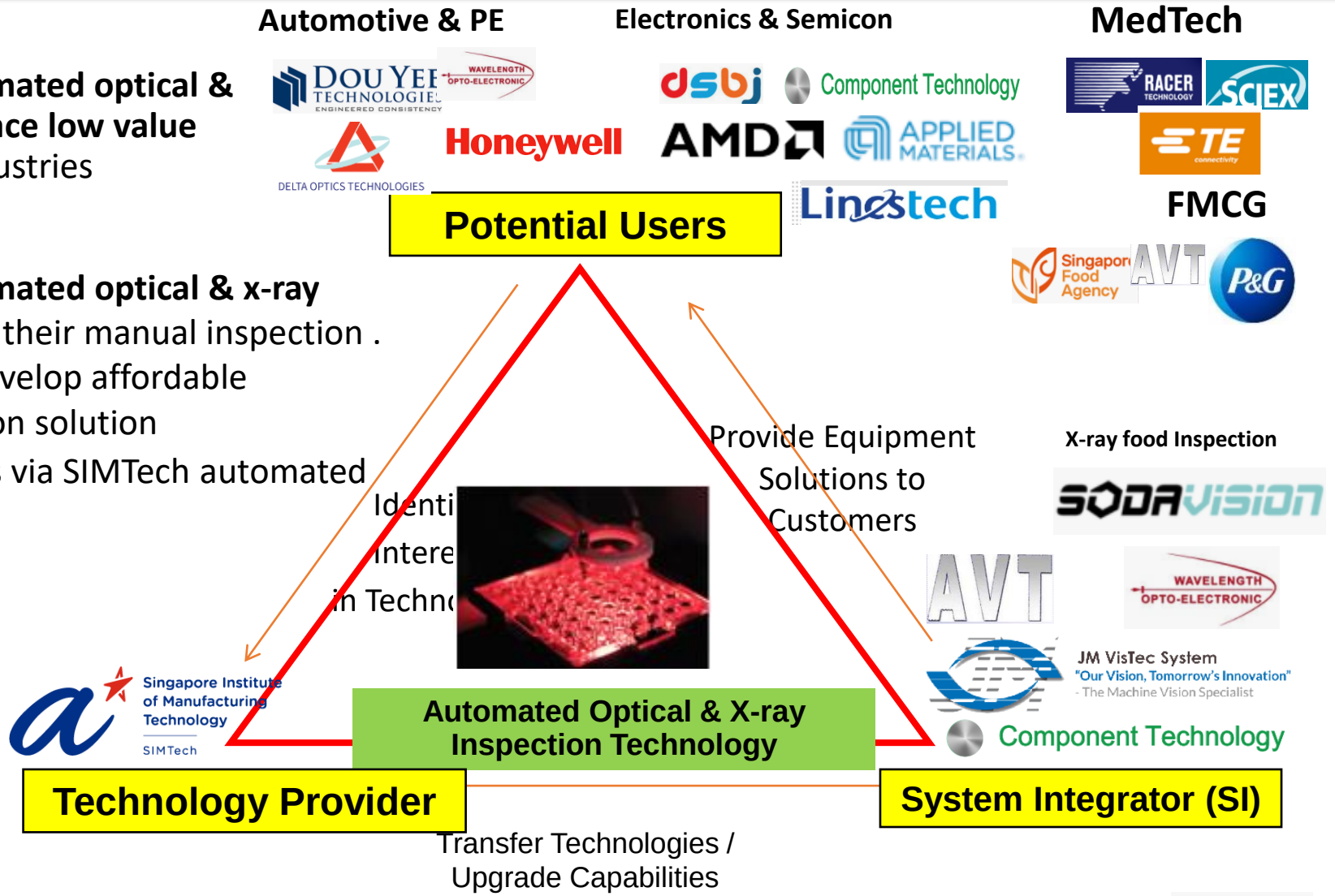
To develop key technologies for **automated optical & x-ray inspection** technologies t**o replace low value add manual inspection** in various industries

Value Capture:

- Develop industry capability in **automated optical & x-ray inspection technologies**, to replace their manual inspection .
- Work with **System Integrators** to develop affordable automated optical & x-ray inspection solution
- ↑ Productivity ≥ 30% in companies via SIMTech automated optical & x-ray inspection solution

Activities:

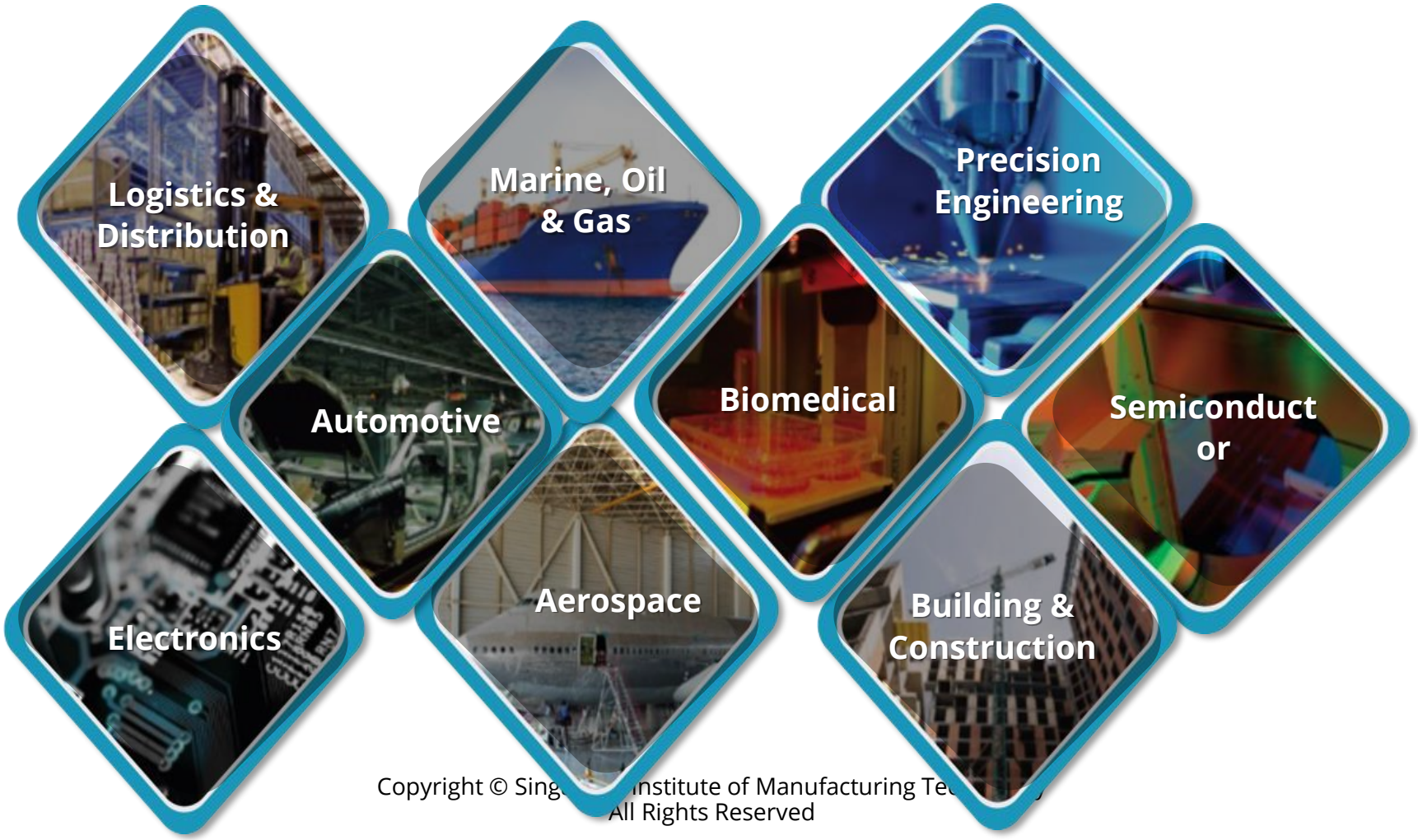
Phase 1: Uplift knowledge & tech assessment via training
Phase 2: Further evaluate tech via feasibility study .
Phase 3: Full Implementation via SIMTech and SI with Grant



Conclusion

SIMTech has been your R&D and Technology Partner for the last 30 years

SIMTech MPTC is committed to be your Advanced Manufacturing Partner to Drive Digital , Automation and Value chain innovation in Various sector of Singapore Mfg



CREATING GROWTH, ENHANCING LIVES

CREATING GROWTH, ENHANCING LIVES

Singapore Institute of Manufacturing Technology
SIMTech

THANK YOU

www.a-star.edu.sg

Rick Yeo – MPTC
Email : Rickyeo@simtech.a-star.edu.sg
Mobile : 96688473

for Industry

INNOVATION & TECHNOLOGY
CONFERENCE 2023
Innovation Through Advanced Manufacturing
Research & Technologies

Keynote for Digital Manufacturing:
Get Set for the Next Paradigm Shift in Manufacturing – Industry 5.0 & Beyond

Dr Tan Puay Siew
R&D Director
Digital Manufacturing Division,
SIMTech

CONTENT

Fast Changing Environment

- Changing Manufacturing Landscape
- Technology & Trend Push

Key Focus Areas → **Autonomous Manufacturing**

Getting There (Digital)

- Smart Manufacturing
- Baby Step: Cyber-Physical Production System
- Next Step: Distributed Smart Value Chain

What is NEXT?

- Model Factory
- Call to Action

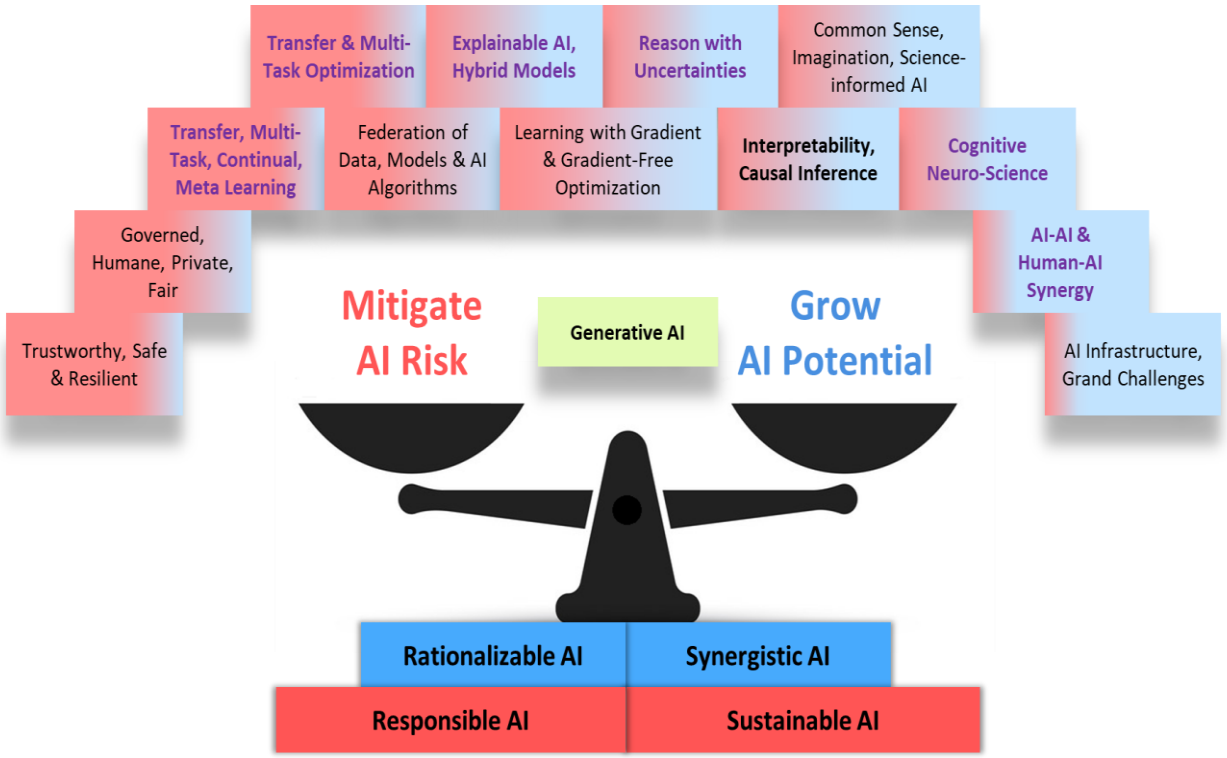
Changing Manufacturing Landscape

- Addressing new needs of the manufacturing industry

Trend	Changing Paradigm	Consequent Focus
 High Demand Fluctuations & Disruptions needing ↑ Resilience	Single Factory → Network of Factories	Towards **SMARTER**, **GREENER** and **More Connected** Manufacturing
 ↑ Responsiveness to customers & customisation needs	Product Customisation Postponement to as near to customer as possible (last-mile production customisation)	
 Rise of Sustainability	Eco-efficient → Circular Mfg towards Net-Zero Mfg	
 **↑ Value-add of SG companies**	**Manufacture to specifications → Product/Design Owners**	

Technology & Trend Push

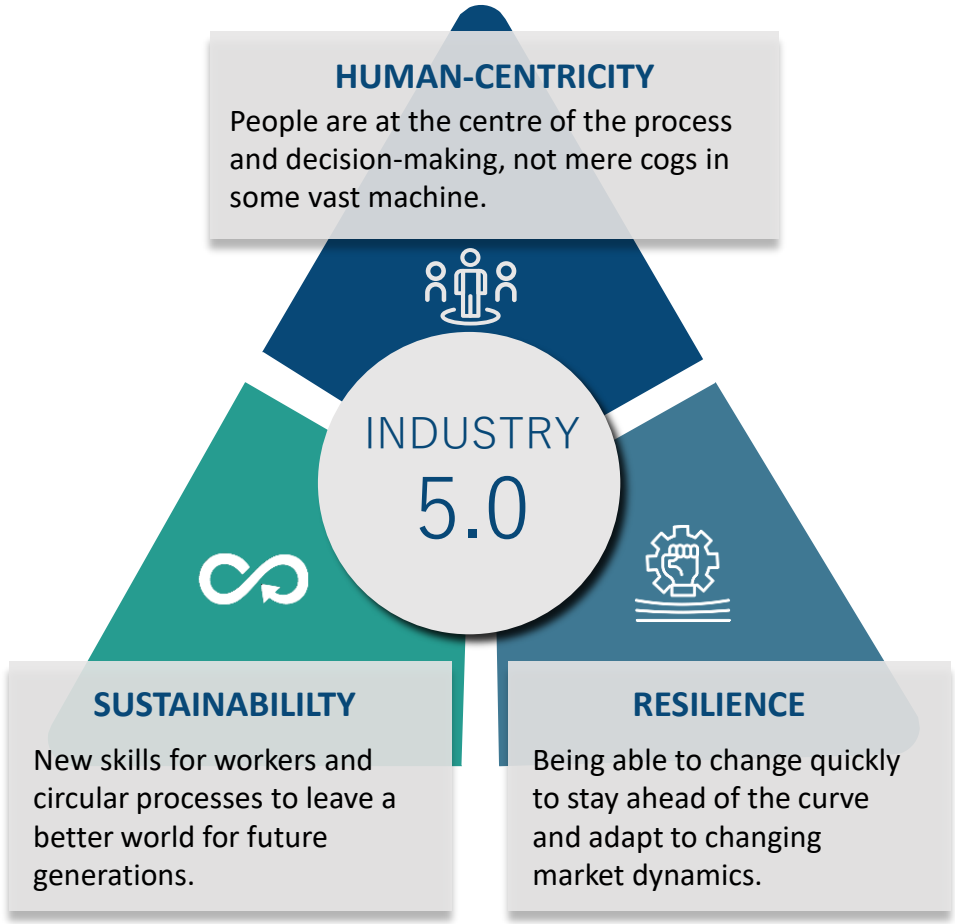
Rise of AI



Adapted From: New Foundations of AI, Ong YS, 2022

Industry 5.0

Industry 4.0 +++



Adapted From: Proactioninternal.com, Raiche, 2022

Strategic & Inter-related R&D Themes To Support Singapore Manufacturing 2030 & RIE 2025

Smarter, Greener & More Connected Manufacturing

Manufacturing 2030 Vision: Singapore's manufacturing sector to grow by 50 per cent of S$106 billion value as of 2021

Advanced Manufacturing Process

- Hybrid / Heterogenous material manufacturing
- 4D metamorphic manufacturing
- Enabling manufacturing processes for Green H_2 Economy and MedTech

Autonomous Manufacturing

Lights-Out Manufacturing with total autonomic capabilities across

- **System**
- **Automation & Verification**
- **Process**

Supported by Connectivity and AI

RIE 2025 DOMAINS

Resilient Value Chain

- Manufacturing resilience
- Distributed & circular value / supply chain
- End-to-end continuous logistics
- First- / last-mile and reverse logistics
- Digital workflow automation

Net Zero Manufacturing

- Life Cycle Management for Decarbonisation & Circular Economy
- Resource-efficient Manufacturing
- Smart Remanufacturing
- Design for Life Cycle (Sustainability)
- Industrial Symbiosis

Future of Manufacturing

with **Autonomous Manufacturing**

Link to video:https://youtu.be/hiJFsEgfOgo

Research Roadmap of Digital Manufacturing

Autonomous Manufacturing

2023

2022

2014

Holistic & Autonomous Response

Holistic & Collaborative DS, with circular economy considerations
Autonomous self-learning systems

Collaborative Cognition

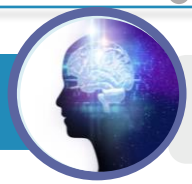
Distributed & Fast Intelligent Response

Fast & Robust Intelligence, with Decentralised DS

Decentralised Smart Capabilities

Contextual & Intelligent Response

Scalable CPPS
AI-Enabled Intelligent DS



Smart Capabilities

Timely Response

Dashboarding
Real-Time Feedback
Decision Support (DS)

Management (By Exception)

Correlations
Understand Context, Conditions

Insights

Sensing - Enabling Visibility

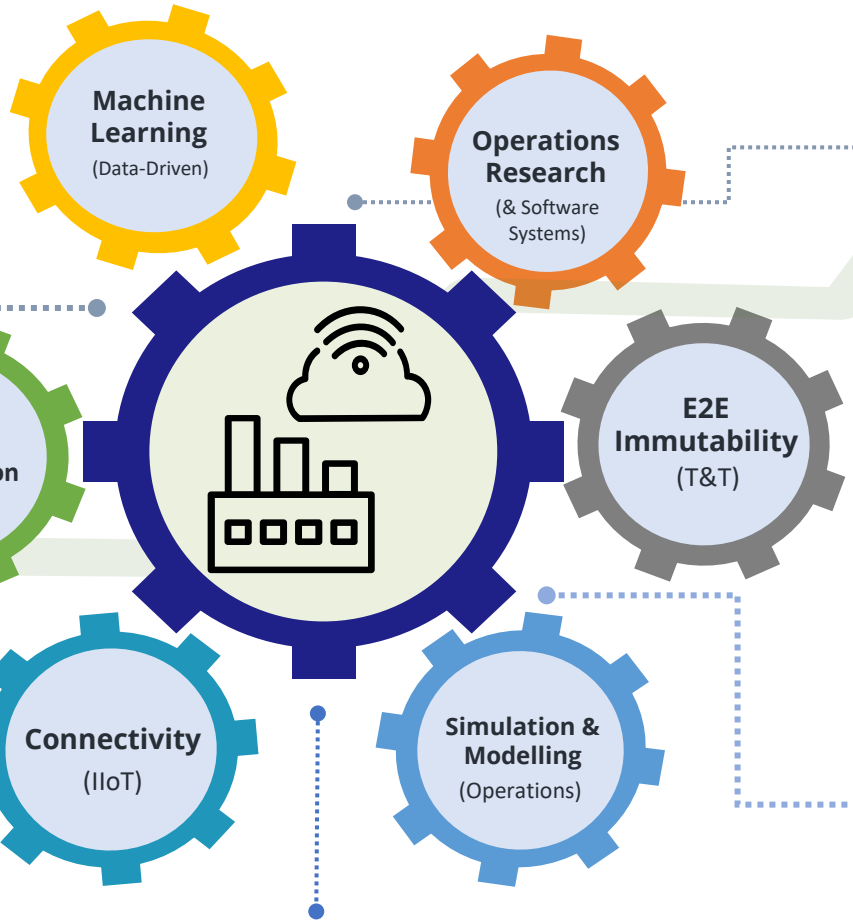
IoT Enabled
(Brownfield/Greenfield)
Business Process
Automation (RPA, OCR etc.)

Digitalisation & Sensorisation

SMART Manufacturing

Towards SMARTER, GREENER and MORE CONNECTED Manufacturing

Autonomous Manufacturing



Robust Shopfloor

- Predictive n Prescriptive Maintenance & Quality
- Smart Tracking & Management

Resilient Enterprise Value Chain

- Adaptive multi-resource real-time Planning & Scheduling
- Operations Track & Trace
- Manufacturing Control Tower™ & Value-chain Control Tower™
- AR/VR for Industrial applications

Reconfigurable Factory

- Reconfigurable Line/Equipment
- First Article/ NPI
- Fast/HA Connectivity

Key Competency and Strengths

Summary of Digital Capabilities in SIMTech

Shopfloor

Robust Shopfloor

- Predictive Quality Monitoring & Management (PQM)
- Predictive Maintenance Management (PMM)
- Reconfigurable Operation Control & Execution (ROCE)

Smart Factory

Reconfigurable Smart Factory

- Smart Engineering System (SES)
- Immersive Digital Twin (IDT)
- Industrial AR-Guided Operation
- Tools and Enablers for Reliable 5G Industrial IoT Applications

Enterprise VC

Resilient Enterprise Value Chain

- Real-Time Planning & Scheduling (RPS) System
- Manpower Scheduling System (MSS)
- Inventory Analytics and Planning (IAP) System
- Operations Simulation and Optimisation (OSO)
- Real-Time Dashboard for MCT (RTD)
- Digital Workflow Automation (DWA)
- Logistics Planning and Tracking System (LPT)

LPI-based Programmes

Learn, Practice & Implement

- Digital Leadership
- Digital Transformation & Innovation™ (DTI™)
- Operations Management Innovation™ (OMNI™)
- Lean
- Platform and DevSecOps Engineering (PDE)
- Manufacturing Data Mining

& many more

Research Roadmap of Digital Manufacturing

Autonomous Manufacturing

2023

2022

2014

Holistic & Autonomous Response

Holistic & Collaborative DS, with circular economy considerations
Autonomous self-learning systems

Collaborative Cognition

Distributed & Fast Intelligent Response

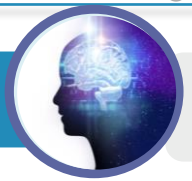
Fast & Robust Intelligence, with Decentralised DS

Decentralised Smart Capabilities

Contextual & Intelligent Response

CPPS

Scalable CPPS
AI-Enabled Intelligent DS



Smart Capabilities

Timely Response

Dashboarding
Real-Time Feedback
Decision Support (DS)

Management (By Exception)

Correlations
Understand Context, Conditions

Insights

Sensing - Enabling Visibility

IoT Enabled
(Brownfield/Greenfield)
Business Process
Automation (RPA, OCR etc.)

Digitalisation & Sensorisation

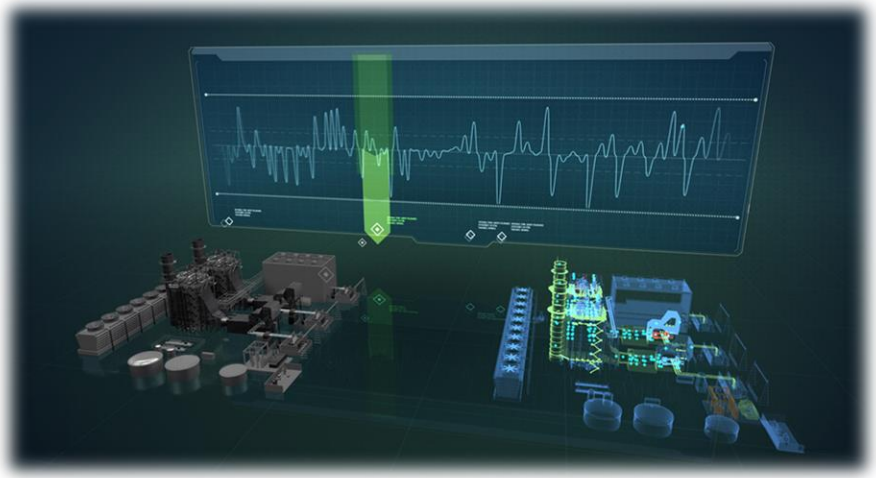
Baby STEP: Addressing Key Industry UNMET Needs

What is CPPS?

- **Operational** Digital Twin of the **Production** environment
- A Cyber representation with *real-time connectivity* of the physical world (operations incl. logistics, machines, Sale/Work Orders etc)

Why is it needed?

- Allows for TIMELY fact-based Decision Making, Tracking and Virtual Experimentation, Future Prediction, What-if Analyses, …



Targeted Common Problems

Inability to handle real-world uncertainties

Enterprise

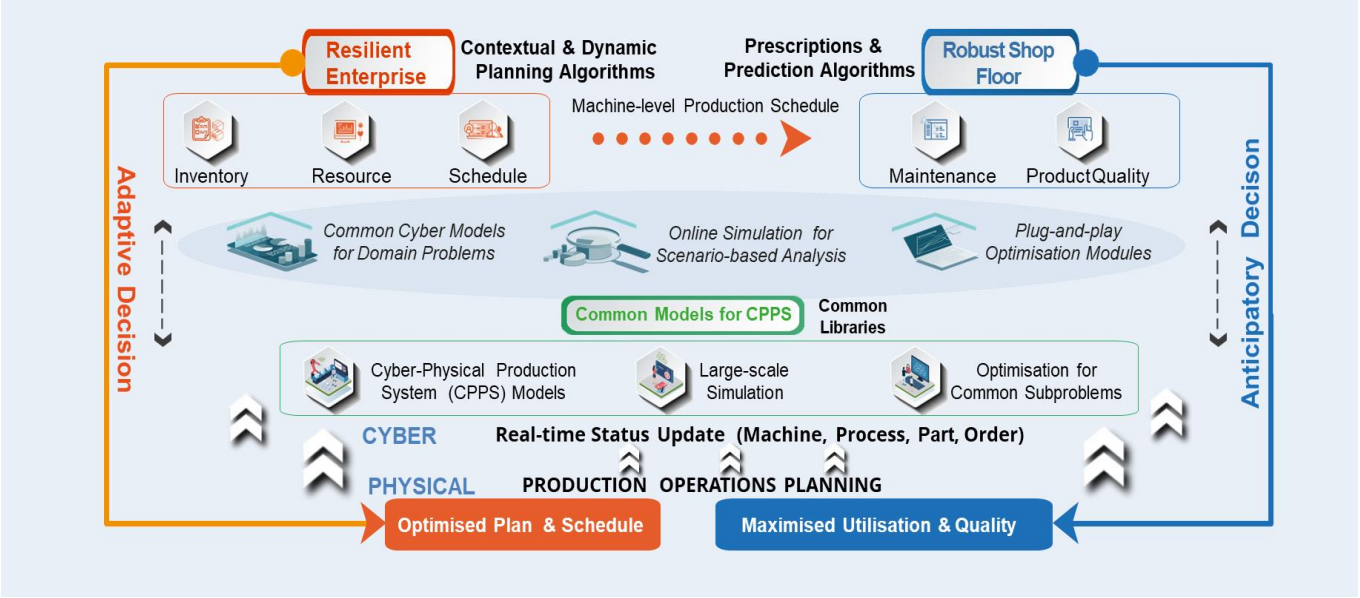
- Plan & Schedules: Inaccurate future performance prediction, Gaps between planned & actual performance
- Inventory: Excess and insufficient inventory, unable to provide global optimisation
- Multi-resource planning: Inefficient & not realiable, today mainly planned in silos

Shop Floor

- Accuracy of sensor data: real-time/online calibration not available
- Predictive Capabilities: Lack of capabilities of correlation analysis and (automatic) root cause identification
- Maintenance: Difficult to achieve accurate predictive capabilities
- Quality: Offline/delayed with in-situ or future prediction not possible

Developing Technologies for the Industry

Overview



What is Novel/New?

- A **targeted system approach** for **sense & response** manufacturing environment with
  - A complete digital thread able to handle **relationships on-the-fly** to support different applications
  - Single source of truth, **contextually accurate total visibility**, reinforced by fast decision support/making capabilities, with predictive & prescriptive capabilities
- Fast decision-making capabilities that is **tractable** and able to **handle uncertainties** arising in real-world problems

Resilient Enterprise

- Adaptive and real-time multi-resource Planning & Scheduling
- Globally optimised multi-site Inventory Planning with repositioning

Robust Shop Floor

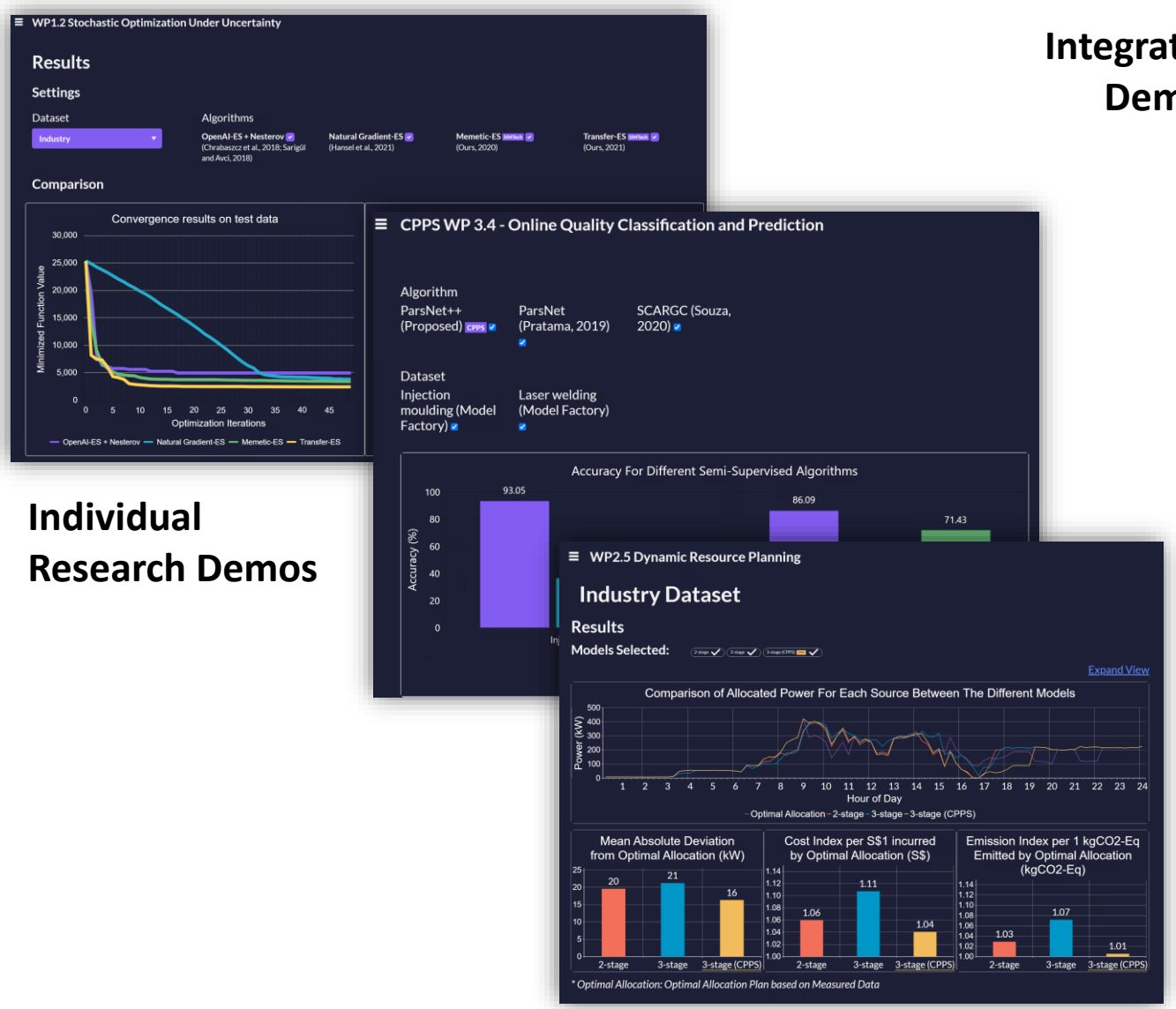
- In-situ & next-batch online Quality Prediction
- Predictive and Prescriptive Maintenance
- Online sensor calibration

Common

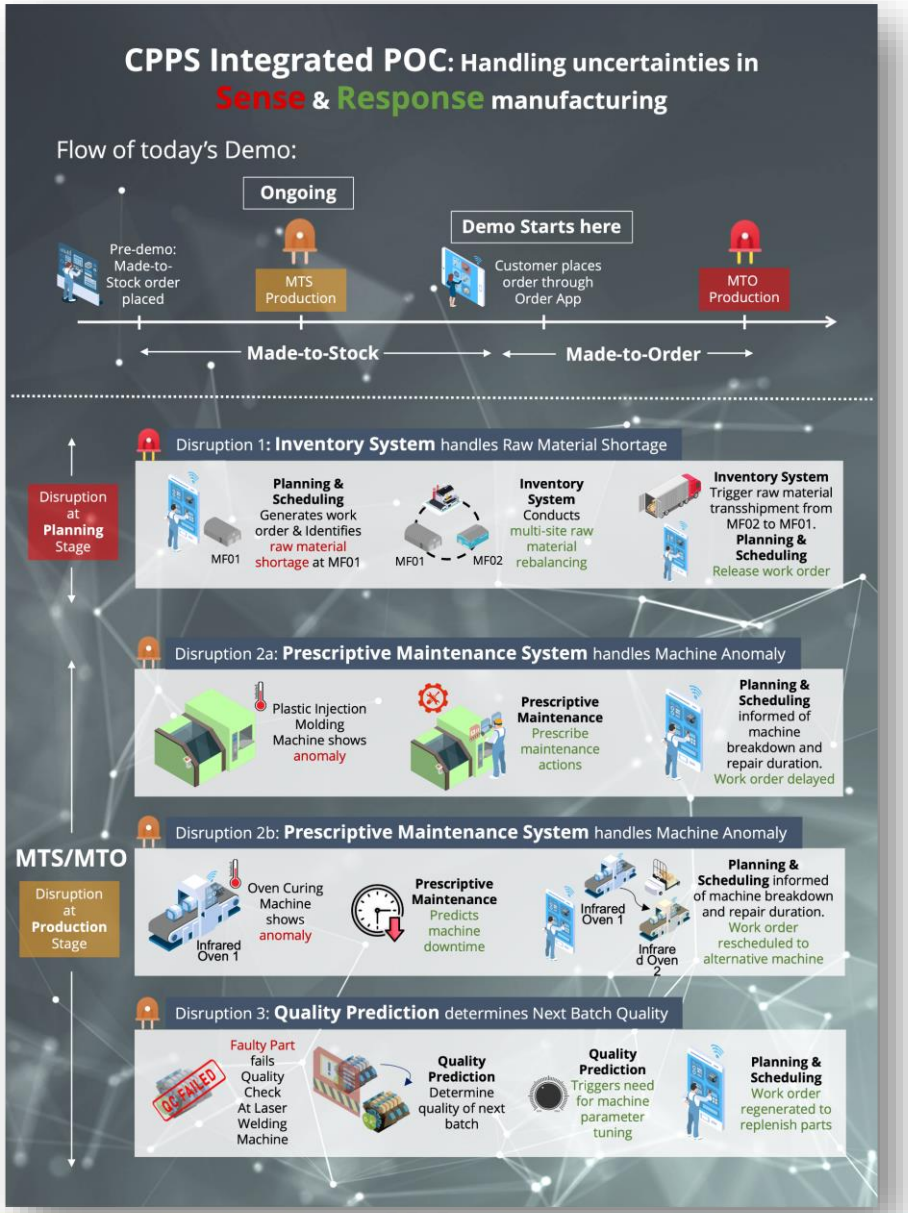
- Automatic contextual process mining
- Large-scale operations simulation
- Multi-objective Optimisation
- Micro-service platform

Live Demos of CPPS Technologies at Model Factory@SIMTech

Individual Research Demos



Integrated Demos

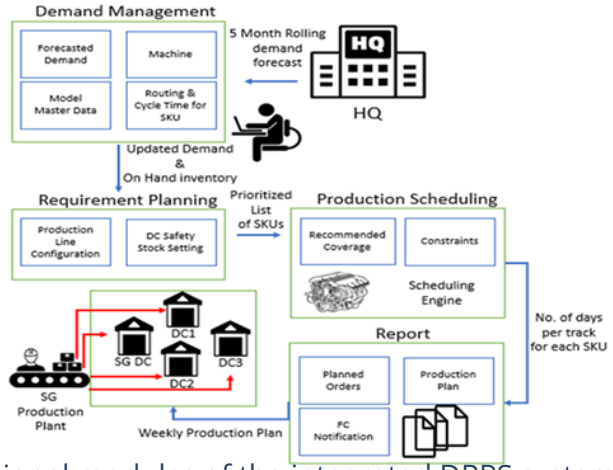


Use Case

Contact Lens Manufacturer

Manufacturing in ophthalmic surgical and vision care

Company's Planners perform what-if analysis through the DRPS system



Functional modules of the integrated DRPS system

Technology

- Developed and implemented An Integrated Distribution Requirement Planning & Scheduling (DRPS) System

Impact

80%

Planning Efforts

from 3 days to 2-3 hours per week

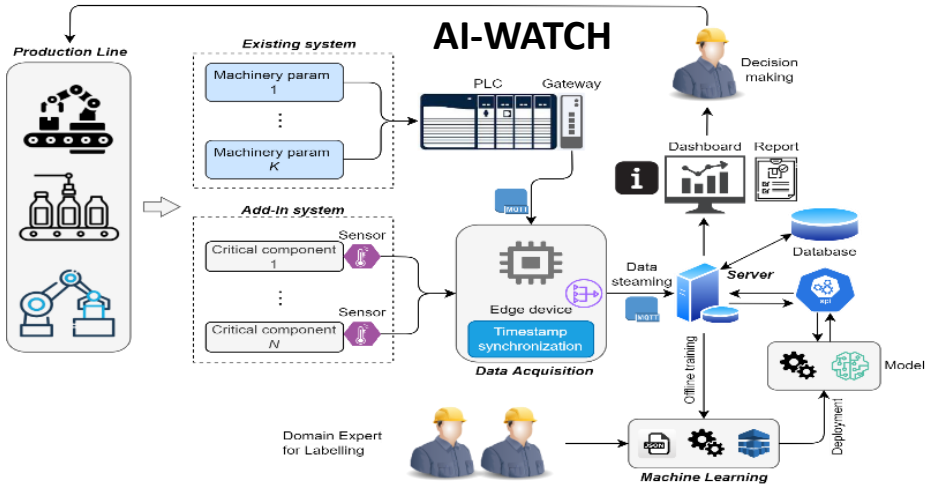
Usefulness

A decision support tool with what-if scenario analysis and evaluation of the demand fulfilment plans

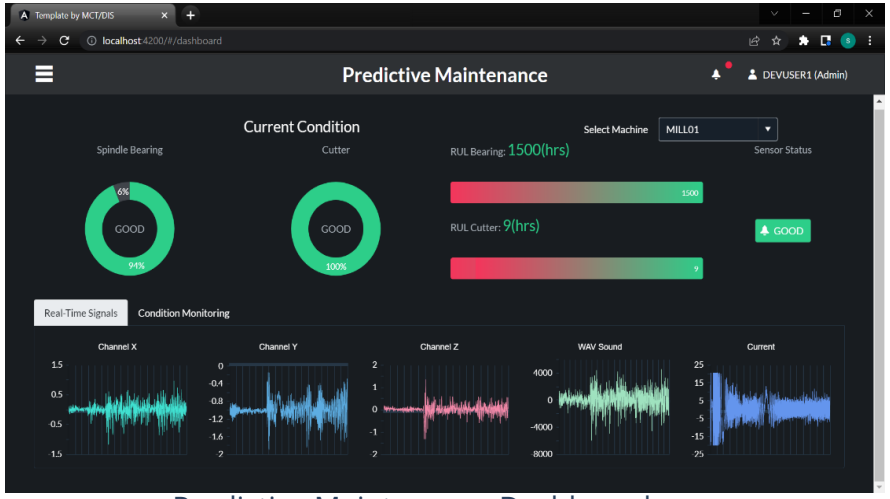
Use Case

Consumer Goods Manufacturer

Manufacturing household and personal products



Predictive Maintenance framework



Predictive Maintenance Dashboard

Technology

- Developed and deployed a **predictive maintenance** software for side milling machine with fault detection/diagnosis and lifetime estimation abilities

Impact

30%

Maintenance efficiency

Reduce downtime

Usefulness

A tool for real-time visibility to equipment condition and failure prediction for JIT maintenance planning

Research Roadmap of Digital Manufacturing

DISTRIBUTED SMART VALUE CHAIN

Infrastructure (Value-Chain)	**Intelligence** (Decentralised)	**Shopfloor** (Flexible)
Multi-Enterprise	*Multi-Site*	*Family of Products*

Autonomous Manufacturing

2023

2022

2014

Holistic & Autonomous Response

Holistic & Collaborative DS, with circular economy considerations
Autonomous self-learning systems

Collaborative Cognition

Distributed & Fast Intelligent Response

DSVC

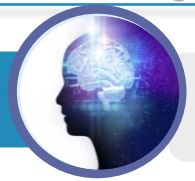
Fast & Robust Intelligence, with Decentralised DS

Decentralised Smart Capabilities

Contextual & Intelligent Response

CPPS

Scalable CPPS
AI-Enabled Intelligent DS



Smart Capabilities

Timely Response

Dashboarding
Real-Time Feedback
Decision Support (DS)

Management (By Exception)

Correlations
Understand Context, Conditions

Insights

Sensing - Enabling Visibility

IoT Enabled
(Brownfield/Greenfield)
Business Process
Automation (RPA, OCR etc.)

Digitalisation & Sensorisation

Strategic Imperative of Distributed Smart Value Chain (DSVC)

From PE ITM 2025

Where we want to be 1. Shift PE industry towards the digital manufacturing paradigm

Accelerate PE industry's capitalisation of digital manufacturing future by:

- ❑ **Entrenching design and R&D of innovative, high - VA products/services**
- ❑ **Building platforms to enable global export of these high VA products/service**

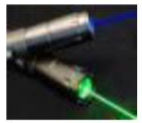
Scale
Leveraging strong growth in Semicon industry

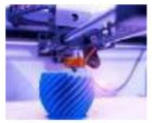

Semicon Eqpt


Test & Measurement

PURSUE
Sectors that are critical enablers for digital manufacturing


Robotics


Lasers & Optics

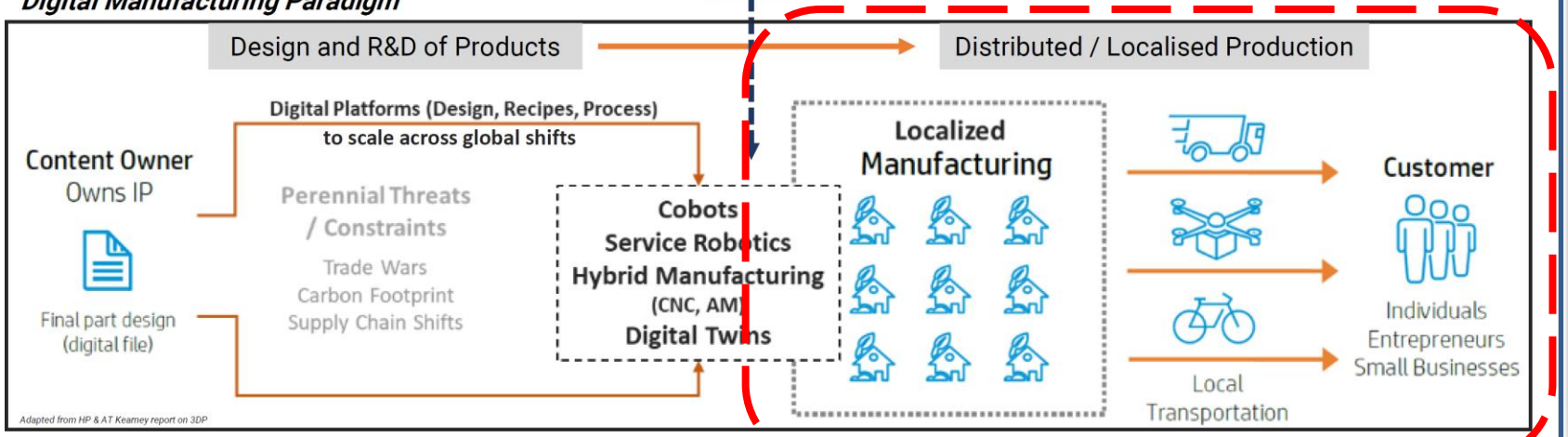

Addtv Mfg

Focused Approach
On enterprises that are key suppliers to major exporters


Plastics*


Sensors

Digital Manufacturing Paradigm



DSVC's Focus

Alignment to PE ITM 2025 needs

- SG as key tech devt hub for digital mfg
- Catalyse local PE enterprise growth into intl markets
- Near-shore key supporting mfg activities for PE

Supporting Manufacturing 2030

- Reshoring/Near-shoring
- Digital Factory & Workforce
- Rise of Digital Ecosystem & Platforms

DSVC's 3 thrusts:

1) Decision-making for companies in a distributed value chain (i.e., **decisions made collectively**, not centrally)
2) Enable manufacturers to take advantage of opportunities quickly (**changeover** of production line **one order of magnitude faster**)
3) **Smart manufacturing platform** and pilot line(s) to demonstrate viability of DSVC

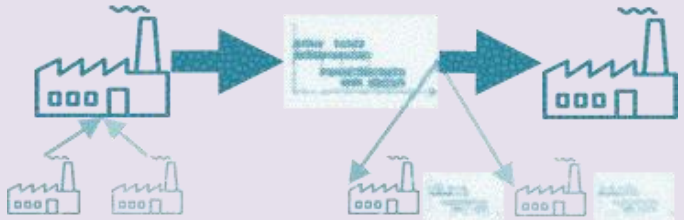
Objective and Deliverables

OBJECTIVE

Enable **distributed smart value chain** with decentralised manufacturing supported by **facilitative decision making** and a **flexible shopfloor**.

WP 1 Facilitative Decision Making for Decentralised Manufacturing

- Decision models for multi-enterprise planning
- Optimisation under partial information visibility



Value chain

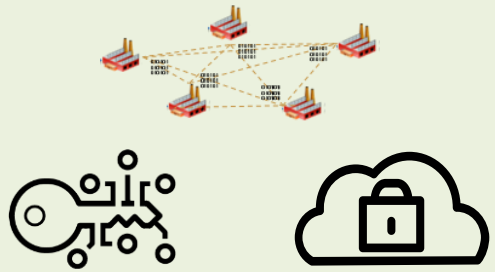
WP 2 Flexible Shopfloor

- Methods for flexible equipment reconfiguration planning & setup
- Intelligent & adaptive learning with few-shot data for fast production setup

Shopfloor @ each site

WP 3 Proof-of-Concept of Distributed Smart Value Chain

- Platform and infrastructure for secure sharing of manufacturing data
- Pilot lines for multi-site & decentralised production



Platform & pilot lines

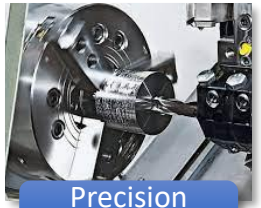
PROGRAMME DELIVERABLES

1. **SOFTWARE and ALGORITHMS** *for decentralised decision making with partial information visibility*	2. **SOFTWARE and ALGORITHMS** *for fast setup of equipment with adaptive few-shot intelligence*	3. **SMART MANUFACTURING PLATFORM TECHNOLOGIES** *to enable distributed smart value chain*	4. **PILOT LINE(S)** *for proof-of-concept of multi-site & decentralised production*

Implementation & Commercialisation Approach

	During the Programme		and Beyond
	CAPABILITY BUILDING	ENGAGEMENT	IMPACT MAKING
End-user manufacturers (SMEs/ MNCs)	**Research** • Digital enablers • Models • Technologies • Collaborative Framework **Proof of Concepts & Testbed** • DSVC Partners • A*STAR Model Factories	Pilot Implementation at partners	Full implementation at companies (Project-based)
Technology Partners (MNCs)		Test-bed into their commercial products	Partners market in SG & beyond
System Integrator (Local)		Test-bed into their commercial products or pilot testing/implementation	Joint Devt to Productise through technology licensing
		Platform solution offerings for DSVC	Manufacturing-as-a-Connected-Service beyond Singapore

Targeted Industries (Initial)


Precision Engineering


Electronics


Marine & Offshore

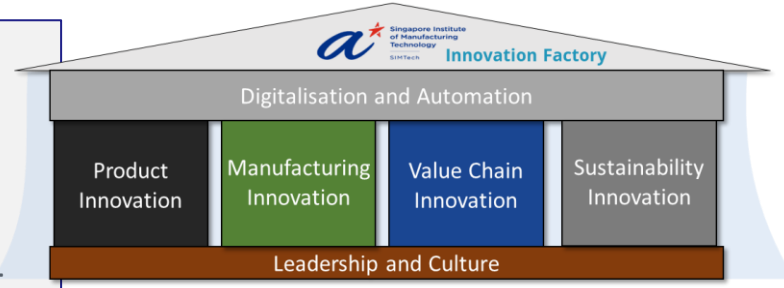

General Manufacturing

Technologies developed are transferable to other sectors too!

A*STAR Model Factories

An integrated environment to

- **Inspire** new ideas for technology developments from both industry and research
- **Innovate** or co-Innovate with industry for NPI/First Article of new products
- **Incubate** industry-ready technologies to customise solutions for rapid deployment

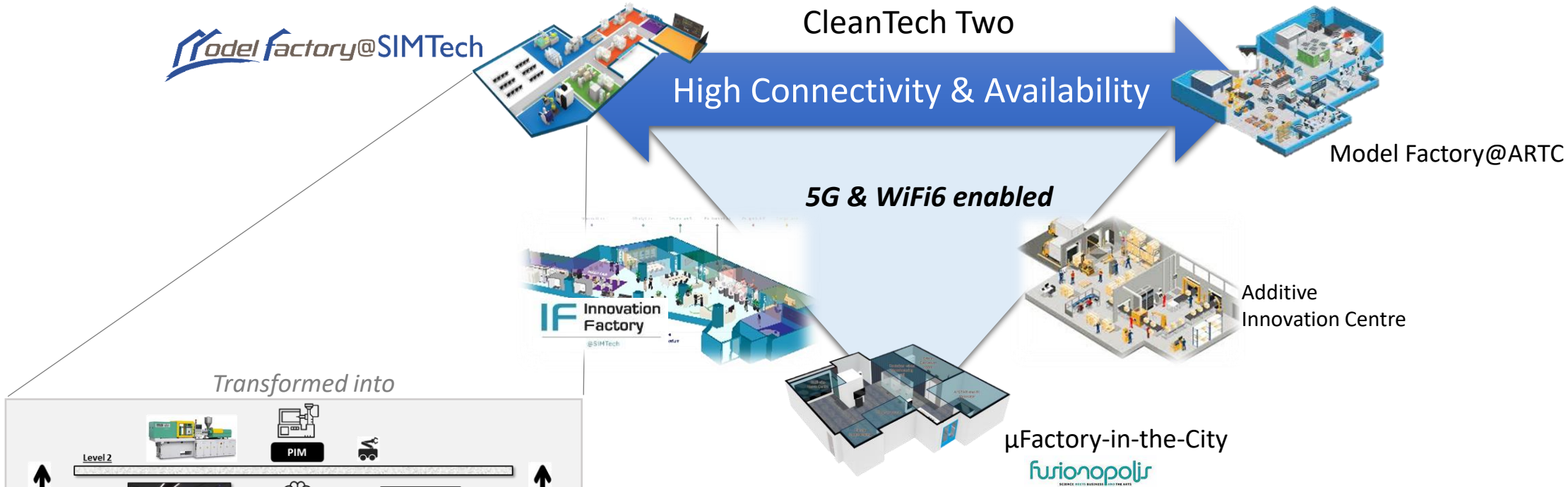


Supported by

- An immersive learning environment for virtual experimentation and more effective LPI-based programmes
- A high-availability connectivity environment (5G and WiFi6)

Manufacturing-as-a-Connected-Service

- Network of factories in a **Distributed Smart Value Chain** supported by micro-Factories



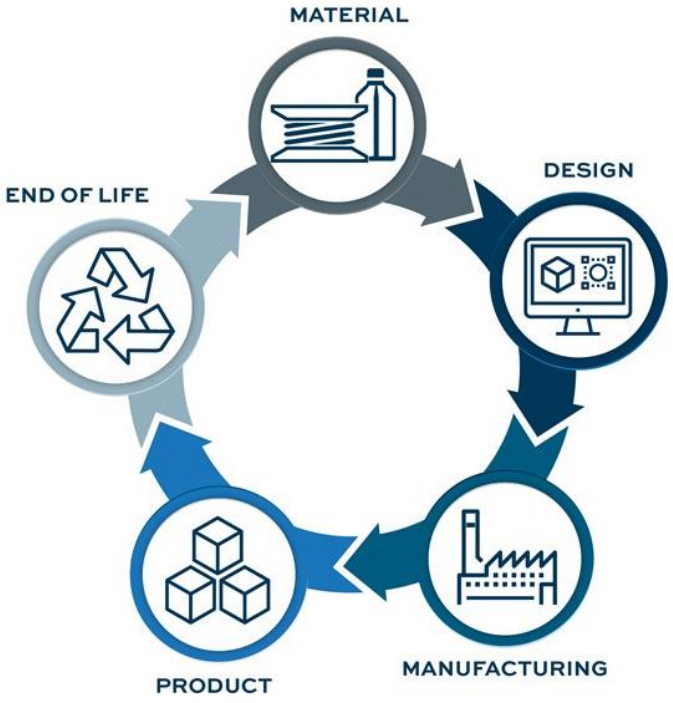
MF Distributed Sites @ CT2B

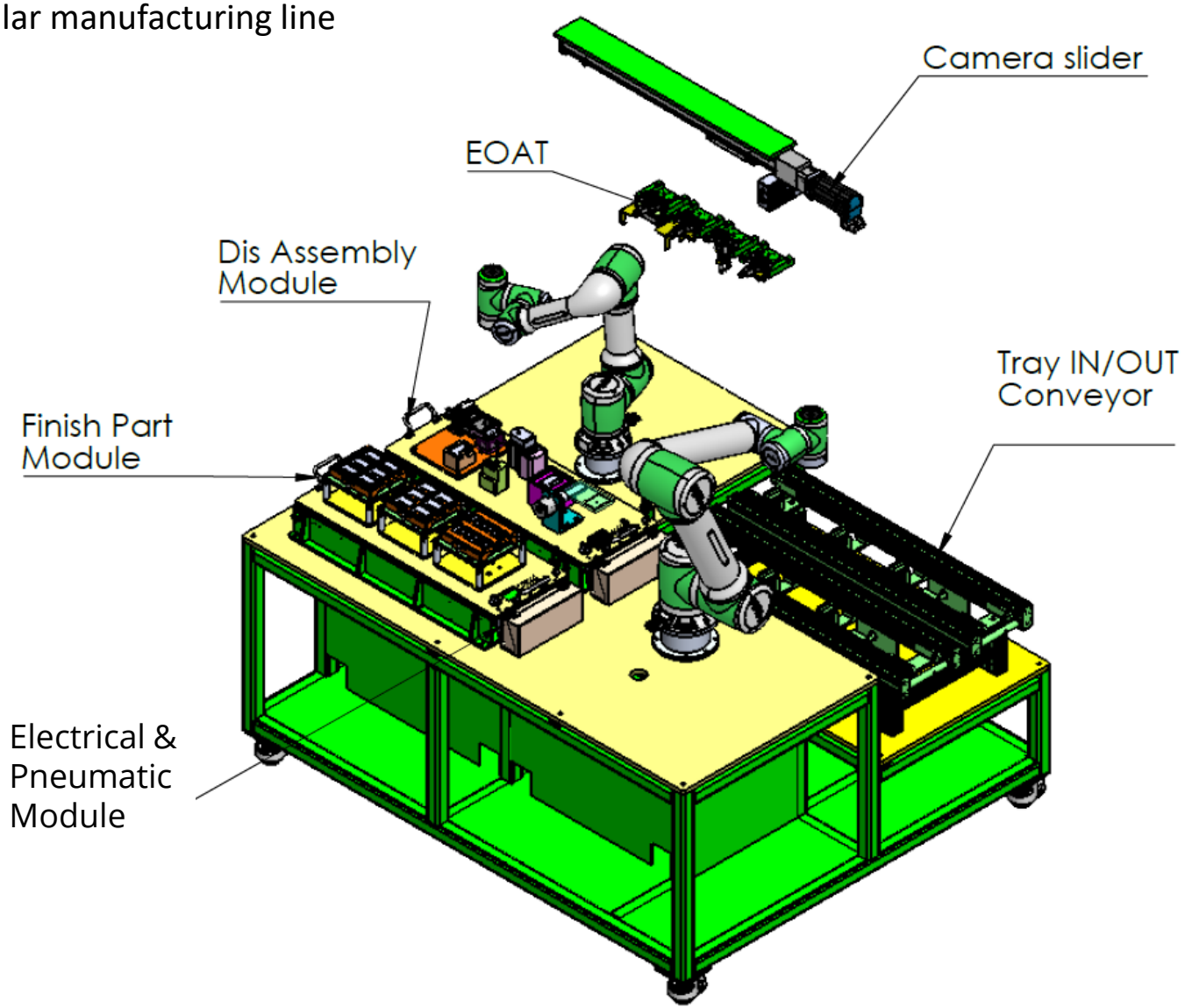
- Explore the concept of sustainability and circular manufacturing with high responsiveness and customisation capabilities
- Last mile customisation supported by new AI-enabled algorithms for handling high demand and customisation flexibilities

Industrial Immersive Capabilities

Circular Manufacturing & Industrial Symbiosis

A joint initiative to establish an integrated circular manufacturing line with key sustainability elements





In collaboration with:

Schneider Electric

SYSMATIC GLOBAL

IF Innovation Factory @SIMtech

New Product Introduction (NPI)

For Industry Test-Bedding: Flexible manufacturing system, reconfigurable process-centric cell and first-article production for dynamic new product introduction

Call-To-Action

Visit Model Factory@SIMTech

Join our LPI-based Upskilling Programmes

Adopt/Customise our ready technologies

Co-innovate with us (long-term collaborations or Joint Labs)

Join our latest R&D Programme: Distributed Smart Value Chain

Schedule a visit to Model Factory!
Visit Coordinator

✉ ModelFactory@SIMTech.a-star.edu.sg

Schedule a discussion with us!
Industry Development Managers
Manufacturing Productivity Technology Centre (MPTC)
✉ Ming Mao: mmwong@simtech.a-star.edu.sg
✉ Connie: yyng@simtech.a-star.edu.sg

CREATING GROWTH, ENHANCING LIVES

Singapore Institute of Manufacturing Technology

SIMTech

30 Years of Driving Manufacturing Innovations with Local Enterprises

1993 - 2023

THANK YOU

www.a-star.edu.sg

✉ pstan@SIMTech.a-star.edu.sg

INNOVATION & TECHNOLOGY
CONFERENCE 2023
Innovation Through Advanced Manufacturing
Research & Technologies

Enabling Dreamers, Empowering Enterprises

Mr Andrew Lim
Director
Ong & T.T. Trading

DEVELOPMENT OF A B2B AGGREGATOR PLATFORM FOR SMES

ANDREW LIM

AGENDA

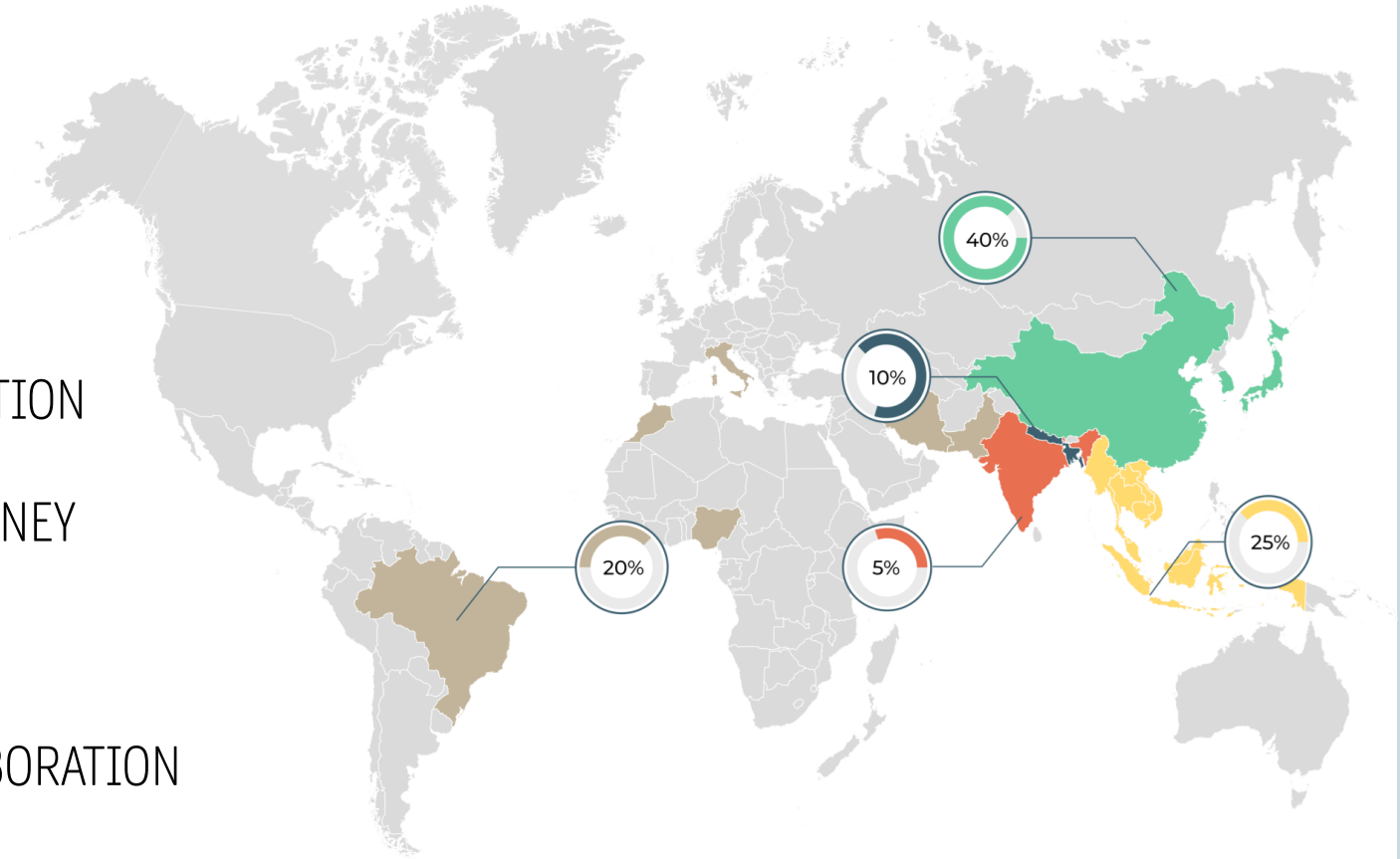
INTRODUCTION

WHY ARE WE DEVELOPING THIS SOLUTION

WHEN DID WE EMBARK ON THIS JOURNEY

WHO DID WE WORK WITH

HOW DID WE DECIDE ON THIS COLLABORATION

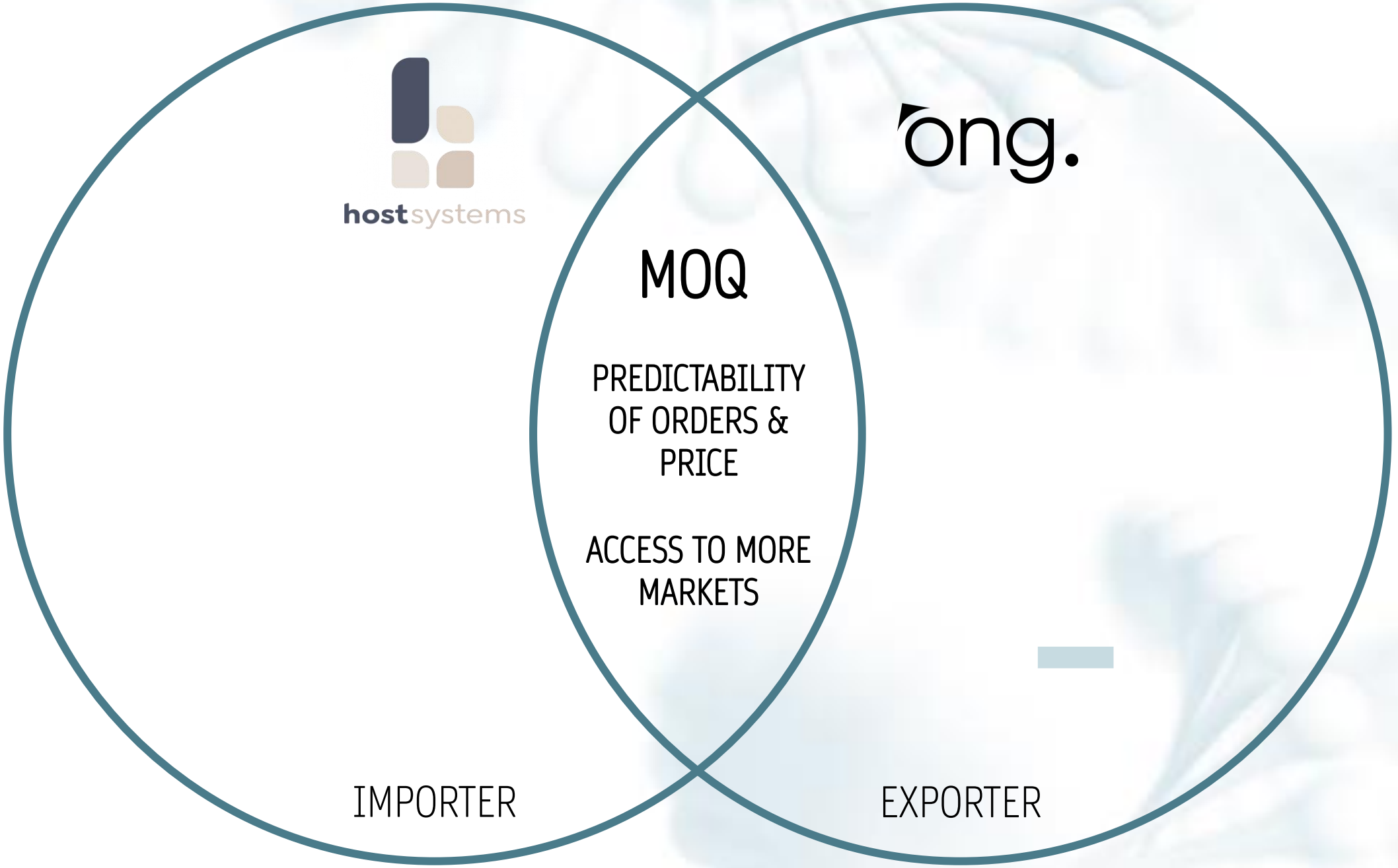


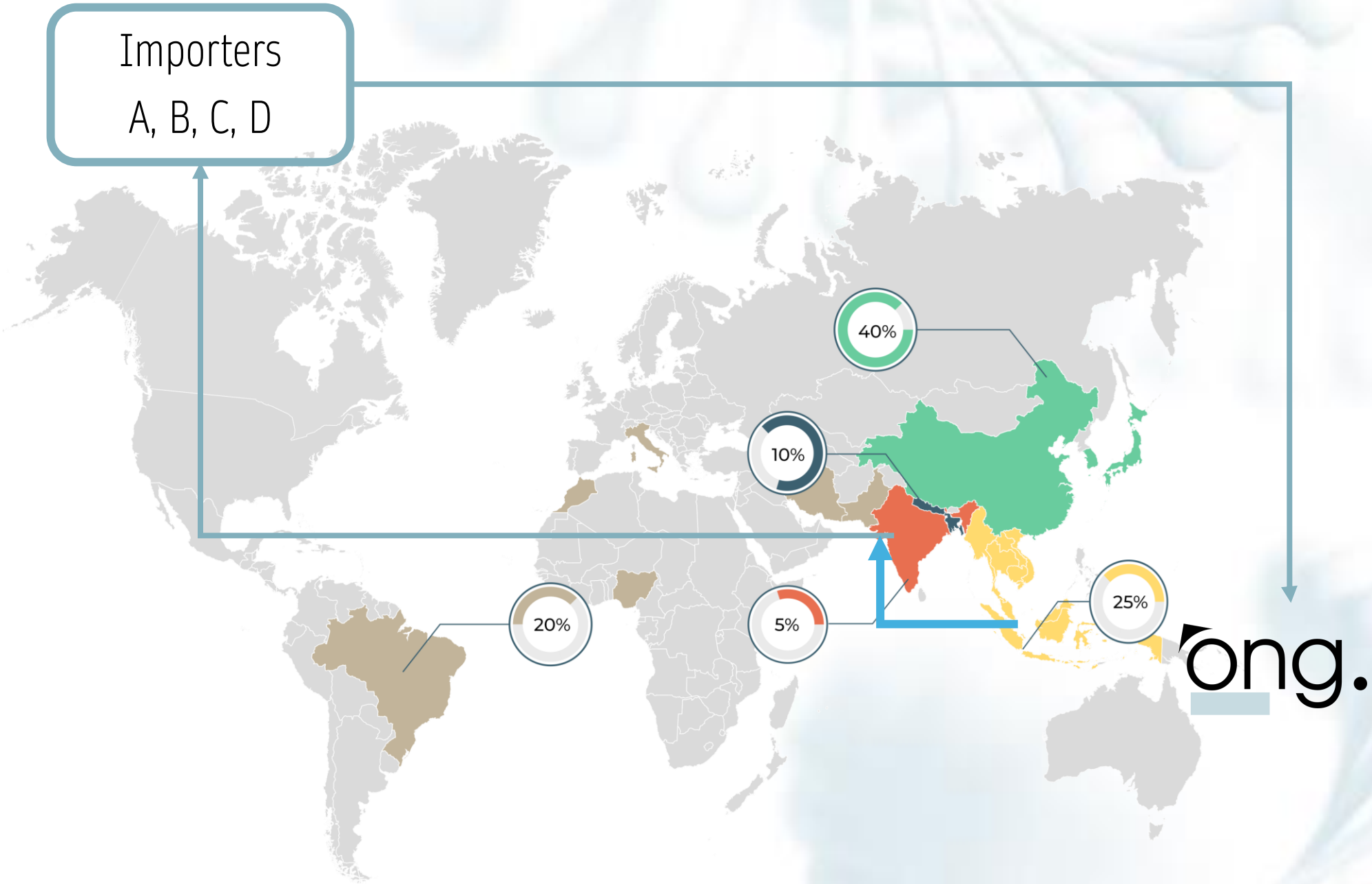
INTRODUCTION

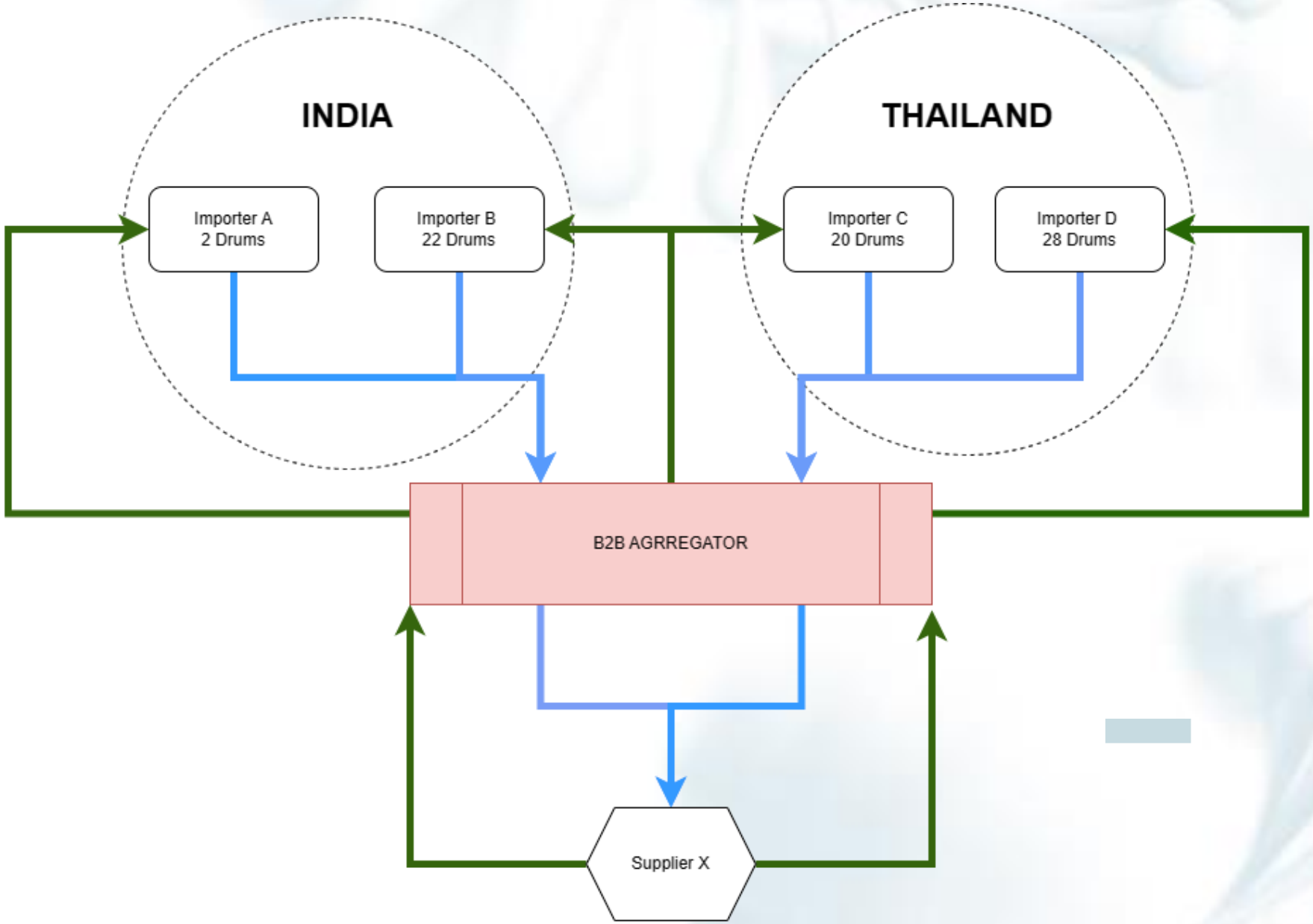
IMPORT

EXPORT

ong.


hostsystems
ong.
MOQ
PREDICTABILITY OF ORDERS & PRICE
ACCESS TO MORE MARKETS
IMPORTER
EXPORTER


Importers
A, B, C, D
40%
10%
20%
5%
25%


INDIA
THAILAND
Importer A
2 Drums
Importer B
22 Drums
Importer C
20 Drums
Importer D
28 Drums
B2B AGRREGATOR
Supplier X
Singapore

“IF YOU WISH TO GO FAST, GO ALONE. IF YOU WISH TO GO FAR, GO TOGETHER.”

SUMMARY

INTEGRITY

COMPETENCY

PASSION

INTENT

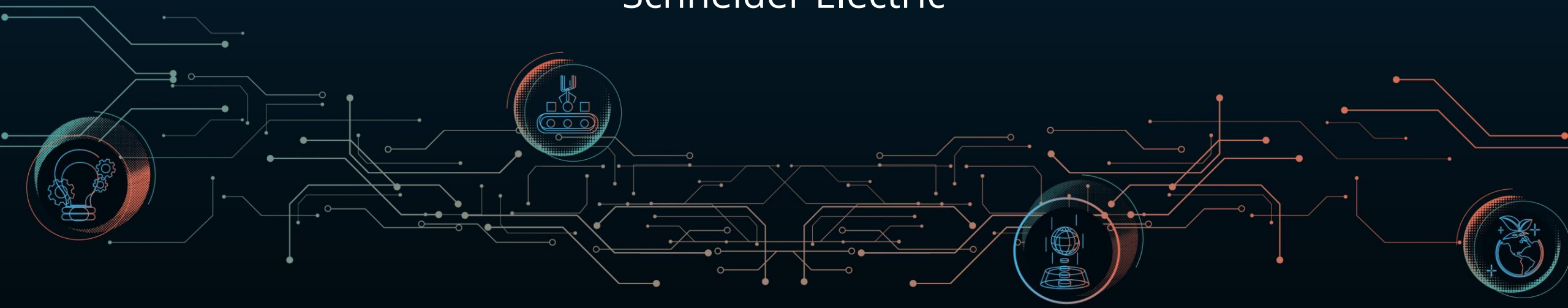
THANK YOU

ANDREW LIM
ANDREW.LIM@ONGNTT.COM.SG | WWW.ONGNTT.COM.SG

INNOVATION & TECHNOLOGY
CONFERENCE 2023
Innovation Through Advanced Manufacturing
Research & Technologies

Unleash Industry 4.0 Capabilities with Universal Automation

Ms Janet Lim
Regional Commercial Director, EA, Software Centric Automation & SI
Industrial Automation Business
Schneider Electric



Unleash Industry 4.0 Capabilities with Universal Automation

Smart & Sustainable Manufacturing

Janet LIM
Regional Commercial Director, Software Centric Automation
Schneider Electric

Industry is on the verge of a Digital Transformation

End users struggle with complexity …

- Continual pressure to reduce costs
- Increased product variants & shorter life-cycles
- Fluctuating demand, energy & raw material prices
- Increasing regulations
- Workforce evolution

… and look to technology to help

- Artificial Intelligence/ Machine Learning
- Augmented/Virtual Reality
- Data analytics
- Digital Twins
- Edge computing/cloud architectures
- Wireless sensors

Does it ring a bell?

"I feel locked to a supplier because switching costs are too high!"

"It is difficult to attract talented young software engineers to maintain my plant or program systems!"

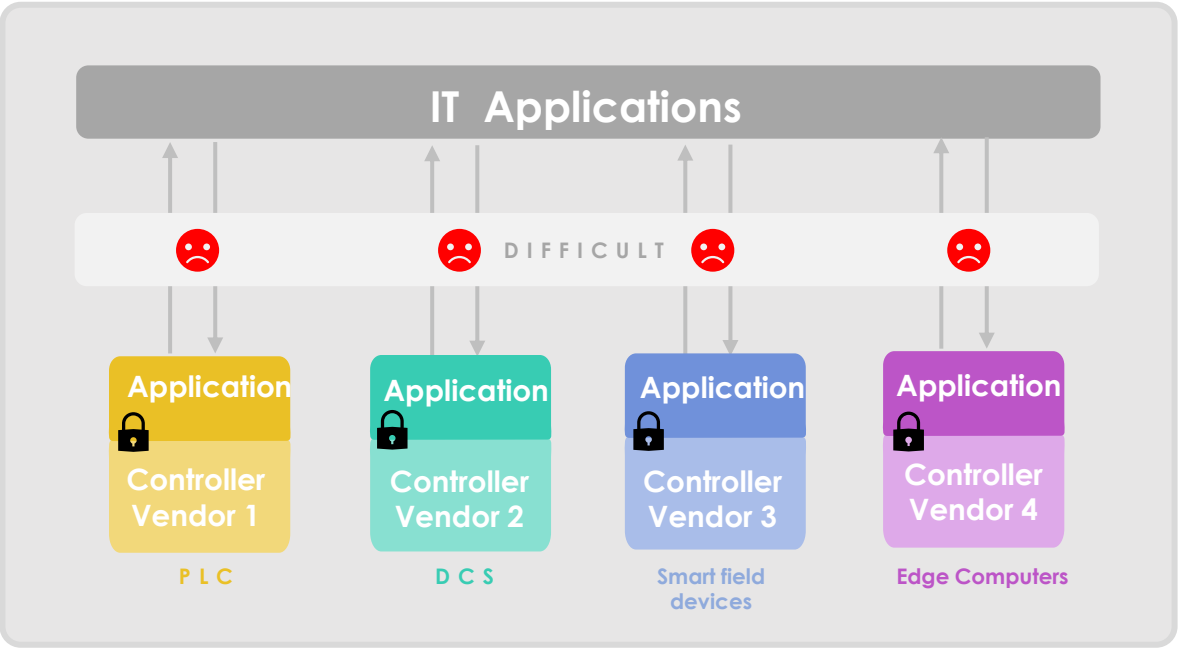
"I hesitate with Industry 4.0 strategies because of high cost and complexity to implement with my existing controllers."

"It is costly to maintain multiple application libraries because of different automation suppliers!"

"On every project we seem to re-invent the wheel. How many times have we re-created simple pump controls…..!"

"I'm obliged to completely rewrite my SW application when my HW reaches end-of-life"

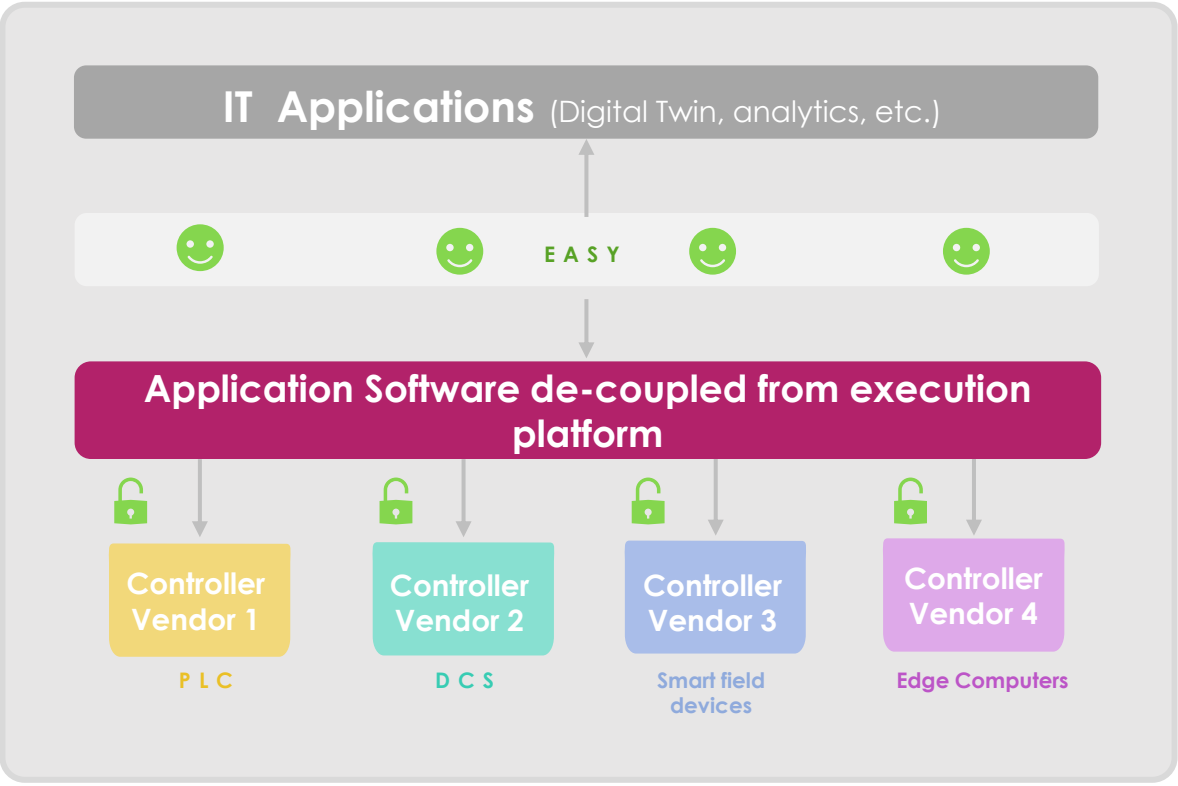
Current automation systems are a barrier to change



Today's automation systems (PLC's or DCS's) are optimized for real-time control, but:

- × **Difficult to couple** controls with IT systems
- × **Proprietary programming** environments
- × **Flat program** structures (not object-oriented)
- × **No clear boundary** between application SW and the HW on which it executes

Automation systems must evolve



Next generation automation systems must have the following characteristics:

- ✓ **Application software** must be **decoupled from hardware** to make it **portable** across different automation platforms.
- ✓ **Fundamentally object-oriented** to **facilitate re-use** via software component libraries
- ✓ **Event/data** driven to make it « easy » to **couple real-time automation with enterprise applications**
- ✓ **Application/Asset-centric** rather than controller-centric
- ✓ **Appeal** to software engineers used to **more modern programming** languages, while maintaining certain OT characteristics.

Universal automation is the solution

A combination of:

1. **IEC 61499 standard –** a technology enabler
2. A **community** of Users and Vendors sharing a **common runtime execution engine** committed to portable automation software apps – **UniversalAutomation.Org (UAO)**

Think of it as the Android of Industrial Automation

For Smartphones

=

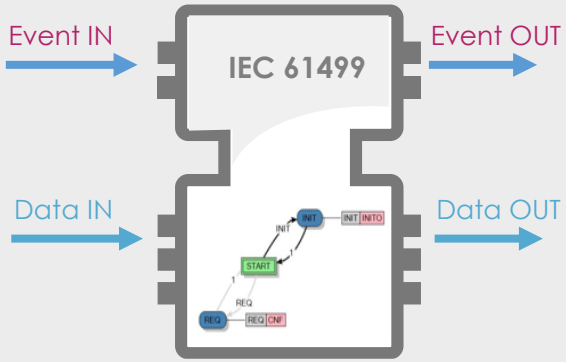
UNIVERSAL
AUTOMATION.ORG

For Industrial Automation

IEC 61499

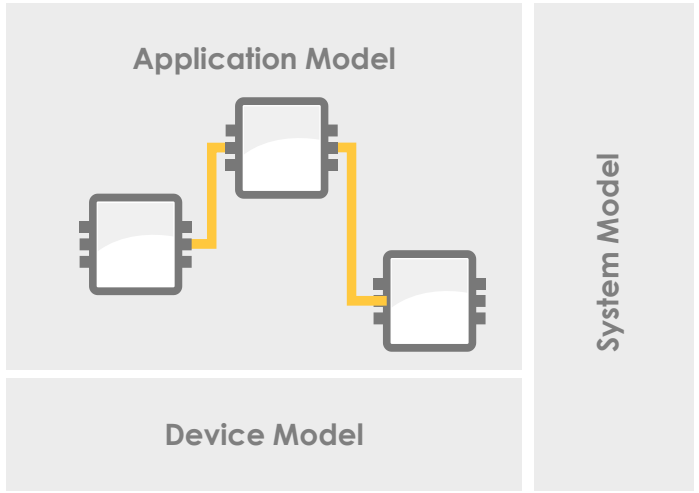
The technology enabler of UAO

Event-Driven Function Block



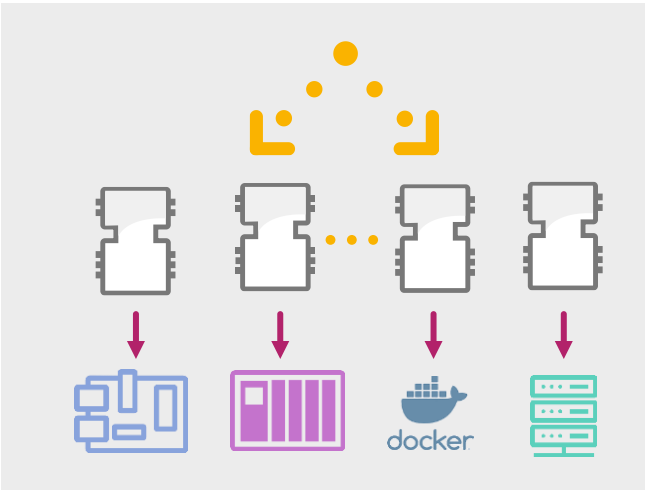
Self-contained SW component

Software-Hardware Decoupling



Decoupling of Application Software from Hardware

Distribution



Distribution of SW components to devices

"Plug & Produce programming using hardware-independent, proven-in-use libraries of software components"

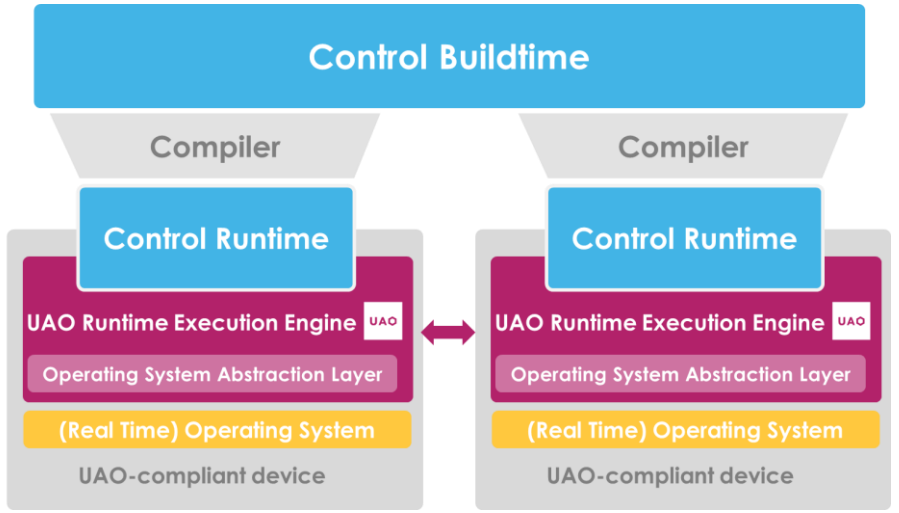
Portability → Reusability → Interoperability

A community

WE are — **A community of users, vendors and universities** organized around an independent non-profit association

WE use — Universal automation platforms that use a **shared-source IEC 61499 runtime execution engine**

WE promote — **Portability/Reusability** of vendor-independent automation application software



Benefits

- ✓ **Maximize application portability across vendor platforms**
- ✓ **Remove issues linked to « interpretation » of written standard**
- ✓ **Release universal automation offers in months rather than years**

GitHub

Next Generation automation

Overview of today's members

Vendors

ADVANTECH Enabling an Intelligent Planet
ASRock Industrial
ANALOG DEVICES AHEAD OF WHAT'S POSSIBLE™
Schneider Electric
intel.
KONGSBERG
HNAC
PHOENIX CONTACT
od-t
HIRSCHMANN A BELDEN BRAND
BELDEN
ProSoft TECHNOLOGY
BUCHER automation
YOKOGAWA
STAHL
wilo
ESA
lumberg automation A BELDEN BRAND

Users

ACTEMIUM
IAS Armony System
Cargill
kyndryl
CRESCENT ELECTRIC SUPPLY COMPANY
ExxonMobil
grEn
GraybaR
Ingénierie
ENG
MASTER SYSTEMES
KPi Automation
MAYER
Shell
Upstate Automation
westcon
PLATINUM
BPX
ICT GROUP
wood.
TriSystems
ICT GROUP Raster Industrial Automation

[Breaking news: Nestlé]

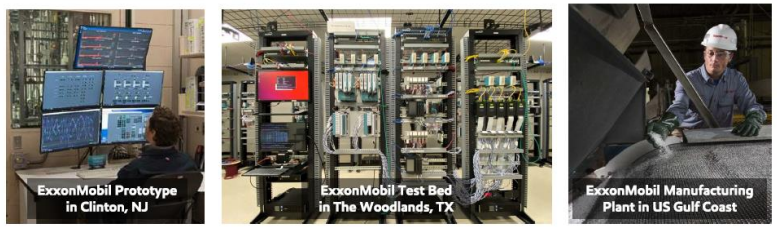
Universities / Startups

Aalto University
Dynamic Process
AUSTRALIA ECU EDITH COWAN
flexbridge
htw Hochschule für Technik und Wirtschaft Berlin University of Applied Sciences
LULEÅ UNIVERSITY OF TECHNOLOGY
TAOTECH
ktl Korea Testing Laboratory

End Users are using the technology

ExxonMobil

- Using UAO runtime execution engine in OPAF test bed since 2018
- Real-life field trial ongoing
  - Replace existing DCS/PLC's
  - 2000 IO points, 90+ loops
  - UAO runtime + OPC UA



ExxonMobil

Shell

- First capital project using EcoStruxure Automation Expert
- Creating OPAF test-bed

KONGSBERG

- Orchestration layer above existing legacy controllers
- Additional IT/OT applications

Cargill

- Objective – decouple application library from vendor platforms
- Step 1: Convert semi-continuous process library to IEC 61499

aren

REDUCE, REUSE, RECYCLE

- Building "Reference IEC 61499 application"
- Plan to use Stahl equipment on core reactor

Addressing your fundamental concerns

"I hesitate with Industry 4.0 strategies because of high cost and complexity."	Plug & produce programming using event/data software components libraries
"I feel locked to a supplier because switching costs are too high !"	HW/SW decoupling, standardized runtime => vendor independence, portability
"On every project we re-invent the wheel. How many times have we re-created simple pump controls…..!"	Asset-centric approach using event/data-driven black-box SW components
"It is costly to maintain multiple application libraries because of different Automation suppliers !"	HW/SW decoupling, standardized runtime => one library, regardless of vendor
"I'm obliged to completely rewrite my SW applicatio when my HW reaches end-of-life"	HW/SW decoupling, standardized runtime => simplify porting to next generation of controllers
" It is difficult to attract talented young software engineers to maintain my plant or program systems !	Modern, sophisticated, object-oriented programming environment following IT principles

Why should users join UAO?

Do you want “Plug & Produce” automation with vendor-independent software components?

Sponsor the initiative => Without users we will NOT attract vendors

Network with other users to learn & drive standardization

Influence the next development of the runtime execution engine

Get trained on the technology, interact with UAO Ecosystem

UAO on the Web

Website

Flyer for end-users

Flyer for EPC/system integrators

Flyer for vendors

UAO contacts

Greg Boucaud - CMO

John Conway - President

VIDEOS

Introduction to UniversalAutomation.org

Testimonials playlist

Executive interview ARC Forum 2022

Universal Automation Panel discussion

Universal Automation CSIA panel

Podcast ARC Forum 2023

Executive interview ARC Forum 2023

UNIVERSAL

AUTOMATION.ORG

JOIN TODAY