

Foolproofing Human Capital in Pharma in the Era of Industry 5.0

Mark Chua

Principal Research Engineer

A*STAR - SIMTech



2024 Pharmaceutical Manufacturing and Quality Conference





CREATING GROWTH, ENHANCING LIVES

VUCA

Volatility Uncertainty Complexity Ambiguity



BRITTLE



INCOMPREHENSIBLE

BANI

BRITTLE, ANXIOUS, NON-LINEAR,
INCOMPREHENSIBLE

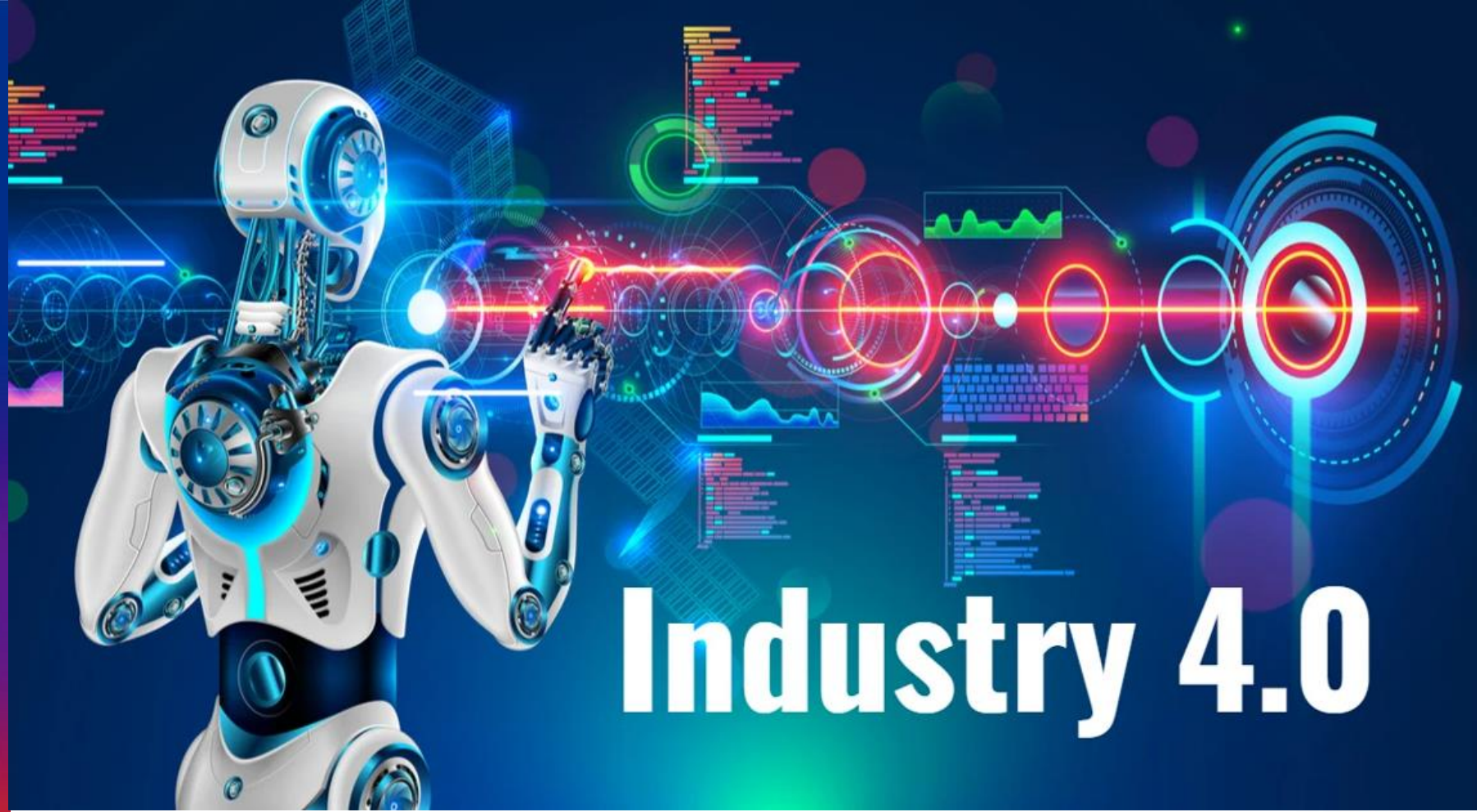
NON-LINEAR



ANXIOUS



CREATING GROWTH, ENHANCING LIVES



Industry 4.0



Data
Overload

Internal
Logistics
Optimization

Labour
Shortage

New Challenges in the Digital Era

Shopfloor
Digitization

Global
Supply Chain
Integration

Two Concerns

Stay Healthy **Tomorrow**

Be Healthy **Today**

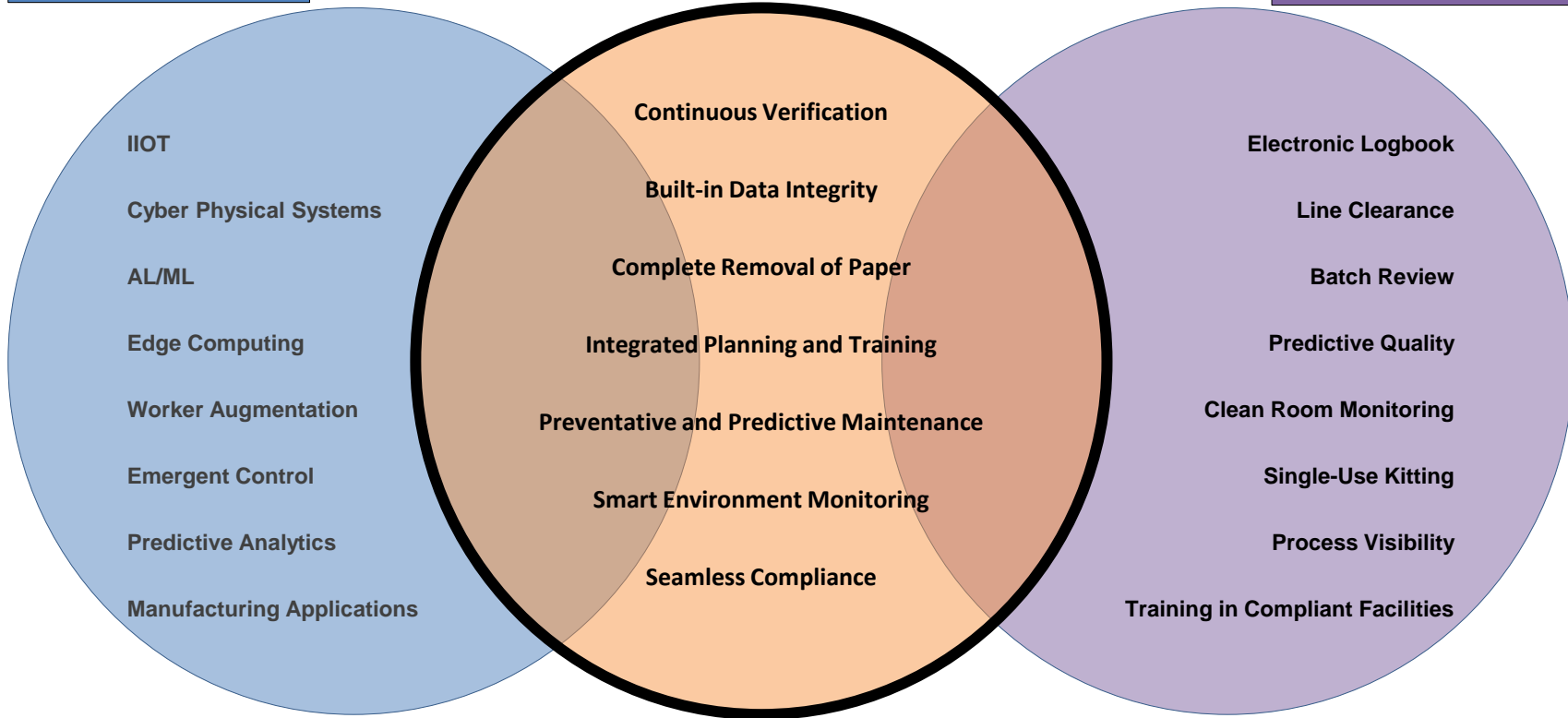
CREATING GROWTH, ENHANCING LIVES



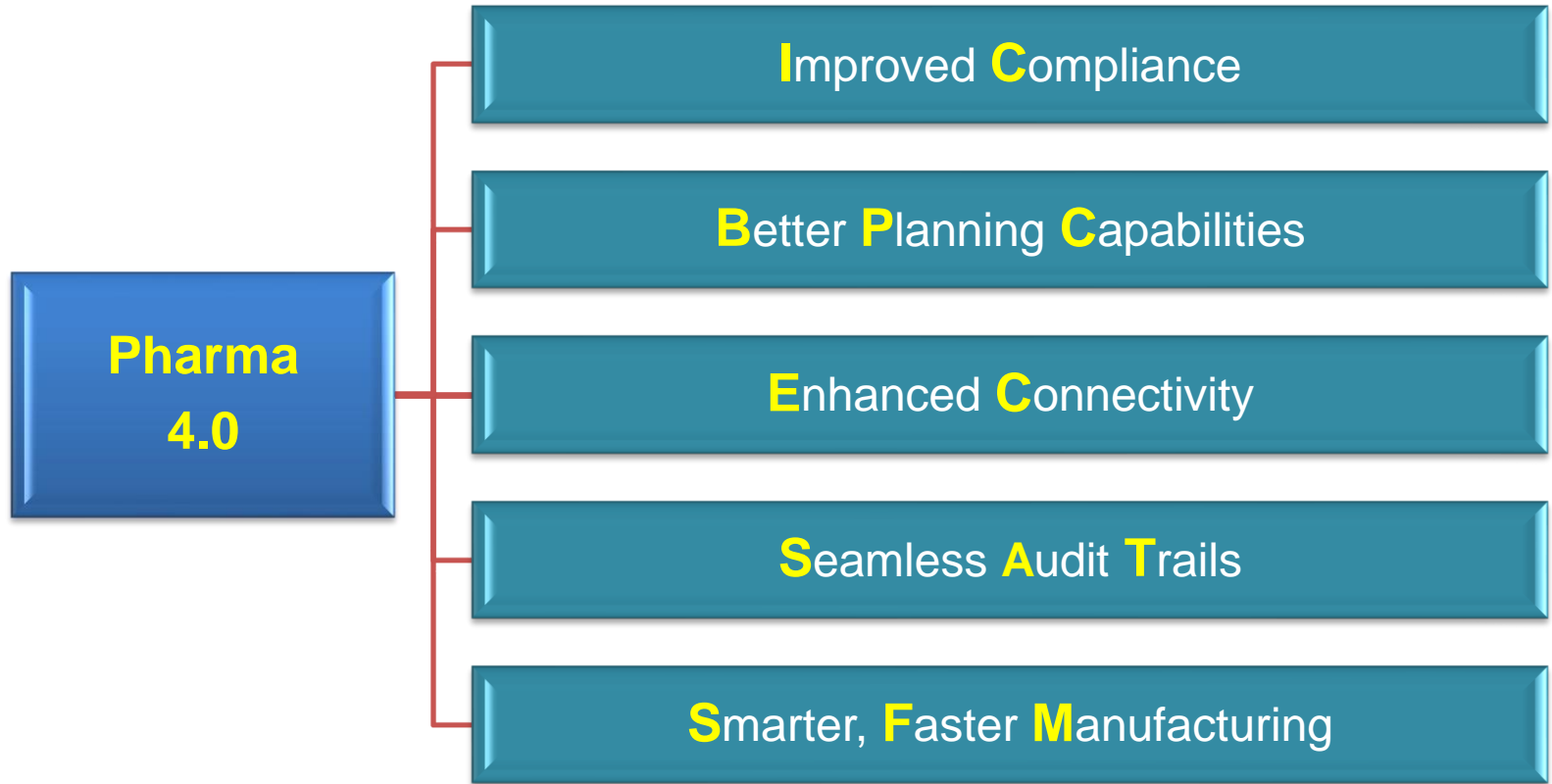
Industry 4.0 vs Pharma 4.0

INDUSTRY 4.0

PHARMA 4.0



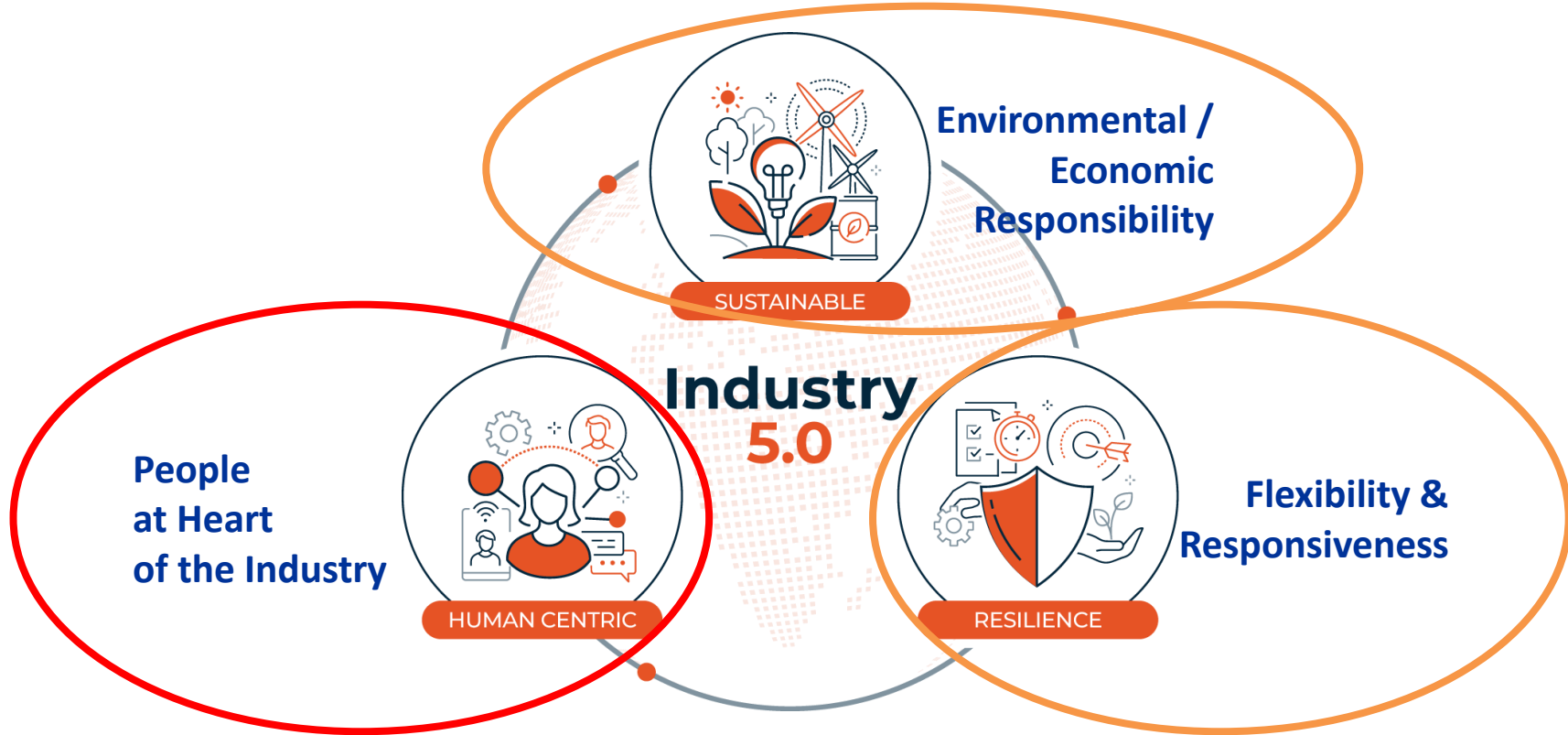
Pharma 4.0 Benefits



The **Future** of Manufacturing



CREATING GROWTH, ENHANCING LIVES



The **Approach** to Smart Manufacturing



CREATING GROWTH, ENHANCING LIVES



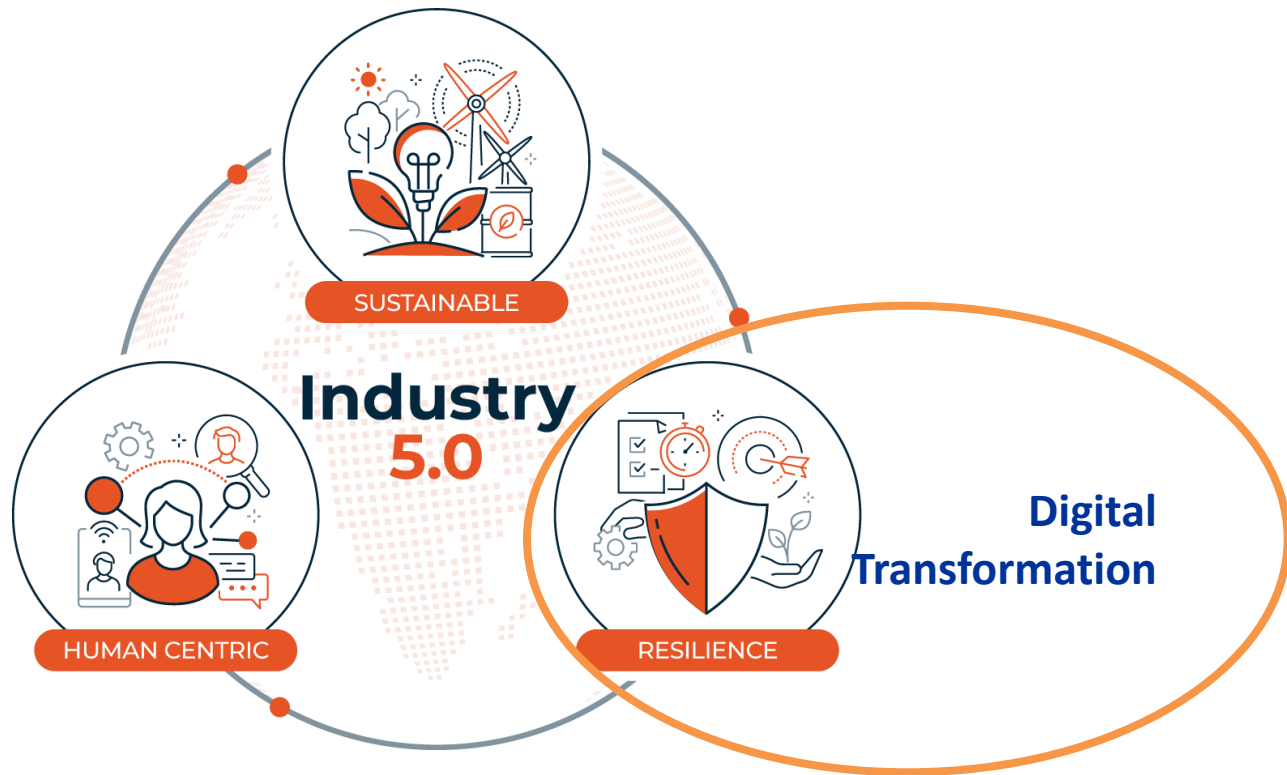
Digital Transformation

People Development

The **Future** of Manufacturing



CREATING GROWTH, ENHANCING LIVES



Digital Transformation

A*STAR–SIMTech Digital Transformation & Innovation (**DTI**) Methodology

What is **Digital Transformation**?

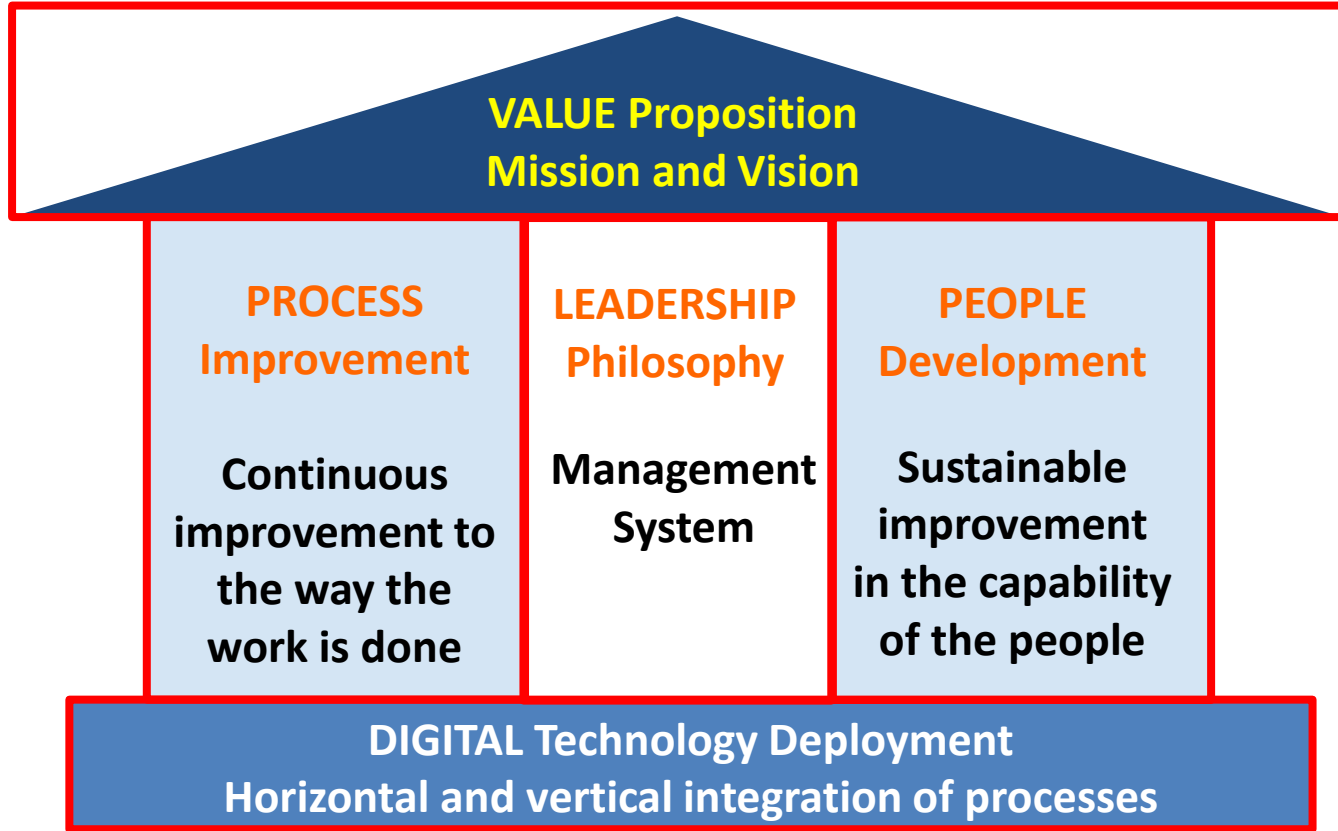
Digital Transformation is **NOT** just about the Digital.

It is about the **Transformation** of the Business Value Proposition, Organizational Process and People.

By leveraging on the **Potentials** of Digital Technologies.



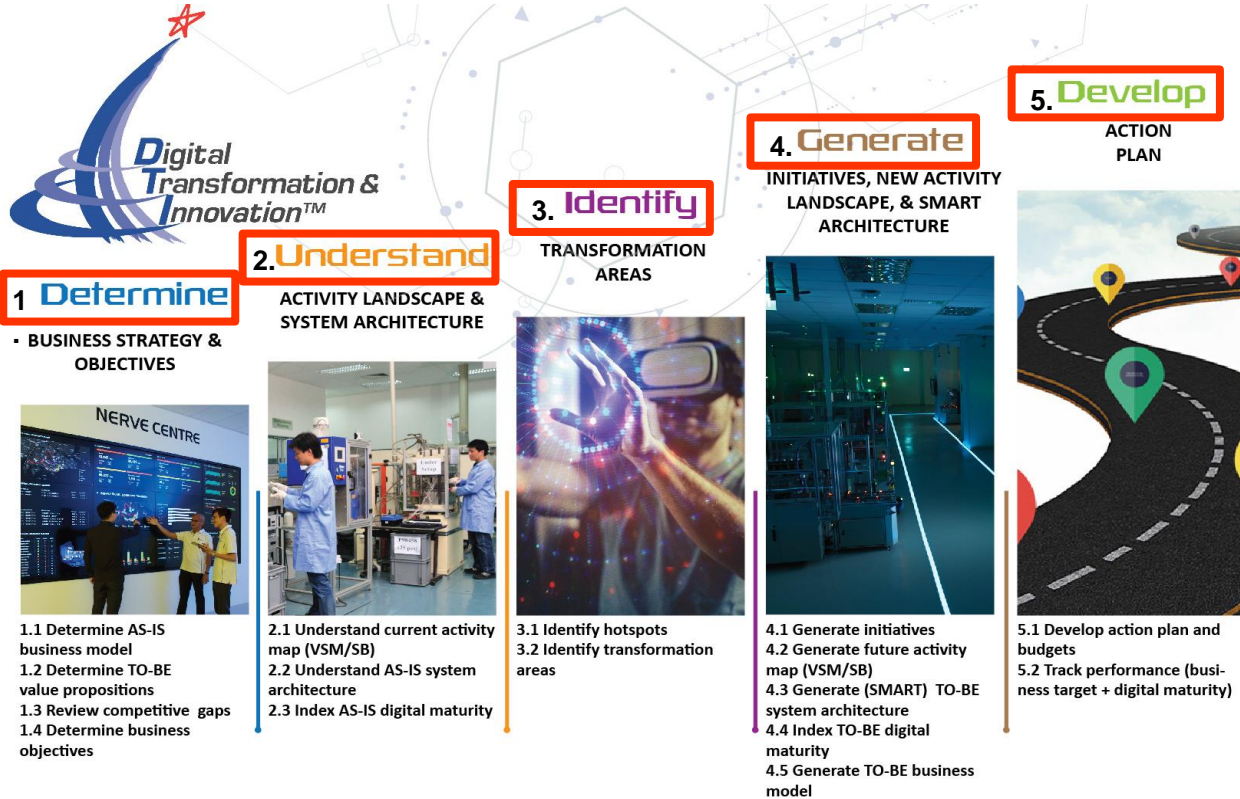
5 Pillars of Digital Transformation



Digital Transformation - DTI Methodology



CREATING GROWTH, ENHANCING LIVES



Digital Transformation - DTI Methodology

Digital Transformation & Innovation™

1. Determine

BUSINESS STRATEGY & OBJECTIVES



- 1.1 Determine AS-IS business model
- 1.2 Determine TO-BE value propositions
- 1.3 Review competitive gaps
- 1.4 Determine business objectives

2. Understand

ACTIVITY LANDSCAPE & SYSTEM ARCHITECTURE



Review

Business Model
Business Objectives
AS-IS Value Stream Map
AS-IS System Architecture
Hotspots & Transformation Areas
Hotspot Clustering → Corporate/ASTAR Solution

- 2.1 Understand current activity map (VSM/SB)
- 2.2 Understand AS-IS system architecture
- 2.3 Index AS-IS digital maturity

3. Identify

TRANSFORMATION AREAS



- 3.1 Identify hotspots
- 3.2 Identify transformation areas

4. Generate

INITIATIVES, NEW ACTIVITY LANDSCAPE, & SMART ARCHITECTURE



Refine

Initiatives
TO-BE Future Value Stream
TO-BE System Architecture
Initiatives Description

- 4.1 Generate initiatives
- 4.2 Generate future activity map (VSM/SB)
- 4.3 Generate (SMART) TO-BE system architecture
- 4.4 Index TO-BE digital maturity
- 4.5 Generate TO-BE business model

5. Develop

ACTION PLAN



Recreate

DX Roadmap
Initiative Visual Management

- 5.1 Develop action plan and budgets
- 5.2 Track performance (business target + digital maturity)

Digital Transformation - DTI Methodology



CREATING GROWTH, ENHANCING LIVES

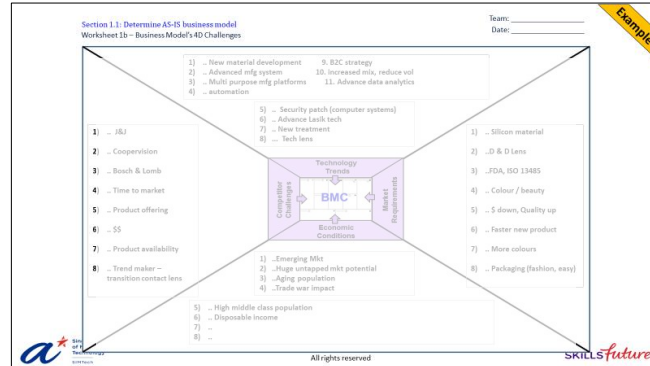
Review

1. Determine

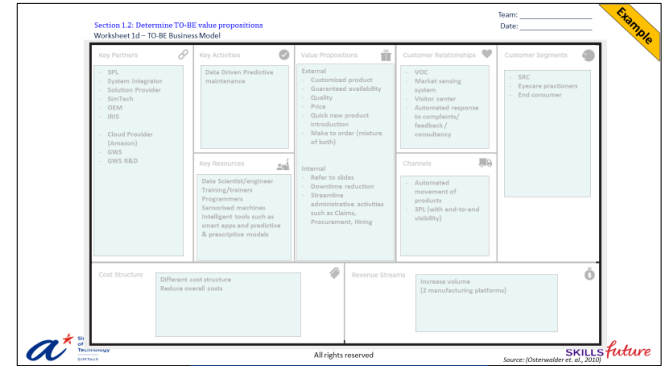
BUSINESS STRATEGY & OBJECTIVES



- 1.1 Determine AS-IS business model
- 1.2 Determine TO-BE value propositions
- 1.3 Review competitive gaps
- 1.4 Determine business objectives



Business Model 4-D Challenges



To-Be Business Model

Section 1.4: Determine business objectives
Worksheet 1c - Business Objectives, Measures and Targets

Team: _____
Date: _____

#	Business Objectives	Measure	Target (Year)	
			As-Is (2020)	To-Be (est. 2024)
A	Reduce Total Production Cost (TPC)	TPC %	100%	30%
B	Increase Overall Equipment Efficiency (OEE)	OEE %	37%	75%
C	Increase Labour Productivity	Unit / FTE (Number)	100%	120%
D	Reduce Inventory Level	Cost (\$)	100%	80%

SKILLSfuture

Business Objectives

Digital Transformation - DTI Methodology



CREATING GROWTH, ENHANCING LIVES

Review

2. Understand

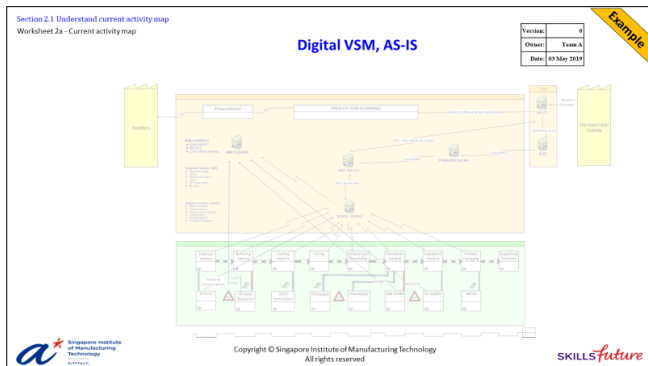
ACTIVITY LANDSCAPE & SYSTEM ARCHITECTURE



2.1 Understand current activity map (VSM/SB)

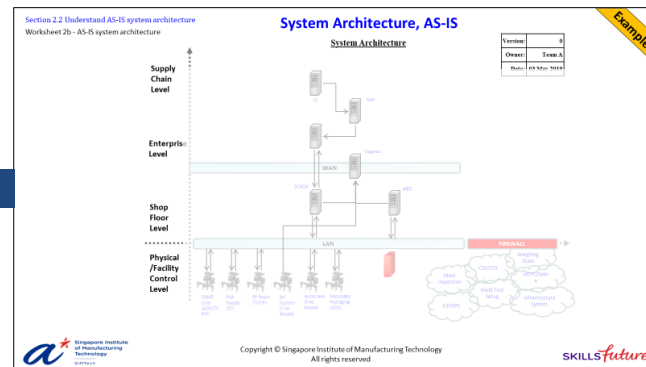
2.2 Understand AS-IS system architecture

2.3 Index AS-IS digital maturity



As-Is Digital Value Stream Map

As-Is System Architecture



Digital Transformation - DTI Methodology



CREATING GROWTH, ENHANCING LIVES

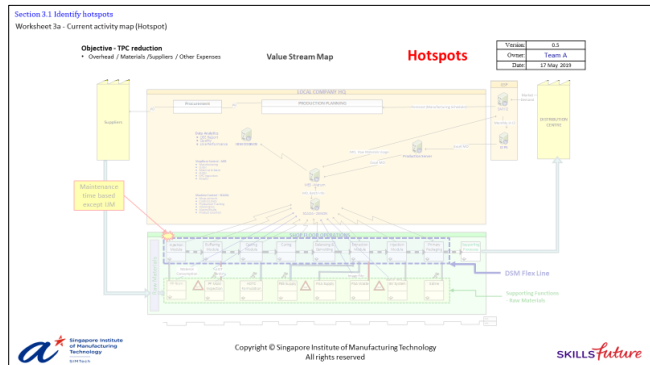
Review

3. Identify

TRANSFORMATION AREAS

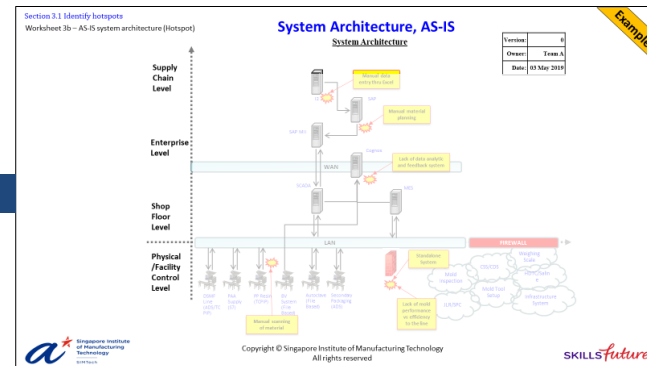
3.1 Identify hotspots

3.2 Identify transformation areas



As-Is Digital Value Stream Map Hotspots

As-Is System Architecture Hotspots



Digital Transformation - DTI Methodology



CREATING GROWTH, ENHANCING LIVES

Refine

4. Generate INITIATIVES, NEW ACTIVITY LANDSCAPE, & SMART ARCHITECTURE



- 4.1 Generate initiatives
- 4.2 Generate future activity map (VSM/SB)
- 4.3 Generate (SMART) TO-BE system architecture
- 4.4 Index TO-BE digital maturity
- 4.5 Generate TO-BE business model

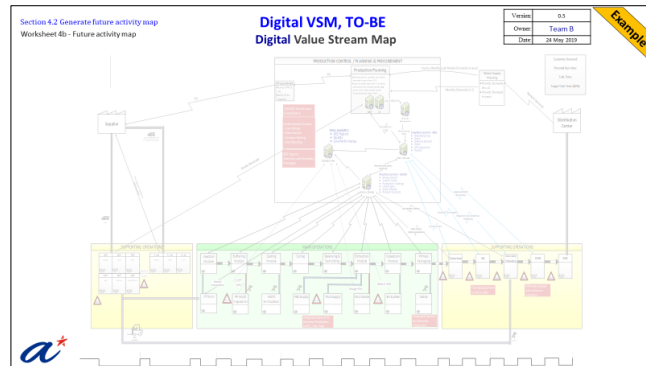
Section 4.1 Generate Initiatives
Worksheet 4a - Alignment between business objectives and initiatives

Team: Team A
Date: 24 May 2019

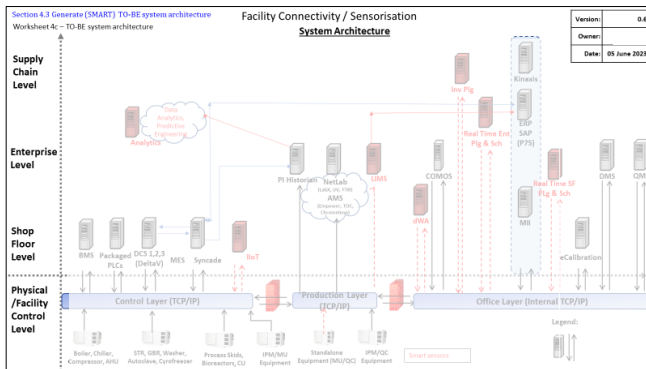
ID	Initiatives	Transformation Area	Business Objectives				Key Considerations		
			#1	#2	#3	#4	Potential Improvement Gains	Estimate Duration of Implementation	Cost
1	Predictive Maintenance (Flux prod. main system (no AMI, process))	SF Connectivity	XXX	XX	XX		Cost Saving on parts OEE Quality	6 to 12 mths	
2	RFID	SF Connectivity			XXX		Labour productivity Volume of data entry		
3	OEE	SF Connectivity	XXX	X	XX		Output, reduce waste, PFG Productivity, ROI		
4	SMART MOM (auto scheduling, 5s with schedule, in-2 to operation and conditions and measurements and auto schedule)	Ext Connectivity	X		XX	XXX	Labour productivity, capacity utilization, inventory loading		
5	Inventory Planning System	Ext connectivity	XXX		X		Cash Flow		
6	Dashboard/WiA 5i data	SF Connectivity	XX	X	X	XX	Direct & timely response to issues Minor connect E&E	6 to 12 months	

Note: "X" = Relevant, "XX" = Important, "XXX" = Very Important
Copyright © Singapore Institute of Manufacturing Technology
All rights reserved

Strategic Initiatives



To-Be Digital Value Stream Map



To-Be System Architecture Hotspots

Digital Transformation - DTI Methodology



CREATING GROWTH, ENHANCING LIVES

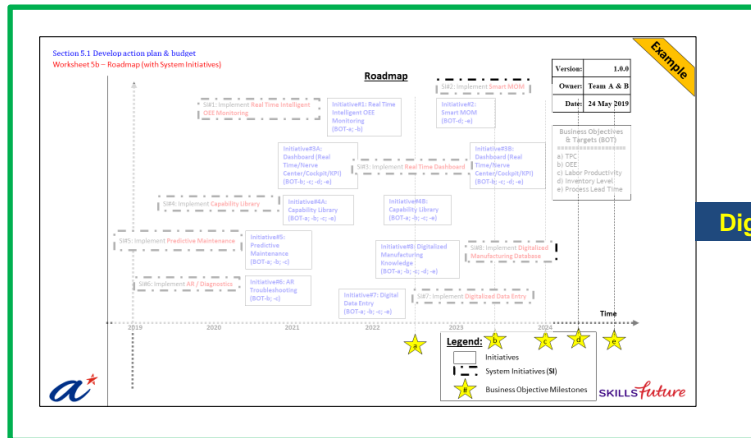
Recreate

5. Develop

ACTION PLAN



5.1 Develop action plan and budgets
5.2 Track performance (business target + digital maturity)



Re-prioritised Road Map

Digital Transformation Road Map

Initiative Visual Management

Section 5.2 Track performance
Worksheet 5c - Initiative Visual Management

Team: Team A
Date: 24 May 2019

#	Initiatives	Business Objectives & Targets	Initiative Lead	Improvement Measure			Start Date	End Date	Saving \$ ('000)	Investment \$ ('000)	ROI (Years)
				Before	After (Est)	% ↑					
1	Real Time Intelligent Mfg (Data Analytics)	Reduce Total Production Cost (TPC) Increase OEE		V13 TPC: 100% V12 TPC: 100% V11 OEE: 37%	V14 TPC: 95% V13 TPC: 90% V12 OEE: 55%	V15 TPC: 9% V14 TPC: 40% V13 OEE: 18%	2019	2022	\$718K	\$2024	< 1 Year
2	SMART MOM (Real Time Planning & Scheduling / Inventory Planning)	Reduce Inventory Level Target: 800k by Q4/24		100%	80%	20%	2020	2024	Optimized Inventory	\$160K	N.A.
3	Dashboard (Real Time Status Center / KPI / Knowledge)	Increase Labor Productivity Target: 100k / PTE Reduce Inventory Level		100%	100%	20%	2019	2022	N.A.	\$240K	N.A.
4	Capability Library (Skill Awareness / Mindset)	Increase Labor Productivity Target: 100k / PTE (N) Reduce Inventory Level		100%	100%	20%	2019	2022	N.A.	N.A.	N.A.

Copyright © Singapore Institute of Manufacturing Technology
All rights reserved

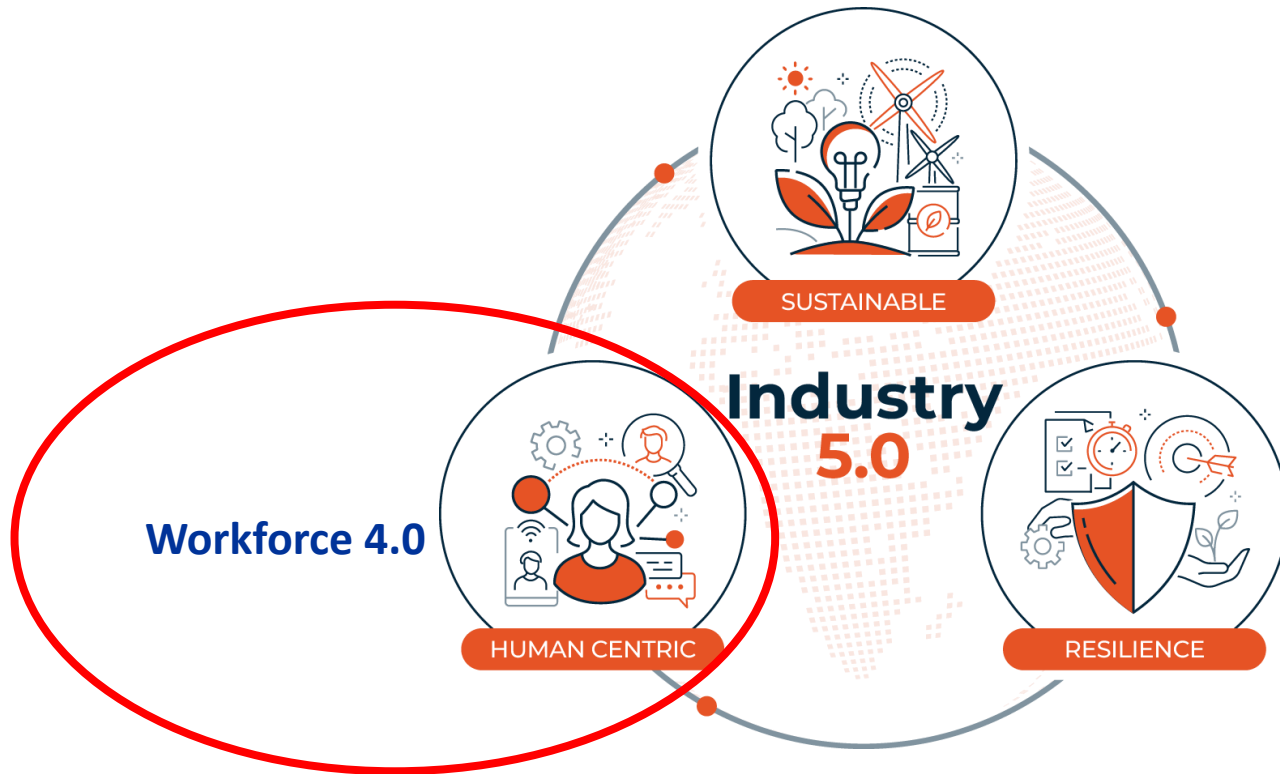
People Development

A*STAR – SIMTech DTI Methodology

The Future of Manufacturing

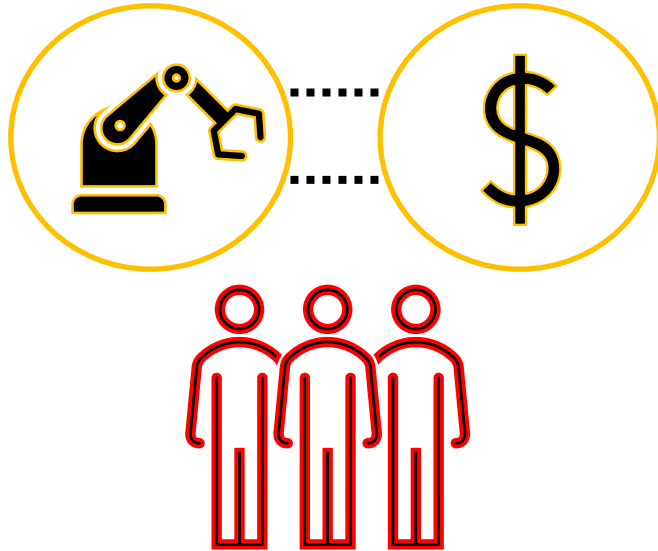


CREATING GROWTH, ENHANCING LIVES



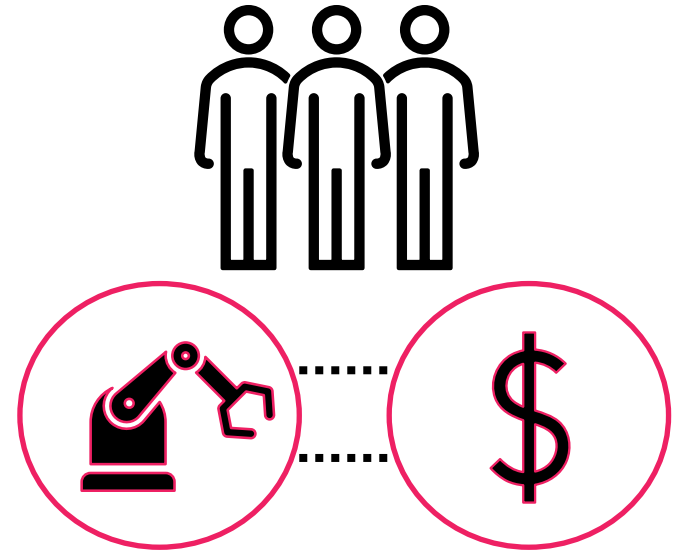
Transition of Industry 4.0 to Industry 5.0

Industry 4.0



Human Capital **IS NOT** a Core Value

Human Capital **IS** a Core Value



Industry 5.0

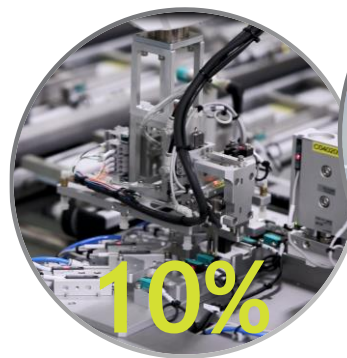
Benefits of Industry 5.0



Source: PROACTION INTERNATIONAL + UTrakk



Digital Transformation **Goes Beyond** Technology



Technology



**Processes &
Operating Model**

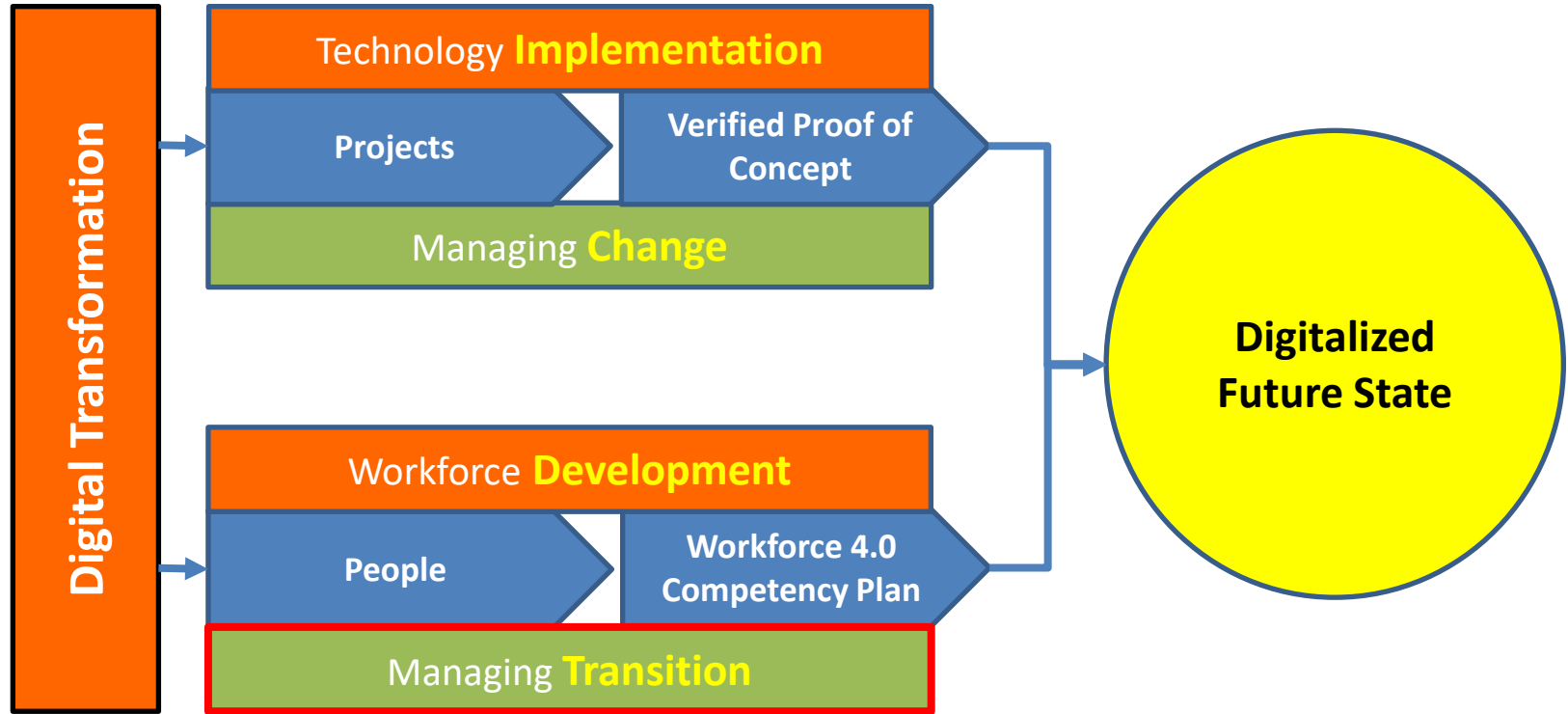


**People &
Skills**

Source: from BCG



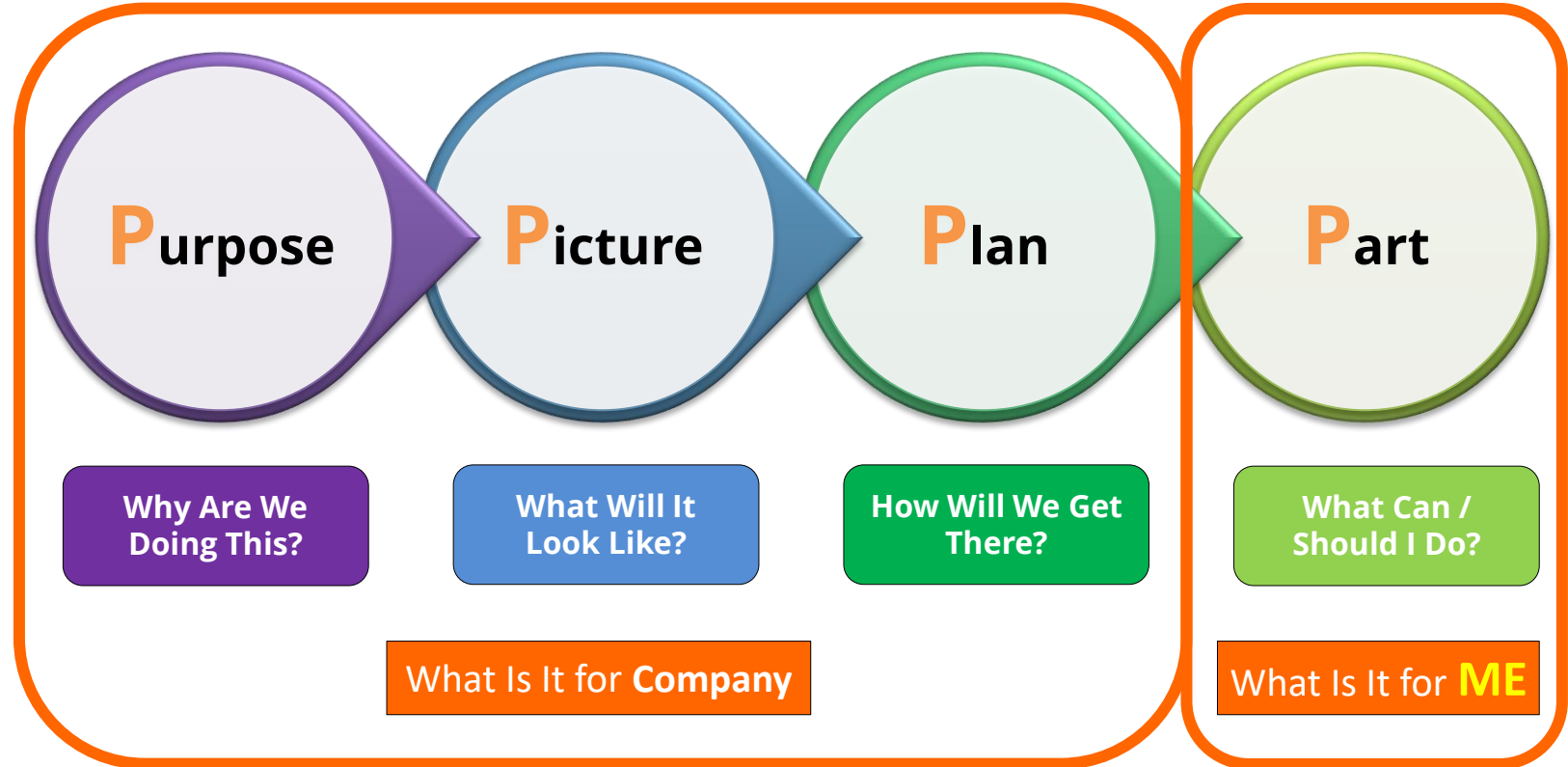
Digital Transformation Overview



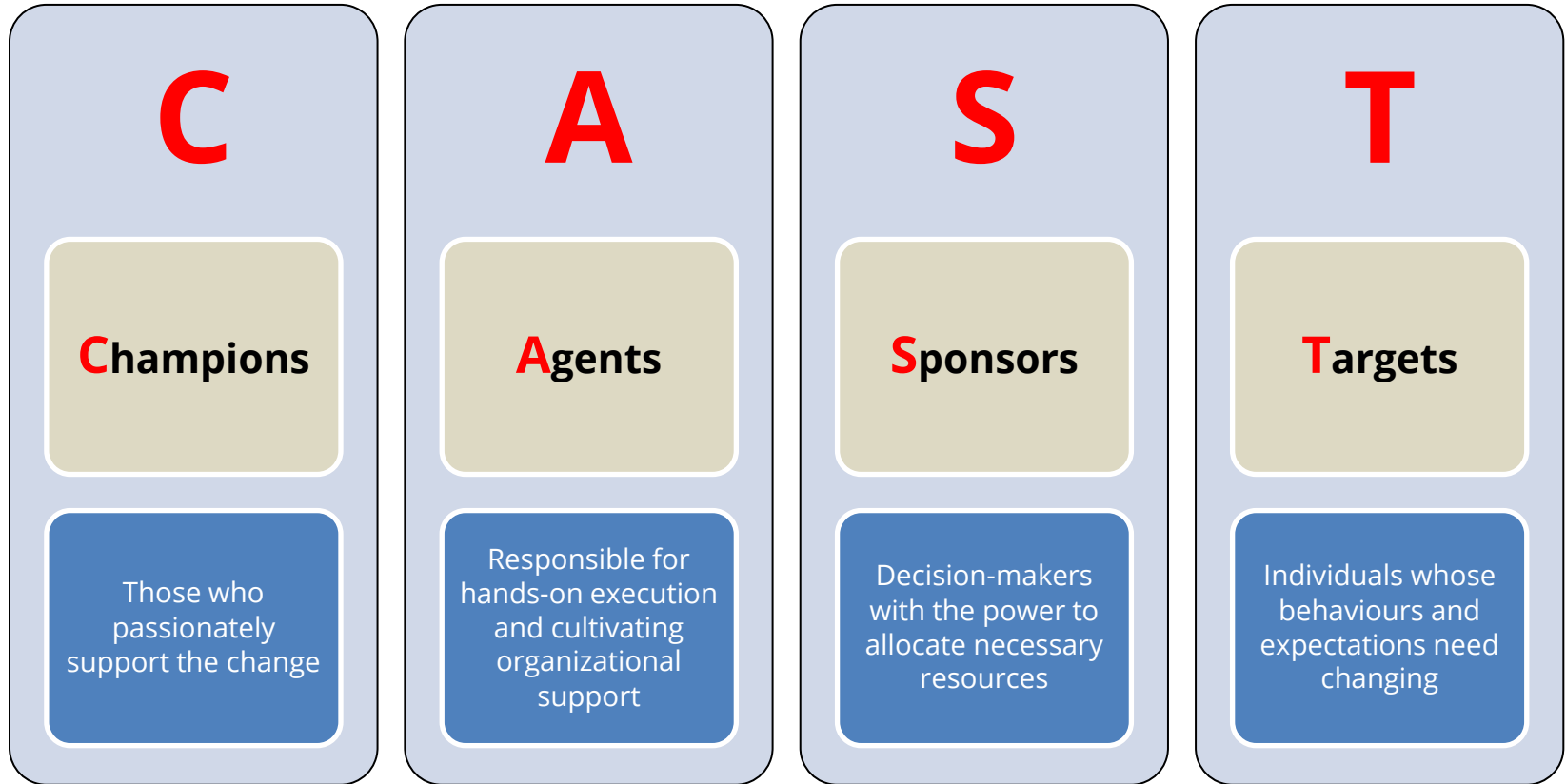
Managing Transition For Digital Transformation



4 P's for Managing Transition



4 P's for Managing Transition - The C.A.S.T



Workforce 4.0 Capability Development



PEOPLE Development – Workforce of the Future



CREATING GROWTH, ENHANCING LIVES



System Design on Workforce 4.0



CREATING GROWTH, ENHANCING LIVES

Digital Technology / System

System Design Specification

Define New Ways of Working

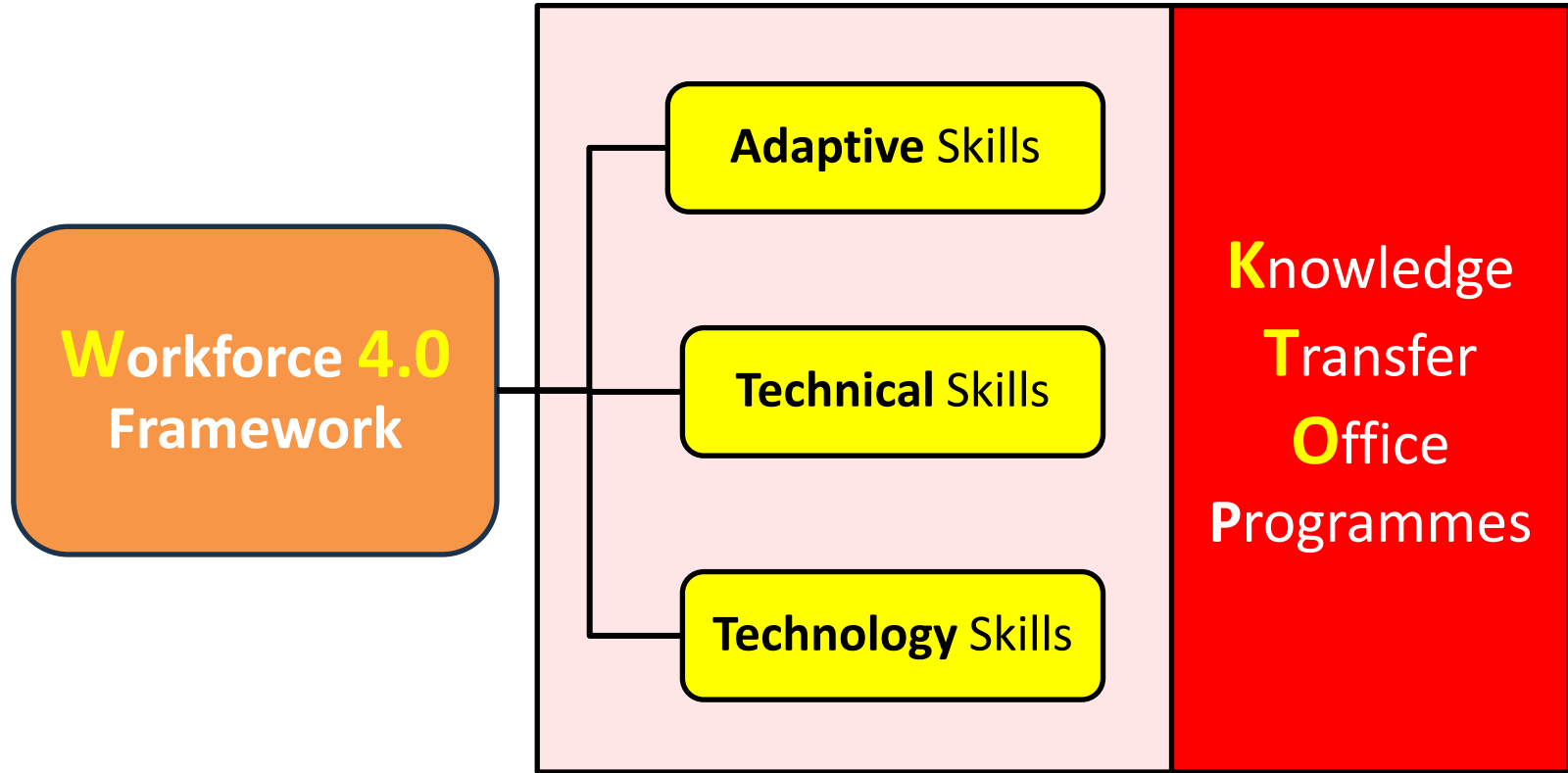
Identify Impacted Job Roles

Determine Task Gaps in Job Roles

Perform Training Needs Analysis

Compile Workforce 4.0 Competency Library

Competency Development of Workforce 4.0



1

Enterprise-Level Transformation

- Operation Excellence
- Business Transformation
- New Product Innovation

Cascading enterprise plan & priorities down to people development / upskilling focus

2

Technology / Capability Deep Dive

- Digital Manufacturing
- Industrial Sustainability
- Product Design & Solutioning
- Industrial Automation
- Precision Measurements & Characterisation
- Mechatronics
- Additive Manufacturing
- Advanced Welding
- Advanced Surface Engineering

Target Audience:

- C-Suite
- Management Team
- Change Makers (e.g. Productivity Champions, Digital Champions, etc)

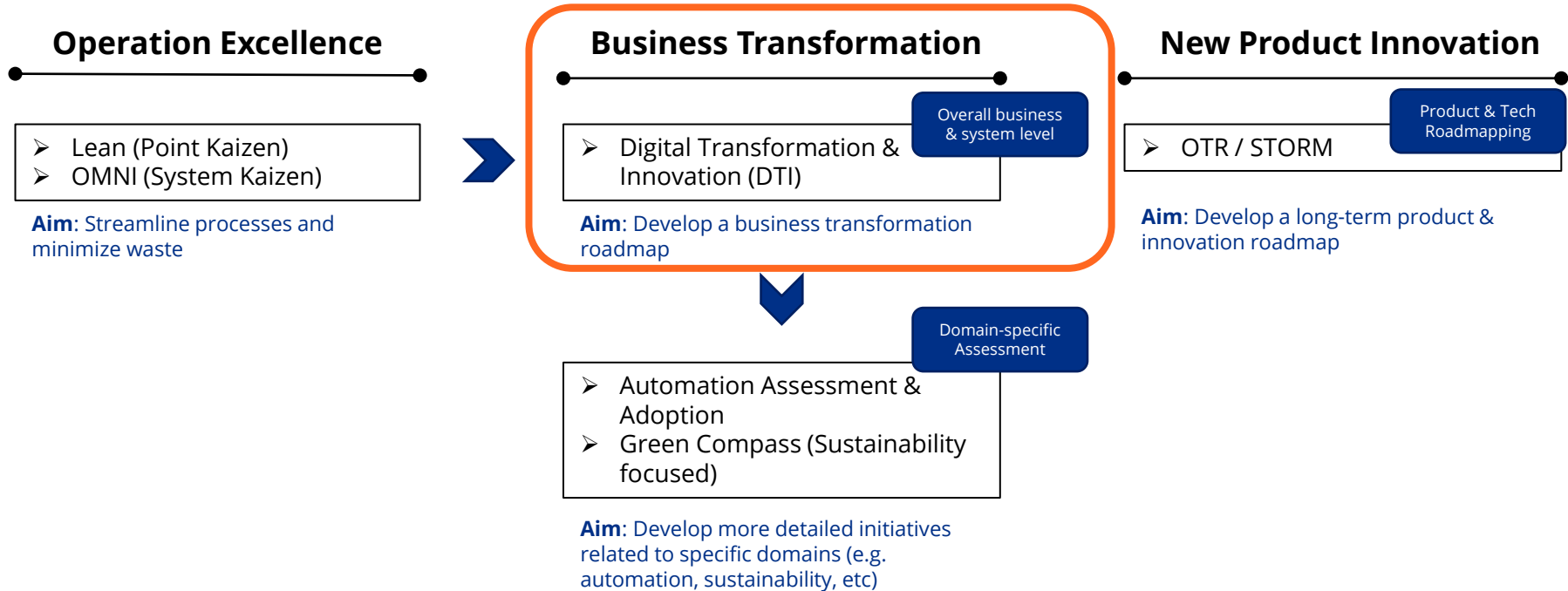
Target Audience:

- Management Team
- Change Makers (e.g. Productivity Champions, Digital Champions, etc)
- Tech / Capability Users (e.g. Engineers, Specialists, Supervisors, etc)

1. Enterprise-Level Transformation

Adaptive Skills

Knowledge
Transfer
Office



2. Technology / Capability Deep Dive

Technology/Technical Skills

Knowledge
Transfer
Office

Digital Manufacturing

- Connectivity for Visibility & Decision Making
- Data Mining
- Real-Time OEE
- Predictive Maintenance
- Improve Quality Monitoring and Management Through Digitalisation

Shopfloor
Planning
Tools

- Digitalisation of Business Process Workflow
- Production Planning & Scheduling
- Inventory Management

Enterprise
Planning
Tools

- Machine Learning for Supply Chain Analytics & Operations

Supply Chain
Planning
Tools

Industrial Sustainability

- Carbon Footprinting through Life Cycle Assessment
- Smart Energy Management for Sustainability
- Smart Waste Management for Sustainability
- Design for Sustainability

Sustainability
Tools

Product Design & Solutioning

- Understand Design Thinking
- Apply Design Thinking
- Product Design Innovation & Fabrication

Product
design &
prototyping

... and **Many More!**

Industrial Automation

- Apply Robotics for Manufacturing Automation
- Automation Components and Systems for Advanced Manufacturing
- Control in Automation Systems
- Automation Design and Simulation

In-depth understanding
of automation solutions

Precision Measurements & Characterisation

- Engineering Optics and Optical Measurements
- Dimensional Measurements and Metrology
- Materials Characterisation



Business

KPI = ~~Key Performance Indicator~~

Keep **P**eople Interested

Keep **P**eople Informed

Keep **P**eople Involved

Keep **P**eople Inspired

Safeguarding Your People

Enable

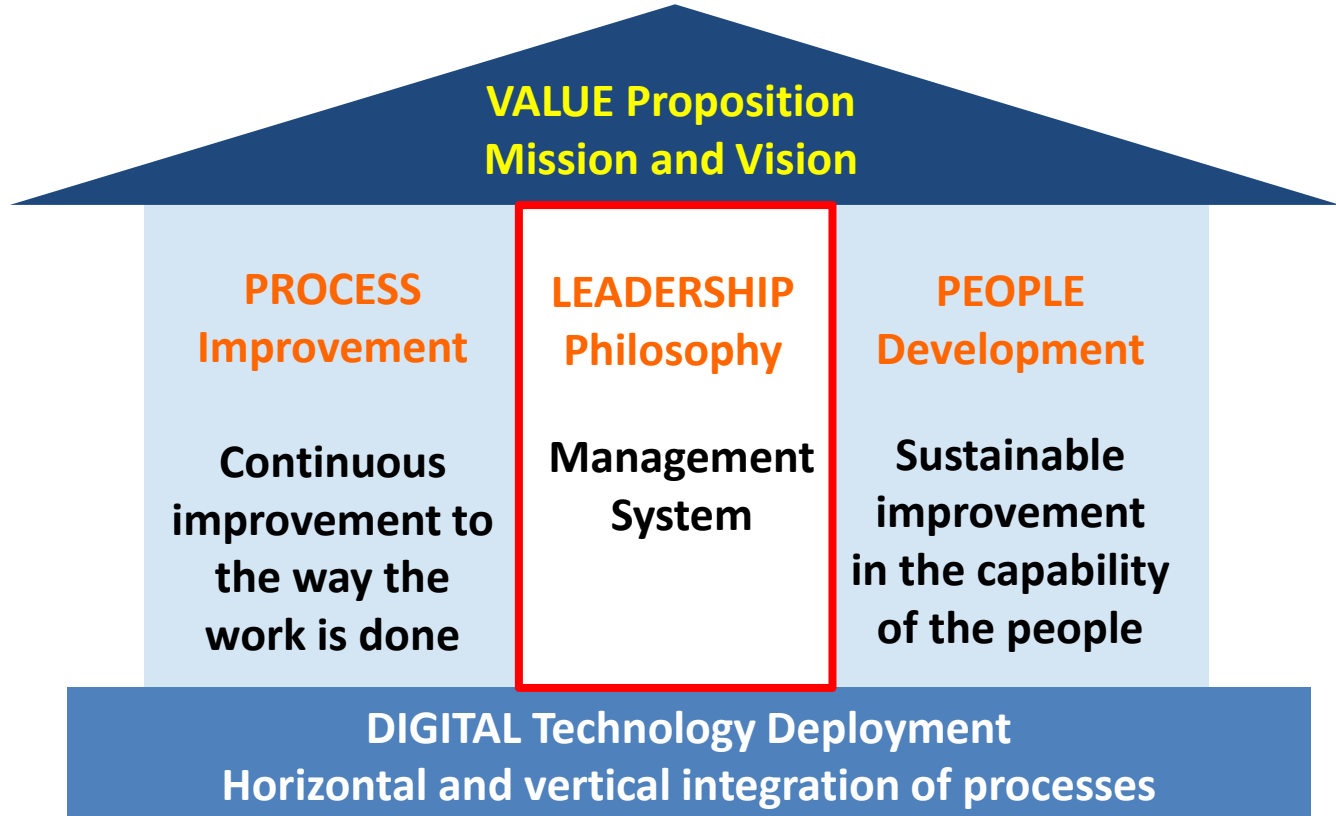
Empower

Engage

CREATING GROWTH, ENHANCING LIVES



5 Pillars of Digital Transformation





Envision **T**he **F**uture

Create **Y**our **P**lan

Lead **T**he **C**hange



Final Thoughts

Not **WHAT** But **HOW**

Not **KNOWING** But **DOING**

Not **THEM** But **ME**



Essence of Fool-proofing Human Capital



Systems Complement
Human for Optimal Synergy

CREATING GROWTH, ENHANCING LIVES





CREATING GROWTH, ENHANCING LIVES

Make An Appointment



Thank You!