Singapore Institute of Manufacturing Technology
SIMTech

for Industry

INNOVATION FACTORY
JUN 2020

Mission

To support SMEs from ideation to design and engineering stage, and migrate them to product owners in order to venture into higher value markets.

Vision

The one-stop design and solution centre for Singapore SMEs.

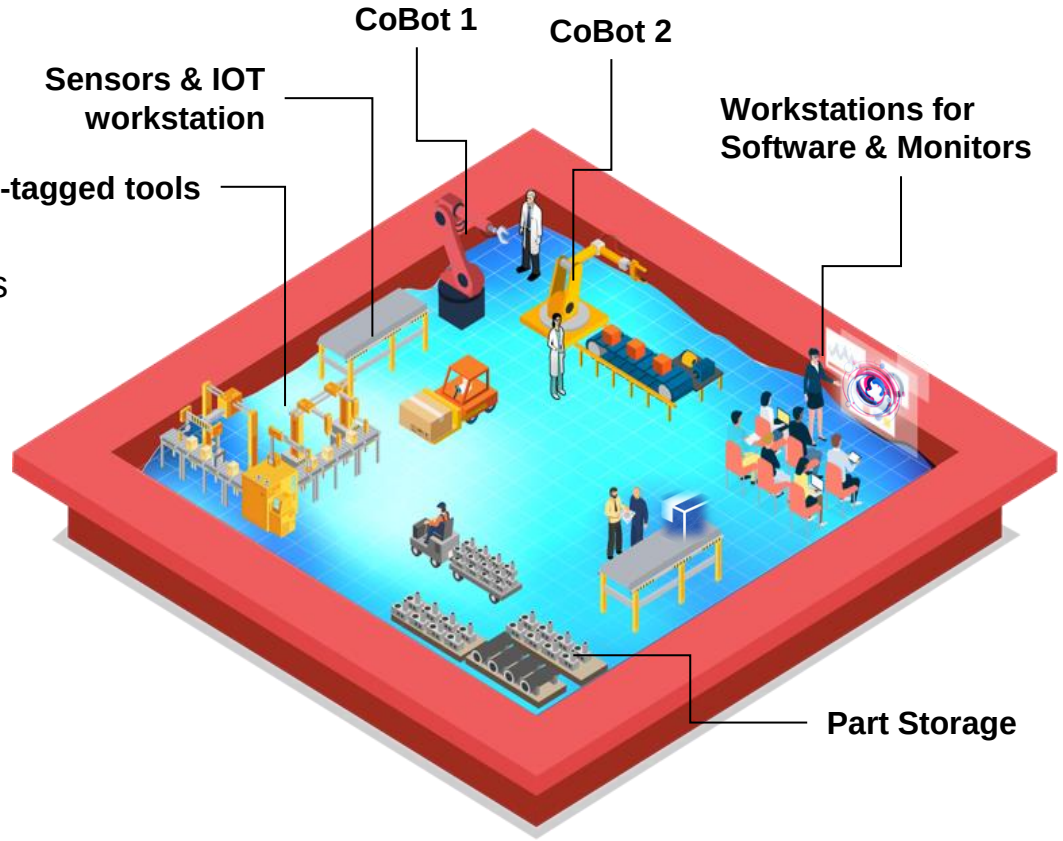
Objectives and Intent of the Innovation Factory

Objectives
- To **plug** the current gaps in companies looking to develop new products
- **Catalyse** innovative design and **Scale up** to Pilot production

Target Group
- Product and Equipment Distributors
- Companies curated via Operational & Technology Roadmap (OTR) process
- PE company aspiring to be an Original Device Manufacturer (ODM)
- 2nd generation SME owners who plan to branch into new areas
- **Lifestyle and consumer products companies**

Value Capture
- Enable local SMEs to move up the value chain and broaden business opportunities
- Migrate SMEs from component / module manufacturer to product owner
- Form network of hardware & software companies to co-develop product

Differentiators
- Enable SMEs to 'Fish' (from Ideation to Pilot Production) via the Product Development journeys



The Innovation Factory

Singapore Institute of Manufacturing Technology
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IDEA Model

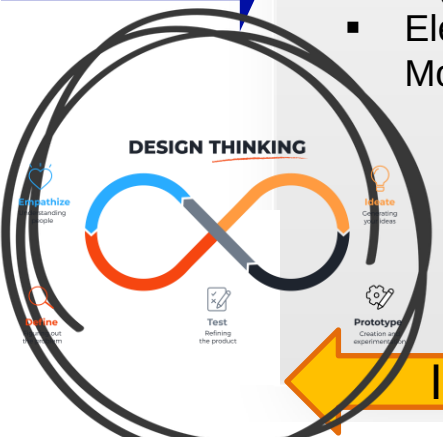
Target Companies

- Product & Equipment Distributors
- OTR Companies
- PE Companies
- 2nd Generation Owners

Stage 1 IDEATION

Ideation Journey Program

- Creating an ecosystem with application of **Design Thinking** methodologies
- Exchange of ideas between SMEs, start-ups, end-users and technology providers
- Design Bootcamp
- Focus Areas:
  - Equipment Design
  - MedTech Devices
  - Digital Solutioning
  - Electromechanical Modules



Start Design Thinking early

Stage 2 DESIGN

Design Journey Program

Companies can tap on:

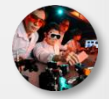
- Advanced Product & Engineering design
- New Product Prototype
- Open Source Software
- Ready-to-Go solutions
- Network of Designers & Consultants
- Software Programming

Stage 3 ENGINEERING

Engineering Journey Program

Access pool of experts & equipment for prototyping:

- Robotics
- Additive Manufacturing
- AI, Sensors & IoT
- Vision & Inspection
- Advanced Materials
- AR, VR, Simulation



SCIENCE AND ENGINEERING RESEARCH COUNCIL

BIOMEDICAL RESEARCH COUNCIL

MPTC Manufacturing Productivity Technology Centre
Enhancing Manufacturing Productivity

PE COI Precision Engineering Centre Of Innovation
Sustaining and Advancing PE Industry

SMC Sustainable Manufacturing Centre
Embracing Sustainable Manufacturing

EAC Emerging Applications Centre
Seeding and Growing Emerging Industries

Stage 4 APPLICATION

Scale-up to Pilot production program

- Assist SMEs to set up Pilot Production line
- Model Factory Digital Solutioning
- Product / Module Performance Validation and Assessment

Model factory@SIMTech

MODEL FACTORY @ ARTC

Innovation Labs to address today's Gap[3]

Innovating with A*STAR RIs

Collaboration with COIs and Larger Ecosystem

Target Companies

Distributors
OTR Companies
PE Companies
2nd Owners

TACs

SPETA
Singapore Manufacturing Federation
SME Centre@SMCCI
SME Centre@SMF
SME Centre@SCCCI
SME Centre@ASME
SME Centre@SICCI

Innovation Factory

1. Provide Design Thinking, human-centered consulting
2. First stage project filtering (Go/~~No Go~~)
3. Leverage on the network of **COIs**, RIs, IHLs for R&D consulting, **train** new talents, job redesign
4. Coordination & Link up with design companies
5. Outsource projects to successful time-to-market;

Market

Productisation
Co-ordinate, manage and perform product focused design and development activities to transform ideas into market ready products/

Outsource Projects to Design Partners

UXC user experience centre
AGENCY
chemistry
STUCK
ThinkPlace
DESIGN SOJOURN
designinsight
ideactio
we are perspective
orcadesign
XENTIQ

AVNET Reach Further
DK engineering
Hdesign
SYNERGY DESIGN SOLUTIONS
opulent
L&T Technology Services
Aztech

Partner COIs and Research Performers

SG:D OPEN INNOVATION PLATFORM
SIM

- SIMTech Precision Engineering COI
- IMRE Materials COI

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
EcoLabs COI for Energy

SINGAPORE POLYTECHNIC SP
Food Innovation Resource Centre

Temasek POLYTECHNIC

- Aquaculture Innovation Centre
- COI for Complementary Health Products

NYP NANYANG POLYTECHNIC
Centre of Innovation for Electronics & IoT (COI-EIoT)

REPUBLIC POLYTECHNIC DISCOVER. TRANSFORM. ACHIEVE
COI for Supply Chain Management (COI-SCM)

NGEE ANN POLYTECHNIC

- Environmental and Water Technology
- Marine and Offshore Technology

SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN
SIT SINGAPORE INSTITUTE OF TECHNOLOGY
NUS National University of Singapore

Industry

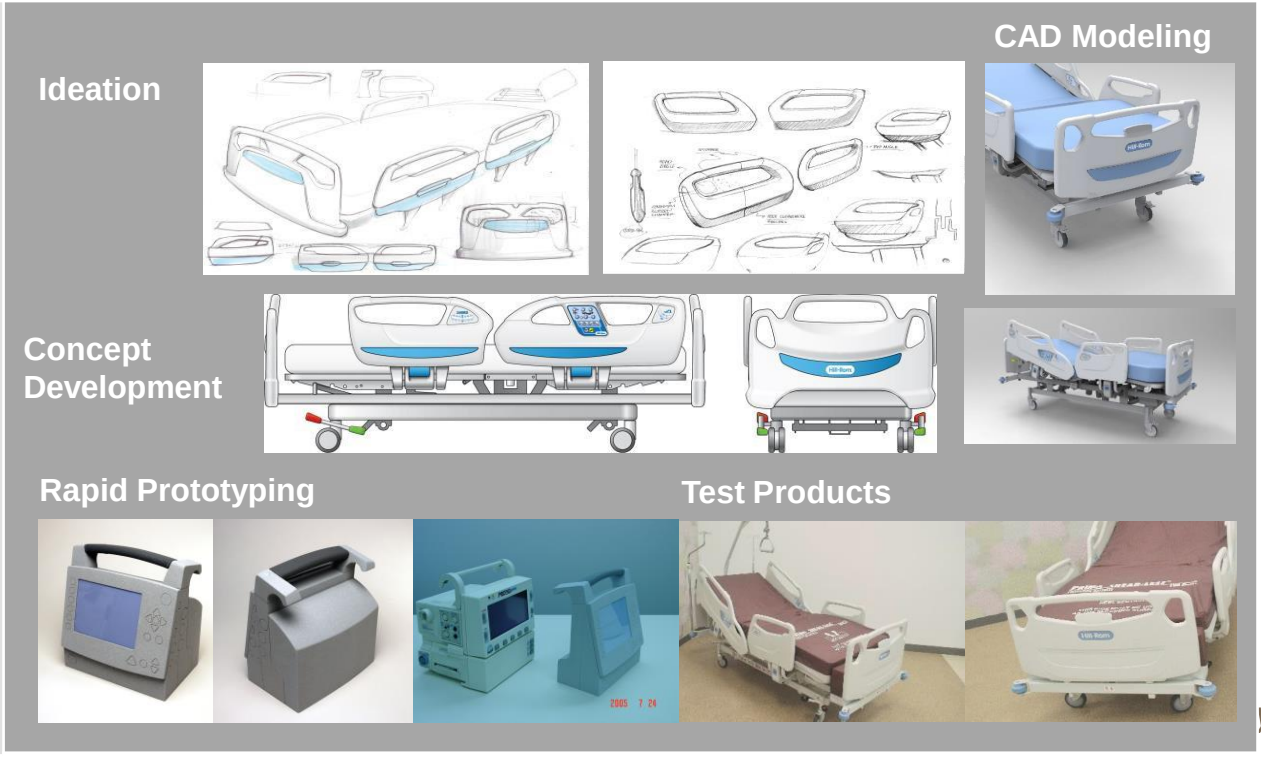
How IF support Design Thinking?

DESIGN RESEARCH
Study the real challenges that users are facing using descriptive or exploratory research methods.

Define the problem statement, unearth issues and unmet needs.

TRANSLATE
Use different types of data analysis tools to study the collected data, translate the findings into design direction that could generate high value propositions.

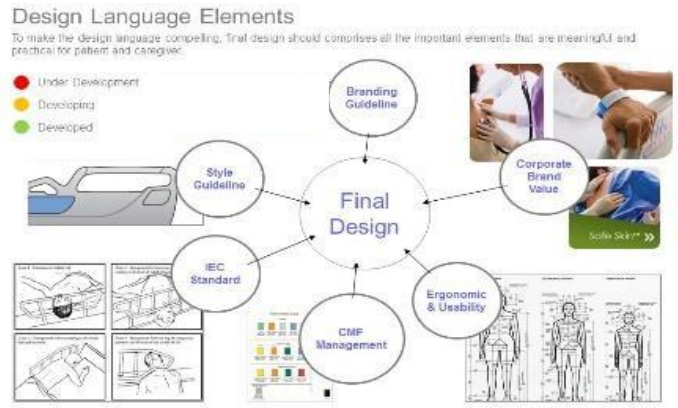
CONCEPT
No idea is bad idea, concepts were explored and developed in early phase, build prototypes rapidly for quick tests to proof the concept and validate the value proposition.

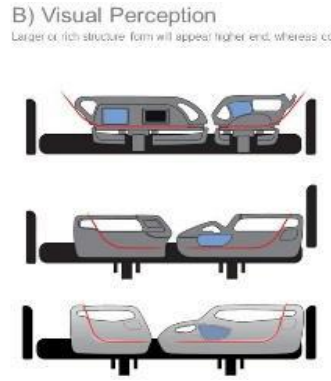


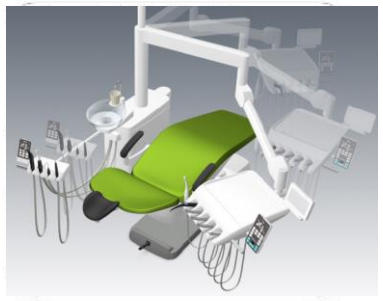
Innovation Factory Consultancy in Design Thinking

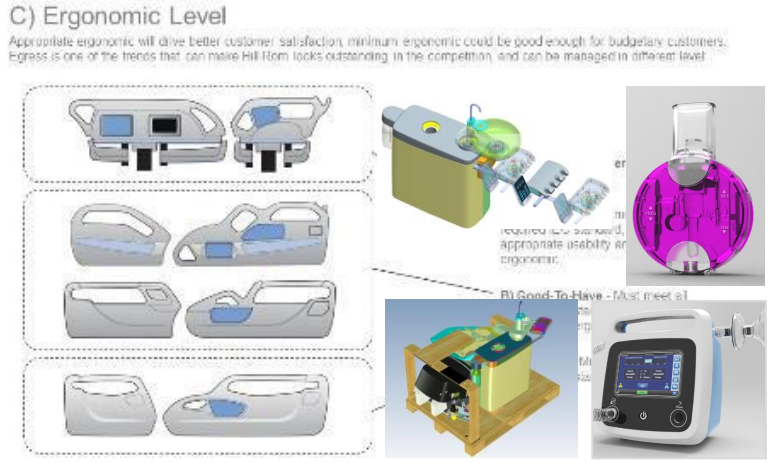
Value of our approach

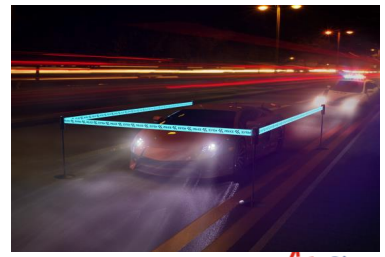
During the consultancy process, all the key design elements such as **design language, CMF, UX/UI, branding**, and relevant design or quality standards will be carefully implemented and refined rigorously.	Design Language	▪ Branding and style guidelines ▪ Corporate brand value ▪ Ergonomic, Usability ▪ CMF management
	Styling Tiers	▪ Primary ▪ Universal ▪ Specialized ▪ Functional
	Visual Perception UX UI	▪ Critical model ▪ Versatile model ▪ Primary model
	Ergonomics	▪ Low risk ▪ Good to have ▪ Baseline
	Color and Finishes	▪ Corporate theme with composition ▪ Non-corporate
	Design and Quality Standards	

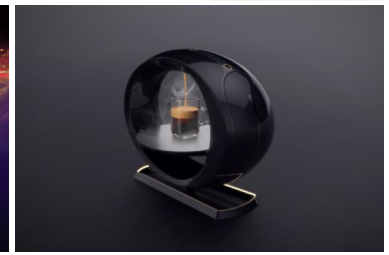












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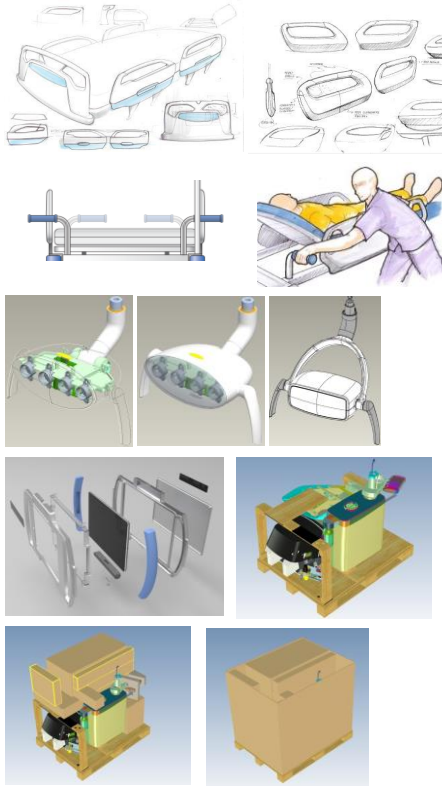
Building Design Capabilities to narrow Market Gaps

PDP | Product & Industrial Design | Technology R&D/ Adoption / Product engineering | Prototype | Design Verification | DFM/ Clinical Validation | Tooling | Mass Production | Market Entry

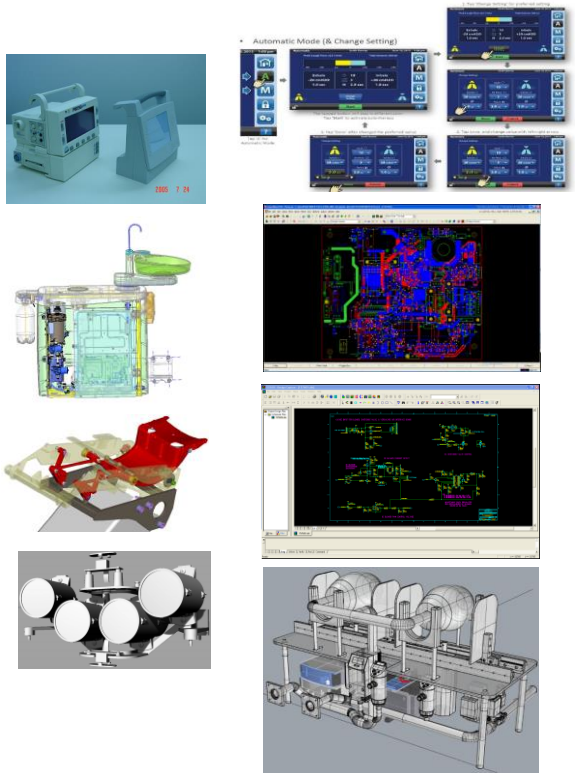
KeyShot KeyVR Rhinoceros

- Rhino 3D
- Adobe Creative Cloud, Photoshop, Illustrator
- Luxion KeyShot 3D photorealistic



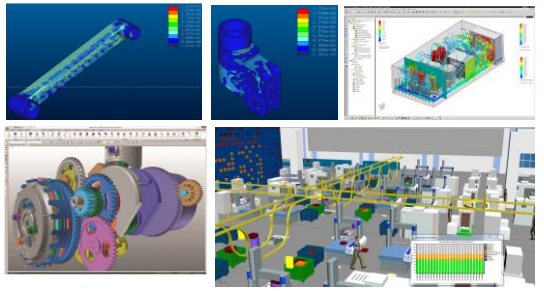
LTspice STM32Cube ARDUINO ALTIUM DESIGNER20 KEIL Tools by ARM AUTODESK EAGLE PADS Micrium Windows Embedded Compact python THREADX SOLIDWORKS SIEMENS NX creo Solid Edge

- 3D concepts
- Go-To-Market Strategy
- R&D (EE, ME, SW)
- Design Reviews

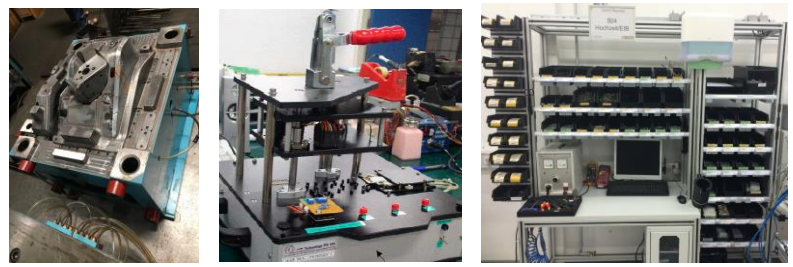


Simcenter COMSOL Ansys MATLAB LabVIEW RECURDYN

- Mold flow analysis
- Simulation (Vibration, Frequency, Buckling, Thermal, Drop Test, topology optimisation, non-linear materials, large deformations)
- Pipe, tube, duct and wire routing
- Environmental Impact Analysis
- Structural part and assembly analysis
- Advanced surface flattening
- Advanced motion simulation
- Advanced stress simulation



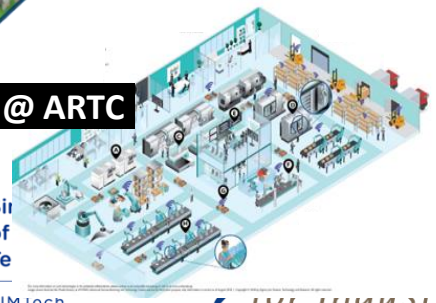
- Blow Moulding
- 2k Injection Moulding
- ODM
- CM
- Finished goods
- Shipment
- Logistics
- Product Lifecycle management
- Lessons learned



Model Factory@SIMTech

Singapore Institute of Manufacturing Technology SIMTech

MODEL FACTORY @ ARTC



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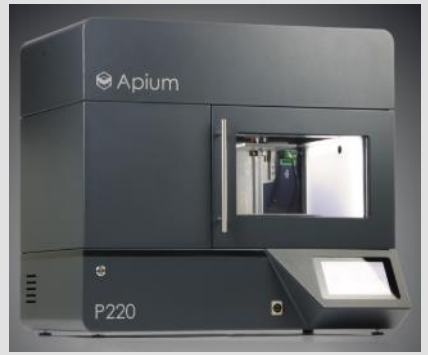
Innovation Factory Build Lab Facilities and Services

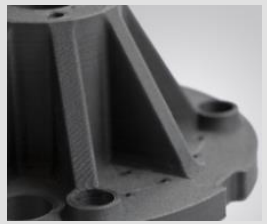
Markforged X7 Continuous carbon fiber

- Fused filament fabrication, Continuous Filament Fabrication
- Top-of-the-line industrial grade platform with strengthened dual nozzle print system that supports **Continuous Carbon Fiber** and **Kevlar** reinforcement.
- Build Volume **330 mm x 270 mm x 200 mm**
- Layer Height 50 µm
- Onyx, Onyx FR, Nylon White Fibers, Carbon fiber, fiberglass, Kevlar®, HSHT fiberglass
- Tensile Strength **800 MPa** (25.8x ABS, 22.2x Onyx)
- Flex Modulus **51 GPa** (24.8x ABS, 14.2x Onyx) *

Metal X Metal 3D

- Atomic Diffusion Additive Manufacturing (ADAM)
- Top-of-the-line industrial grade **metal** printing platform featuring 17-4 PH Stainless Steel PH, Tool Steel, Inconel 625 and Copper materials.
- Build Volume **300 x 220 x 180 mm** (11.8 x 8.7 x 7.1 in)
- Max Post-Sinter Part Size 188 x 54 x 52 mm
- Metal material with ceramic release layer
- Layer height 125 µm and 50 µm, post-sinter





3DP Apium P220

- Material extrusion 3D printer
- supports a wide variety of amorphous and semi-crystalline thermoplastics from **ABS, PP, PVDF, PEI, PEEK, Carbon Fiber Reinforced PEEK** to metal containing compounds such as Stainless Steel (316L)
- Build Size **205 x 155 x 150 mm**
- Layer Thicknesses 0.05 – 0.6 mm
- Wall Thickness > 250 µm
- Noise Emission < 55 dB(A)

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Stage 2
DESIGN

Innovation Factory Collaboration with Design Houses

Scope of Design Services

NPD	Scope	Design Activities	Tools and Deliverables
Transform the finalized design concept into design for manufacturability, cost- effective and reliable product throughout the established product development process. Proposed designs will be reviewed in an iterative manner at every stage to ensure technical problems are solved without compromise the design requirements. Continual refinement of ideation sketches, detail design drawing, 3D CAD modeling and rapid prototyping within the planned project timeline will transform the fuzzy frontend and early thoughts into a high quality and attractive product.	General	▪ Requirement Management ▪ Defect Tracking ▪ GTM strategy ▪ Test Management ▪ Document Control ▪ Project Management	windchill®, PLM Software SIEMENS NX, IBM Rational DOORS Next Generation, IBM Rational ClearCase, ClearQuest
	1.0 Industrial Design	▪ As previous slides on Phase 1	▪ Rhino 3D ▪ Adobe Creative Cloud ▪ Luxion KeyShot 3D Photorealistic Rendering KeyShot, KeyVR, Rhinoceros
	1.1 Electrical Design	▪ 8/16/32 bit processors ▪ Motor controls, robotics ▪ Analog and Digital ▪ Power mgt. ▪ Audio and video ▪ PCB Design ▪ Simulation ▪ Programmable Logic	▪ Linear Tech LTSpice ▪ Keil ▪ STMCube ▪ Code Composer ▪ Arduino LTspice, KEIL Tools by ARM, STM32 Cube, ARDUINO
	1.2 Schematics and PCB Design		▪ Mentor Graphics ▪ Altium Designer ▪ Autodesk Eagle ▪ DDS Circuit Works, Part Libraries PADS®, ALTIUM DESIGNER20, AUTODESK EAGLE

Stage 2
DESIGN

Innovation Factory Collaboration with Design Houses

Scope of Design Services

NPD	Scope	Design Activities	Tools and Deliverables
Transform the finalized design concept into design for manufacturability, cost-effective and reliable product throughout the established product development process. Proposed designs will be reviewed in an iterative manner at every stage to ensure technical problems are solved without compromise the design requirements. Continual refinement of ideation sketches, detail design drawing, 3D CAD modeling and rapid prototyping within the planned project timeline will transform the fuzzy frontend and early thoughts into a high quality and attractive product.	1.3 Embedded software design	▪ Coding/Editing ▪ Compiler ▪ Debugging ▪ Defect Management ▪ Automated Tests ▪ Code analysis ▪ Version control ▪ Code generation ▪ Database management ▪ Packaging	Windows Embedded Compact python THREADX ▪ C/C++ language ▪ ThreadX ▪ Micrium OS ▪ Win CE OS ▪ Raspbian Micrium Embedded Software Raspbian Java ▪ System/Server software ▪ Multithreaded server-based software using C# and the Microsoft .NET Framework ▪ C# application software using Microsoft .NET Compact Framework

Stage 2
DESIGN

Innovation Factory Collaboration with Design Houses

Scope of Design Services

NPD	Scope	Design Activities	Tools and Deliverables
	1.4 Mechanical Design (Packaging, Plastics, electronics packaging with metal work)	▪ Geometric Dimensioning and Tolerancing ▪ Data import and reuse ▪ Advanced 3D part and assembly design ▪ **AR** and export to third party AR/VR/MR ▪ Sheet metal design ▪ Design for cost ▪ Frame & weldment design ▪ Surface modelling and Plastic part design ▪ Jig & fixture design ▪ Conceptual assembly layout ▪ Cam and Gear design ▪ Pulley & shaft, Spring design ▪ Beam & column design ▪ Electrical routing ▪ PCB collaboration ▪ Pipe and tube routing	▪ Automated 2D drawings ▪ Standard parts library (includes machinery content) ▪ Animation and Advanced photorealistic rendering ▪ IFC import & export for Building Information Modelling **(BIM)** ▪ Mesh data reuse (Convergent Modelling) ▪ Reverse engineering (3D scanning) ▪ 3D print preparation and service ▪ Generative design and Data management ▪ Inventor data migration ▪ Pro/Engineer / Creo data migration ▪ Cloud-ready productivity (log-in license, cloud-based collaboration, free viewing tools)

PLM Software SIEMENS NX

creo®

SOLID EDGE

SOLIDWORKS

Stage 2
DESIGN

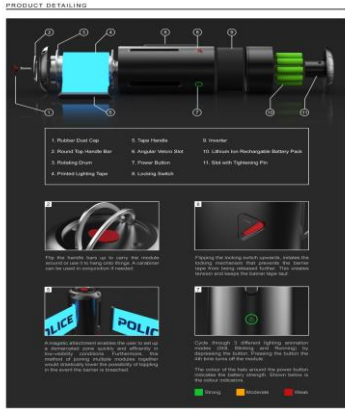
Innovation Factory Collaboration with Design Houses

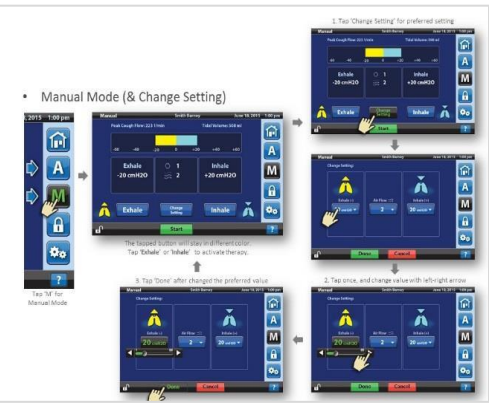
Scope of Design Services

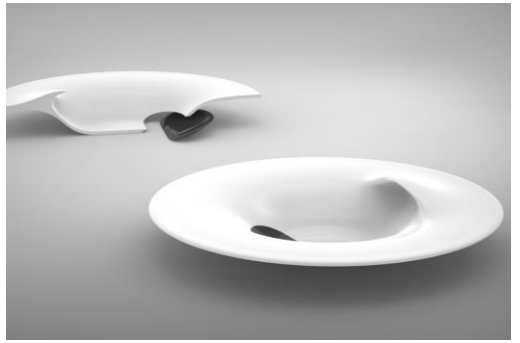
NPD	Scope	Design Activities	Tools and Deliverables
	1.5 Simulation software tools	▪ Mold flow analysis ▪ Simulation (Vibration, Frequency, Buckling, Thermal, Drop Test, topology optimisation, non-linear materials, large deformations) ▪ Pipe, tube, duct and wire routing ▪ Environmental Impact Analysis ▪ Structural part and assembly analysis ▪ Advanced surface flattening ▪ Advanced motion simulation ▪ Advanced stress simulation	▪ Comsol Multiphysics (complex multiphysics interactions e.g. thermal, electrical, mechanical, fluids) ▪ Matlab Simulink (dynamic simulation of systems, Hardware in the loop simulation) ▪ Labview (Real-time simulation and control) ▪ Recurdyn (Multibody dynamic simulation) ▪ Ansys – Fluent (CFD analysis) ▪ Ansys – Maxwell (EM analysis) ▪ Ansys – MotorCAD (Electric machine)

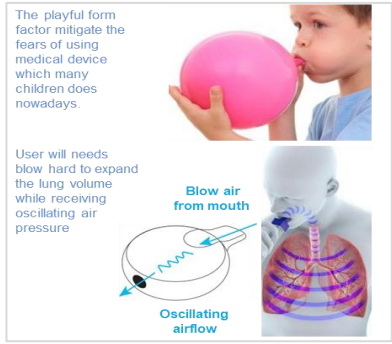
Simcenter™
COMSOL
Ansys
NATIONAL INSTRUMENTS LabVIEW™
RECURDYN
MATLAB

Examples - Design Thinking Approach to Product Design









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Engaging Interested Companies

Product & equipment distributors

TAT CHUAN ACOUSTIC
ESTABLISHED 1966

Ban Leong Technologies Limited

FLEXON

LAU

Ops & Tech Roadmap (OTR) exercise

HAKKO

DMS
DELPHIC

SEIKO Architectural Wall Systems Pte Ltd

YEAKIN PLASTIC INDUSTRY PTE LTD
Shaping The Future...

PE company aspiring to be ODM

CentiFORCE

innogrity

OEM

MPT

CSE
Creative Semiconductor Engineering Pte. Ltd.

Automation Technology Center Pte Ltd

Aurigin technology

AST ASTech

SANWA

2nd GENERATION SME OWNERS

CHONG FONG

CKE MANUFACTURING

FONG LEE

ELITE SPRINGS INDUSTRIES
Springs | Forming | Cutting

Kay Kay Plastic Industries Pte Ltd

Portal Phenom

Others

PROLINK

Fong's

Dornier MedTech

Brain Domain

ALT

FUCHSIA CREATIVE

Swirl.GO

SOLU STAR

mtech IMAGING

GINLEE

HYLAX TECHNOLOGY

COVE

LOI secured

3lagytech

AITECH ROBOTICS

dk engineering

DATATERMINATOR
Security with Confidence

GETECH
"Performance, Value, Integrity"

JM Vistec System
"Our Vision, Tomorrow's Innovation"
- The Machine Vision Specialist

LINE8

MSV
Systems & Services

XENTIQ

Partners

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

NUS National University of Singapore

SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

SIT SINGAPORE INSTITUTE OF TECHNOLOGY

UXC user experience centre

DesignSingapore Council

SG:D PIXEL

CAD-IT CONSULTANTS

pd SOLUTIONS

SKYMECH

ren5 MONITORING INTELLIGENCE

Singapore Manufacturing Federation

SPETA

TÜV SÜD

UL

Standard

SIEMENS

Hdesign

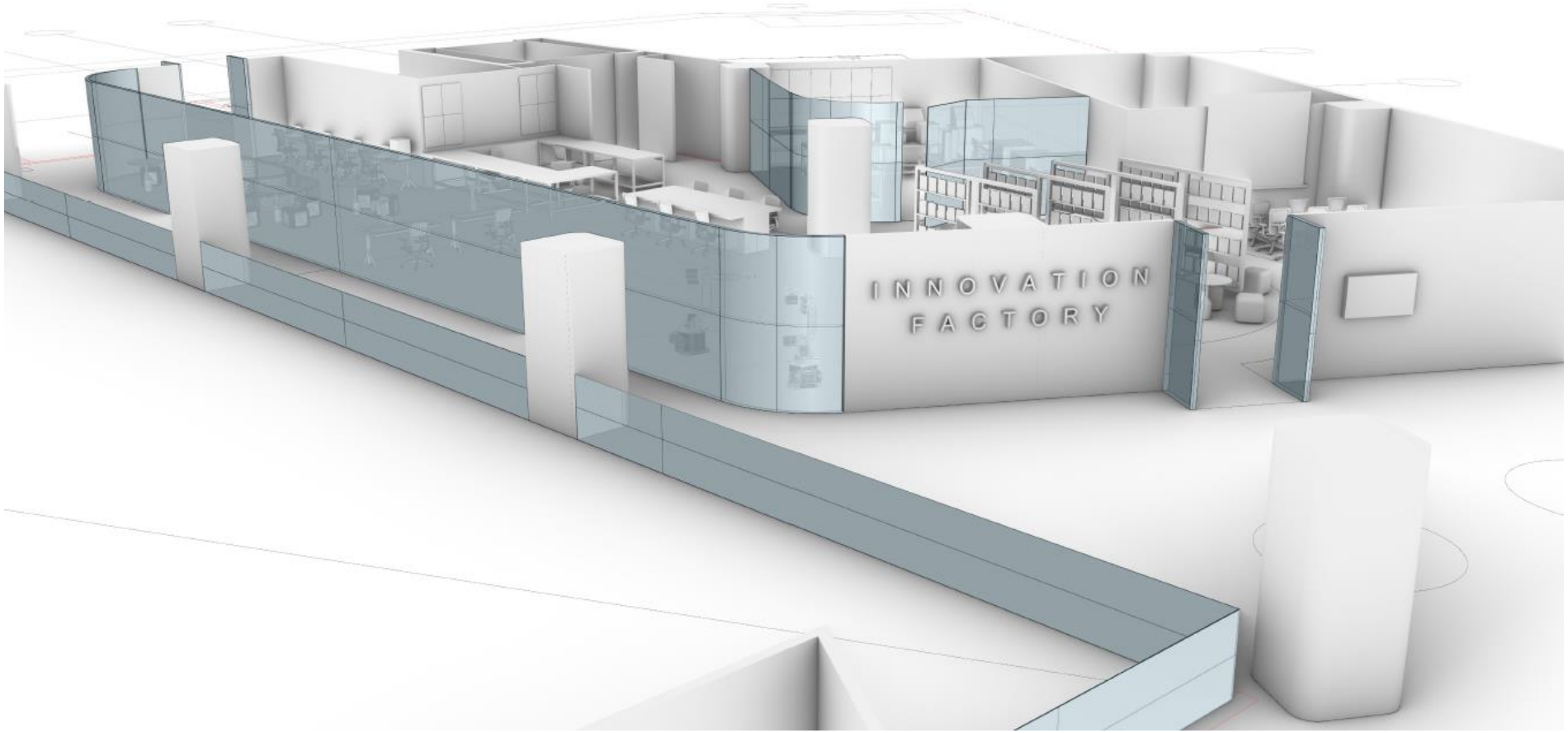
L&T Technology Services

SIM

Artist Impression of CT2B (Front View)

Artist Impression of CT2B (Side View)

Artist Impression of IF at Level 1M



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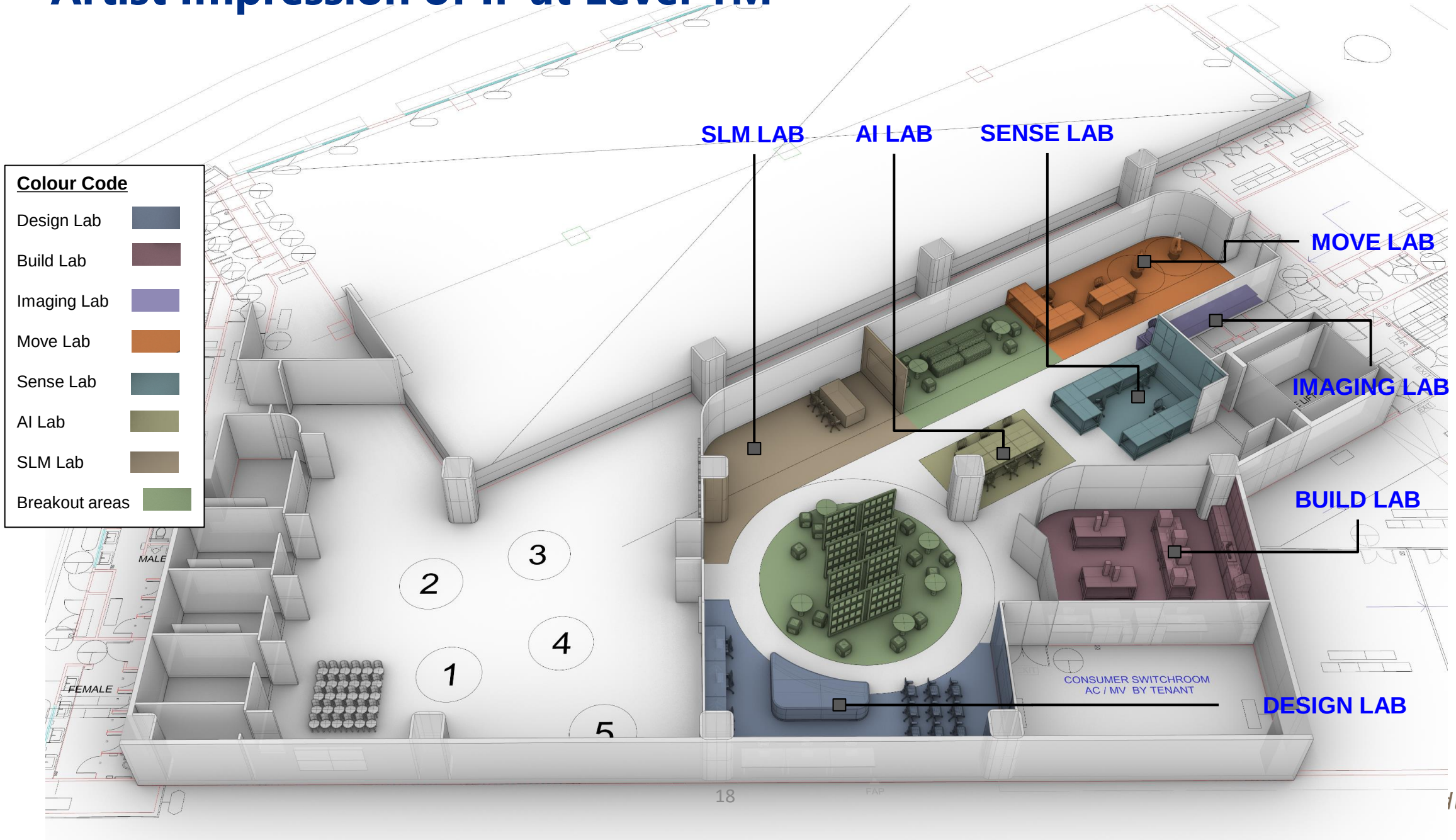
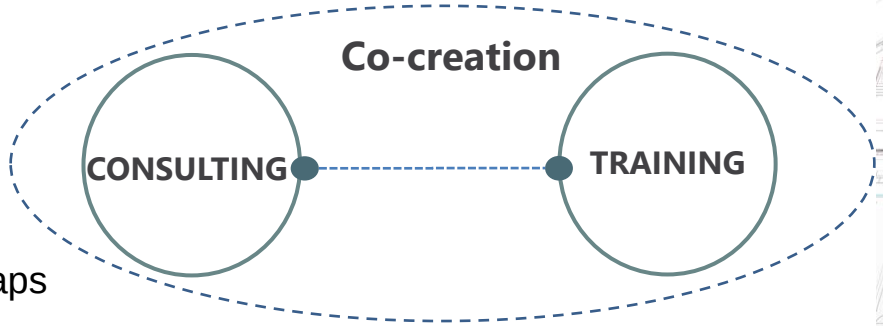
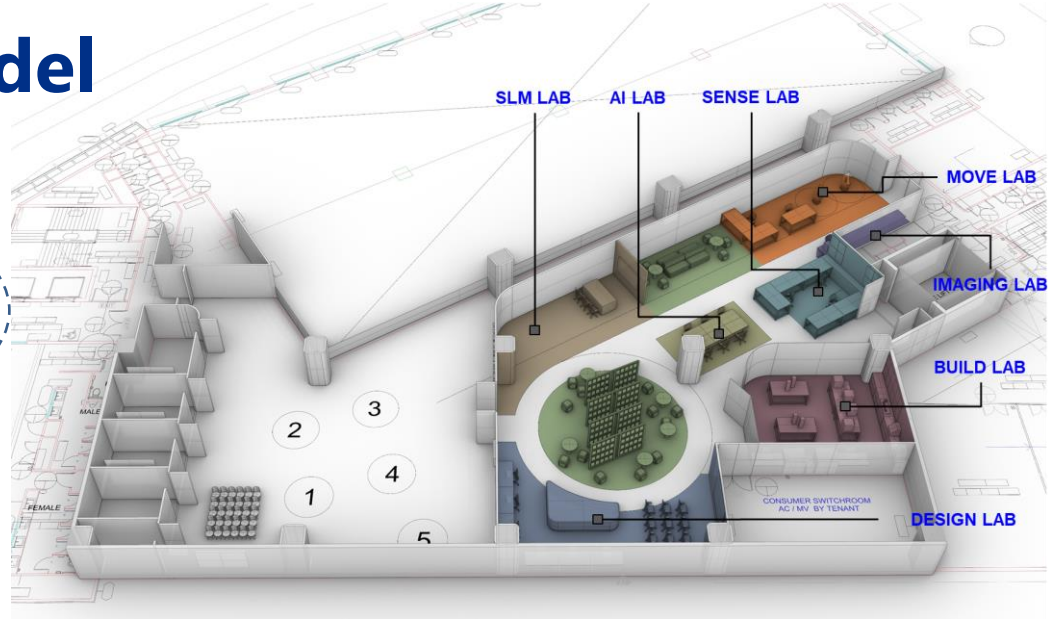
Artist Impression of IF at Level 1M



lustry

Innovation Factory Collaboration Model





Train R&D talent, address gaps
- Develop I&E talent (OJT)
- Expand pool of deep-tech talent

(e.g. Innovation and Enterprise Fellowship Programme (IFP)

Labs	Training to Companies	Subject Matter Experts (Current)
Design	Design Thinking and AM; Human Centered Innovation with Design Thinking; NX for design; Simcenter; PLM	Rayner Ng, Duane Lye, Chikashige Kiyoshi, Tnay Guan Leong, Kentaroh Toyoda (SIMTech), Clive Stanley Ford (IHPC), Lai Szu Cheng, YIN Xuesong, Chiam Sing Yang (IMRE)
SLM	Design & Simulation Software	Johnathan Low, Daren Tan, Yeo Zhiquan (SIMTech)
Sense	Industrial IoT; Analytics Software Sensors & IoT hardware	Liu Wei, Wen Rong, Xiao Long (SIMTech); Cui Shan (NMC), Kwok Yuen Sam, Wong Kok Wai (I2R); YIN Xuesong (IMRE)
AI	Autonomous AI platform	Liu Wei (SIMTech); Gao Fei (IHPC); Xue Yang (I2R)
Move	Process and Plant Simulation; Cobots & AIV	Tnay Guan Leong, Tao Ming (SIMTech), Tijo Thayil (ARTC)
Build	AM; Machining	Wiria Florencia, Soh Fang Hui, Thang & Liu Kui (SIMTech)
Imaging	Inspection tools	Leon Li Xiang (SIMTech), Shihua (NMC)

Plans – Engaging Beyond SERC

SG:D OPEN INNOVATION PLATFORM — Edwin LOW, Eric TEO, Charlene WONG (IMDA)

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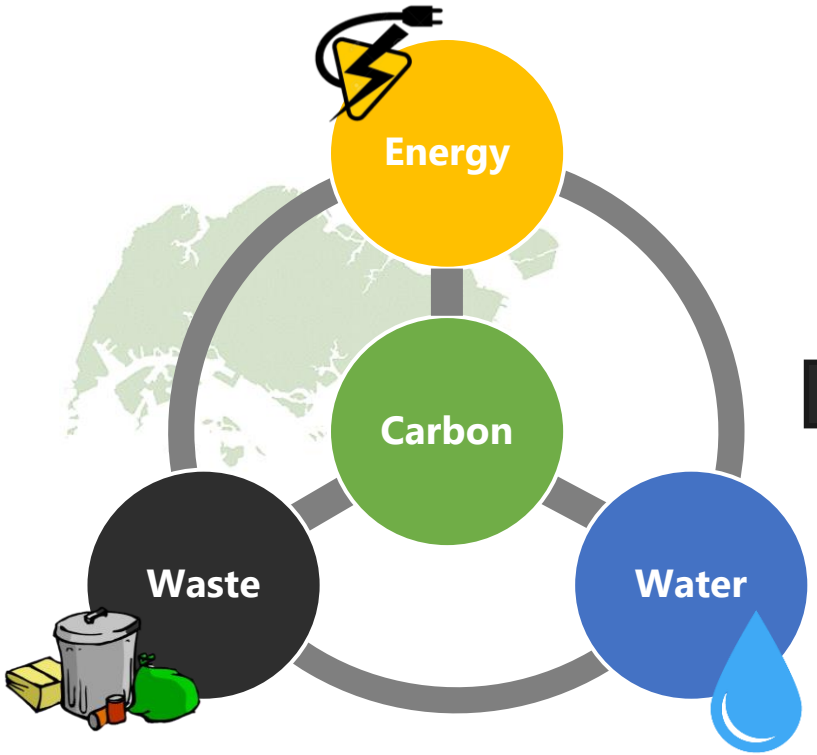
Sustainability and Life-Cycle Management Lab Offering
Underlying Technology Themes

In addressing the nexus of carbon-energy-water-waste, **technologies will be demonstrated through 3 themes**:
1) **sustainable operations**, 2) **industrial ecology**, and 3) **design for sustainability**.

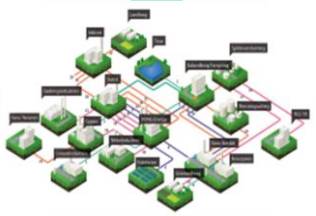


Carbon-energy-waste-waste nexus

Sustainability and Digital Solutions @ CleanTech 2B

1) Sustainable Operations

Improving carbon and resource efficiency through advanced manufacturing and I4.0-enabled technologies **at the shop floor and across the factory**



2) Industrial Ecology

Improving carbon and resource efficiency through collaboratively closing carbon and resource loops **within and across supply chains**

3) Design for Sustainability

Improving carbon and resource efficiency through **product and system design**

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Conclusions

Design Expertise To Hire

Consultants in industry domains
- MedTech
- Industrial IoT
- PE/Industrial Equipment
- Lifestyle/Consumer Goods

With Skills (1 or more) in
- Industrial Design/ UX UI
- Mechanical Design
- Embedded Systems
- Project Management (Lean, Agile, Staged-Gate)

Including training to expand deep-tech technical talents (e.g. Innovation and Enterprise Fellowship Programme)

What can be Outsourced

Design Partners in
- Design Research
- Design Thinking
- Product Design
- Industrial Design
- Contract Manufacturing

Memberships and Projects Pipeline

Interest in Membership
- 35 companies (78%)

Interest in Projects
- 29 companies (64%)
- 5 design projects in scope

Realistic pipeline in first year
- 25 companies onboard
- 15 design projects

CREATING GROWTH, ENHANCING LIVES

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THANK YOU

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