Industry – Academia Collaboration for End to End Innovation

Real Life Experiences and Future Directions

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COPEN 13, NIT CALICUT

In Collaboration with IIT Palakkad, IIST Thiruvananthapuram, and NITK.Surathkal

December 14, 2024

Academia / Industry Collaborative effort Towards End-to-End Innovation

Background:

Substantial collaborative work has progressed inside of India for more than a decade now.

Part 1: **Prof. Babu: Real life experience – home grown - success in Industry/academia collaboration**

Collaboration Efforts of Academia Industry for Technology Development of Manufacturing Technologies

Part 2: Dr. Subramanian: Origins and Strategy (based on over 40 years of experience in inter-industry collaboration and Industry / Academia Collaboration).

A Journey of Collaboration with Industries

Task Oriented

Support for translational R & D and technology development + manpower development

Support for applied R & D and manpower training

Support for academic teaching and training

2011 – GoI & MC

2005 – with Multi National Companies

1980 – with Indian Industries

2015 – with GoI and Indian Industries to setup AMTDC at IITM-Research Park

System Oriented

Micromatic Grinding TECHNOLOGIES LTD. Reliable customer friendly grinding solutions

JYOTI

AMADA AMADASOFT INDIA

SAINT-GOBAIN

INTERFACE DESIGN ASSOCIATES PVT. LTD.

Chennai Metco Finest Products for Micro Structure Analysis

MTAB

TVS Sundaram-Clayton Limited

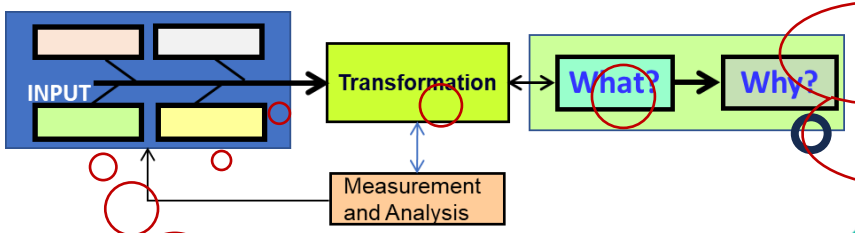
Lucas-TVS Limited

TVS MOTOR COMPANY

amtdc

INDIAN INSTITUTE OF TECHNOLOGY MADRAS

System oriented collaboration



सत्यमेव जयते

Office of the Principal Scientific Adviser
to Government of India

Micromatic Grinding TECHNOLOGIES LTD.
Reliable customer friendly grinding solutions

Machine tool Industry partner

DELPHI-TVS

BOSCH
Invented for life

Machine tool end users

IIM-B

INDIAN INSTITUTE OF TECHNOLOGY MADRAS
सिद्धिर्भवति कर्मजा

AMTTF
ADVANCED MACHINE TOOL TESTING FACILITY

Research & Development

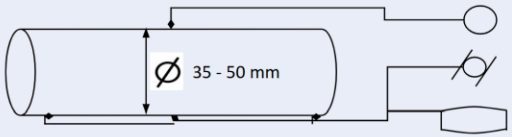
amtdc

System oriented Research & Development

सत्यमेव जयते

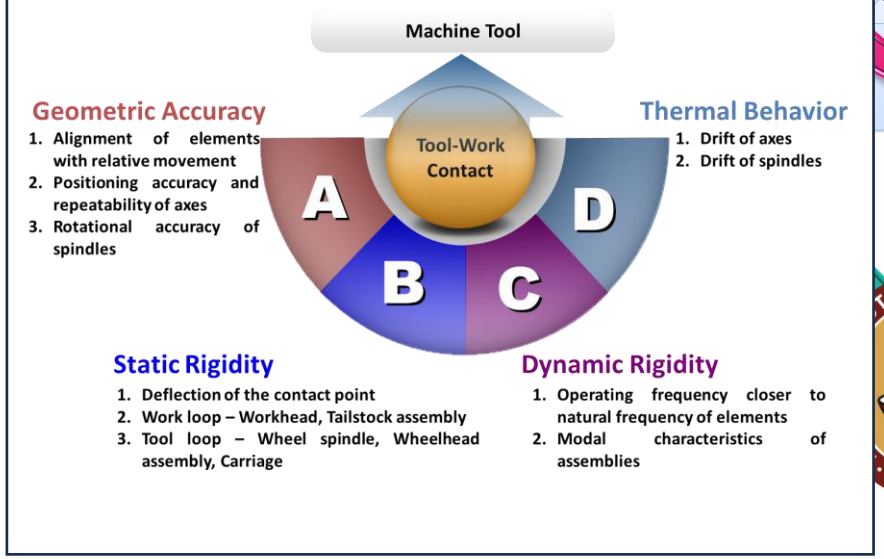
Higher Precision Component

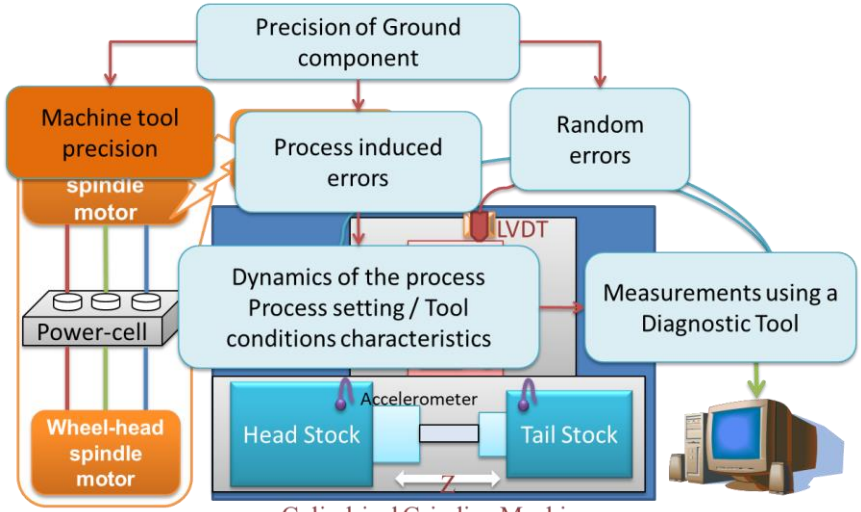
Performance capability of NGPG machine
(Operations: OD plunge and traverse grinding)



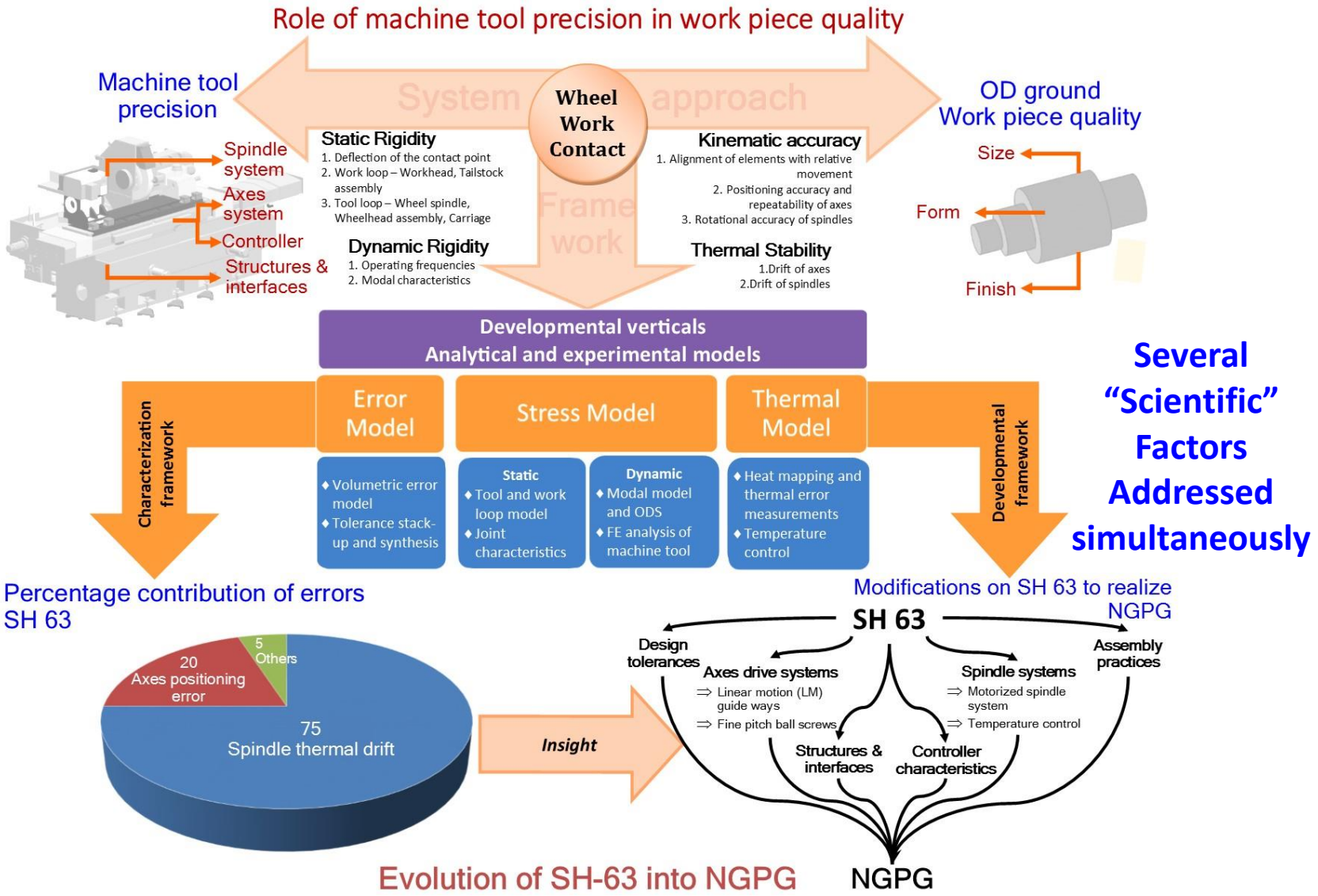
		0.5 µm
		1/300 µm/mm
		1/300 µm/mm
Process scatter (dimensional stability without an IPG)	6σ	4µm
Tolerance grade achievable without an IPG		IT 3

NGPG





System approach to realize precision machine tool



Advanced Manufacturing Technology Development Centre

सत्यमेव जयते
Ministry of Heavy Industries
Government of India

MTAB

Chennai Metco
Finest Products for Micro Structure Analysis

INTERFACE

amtdc

ACE DESIGNERS

JYOTI

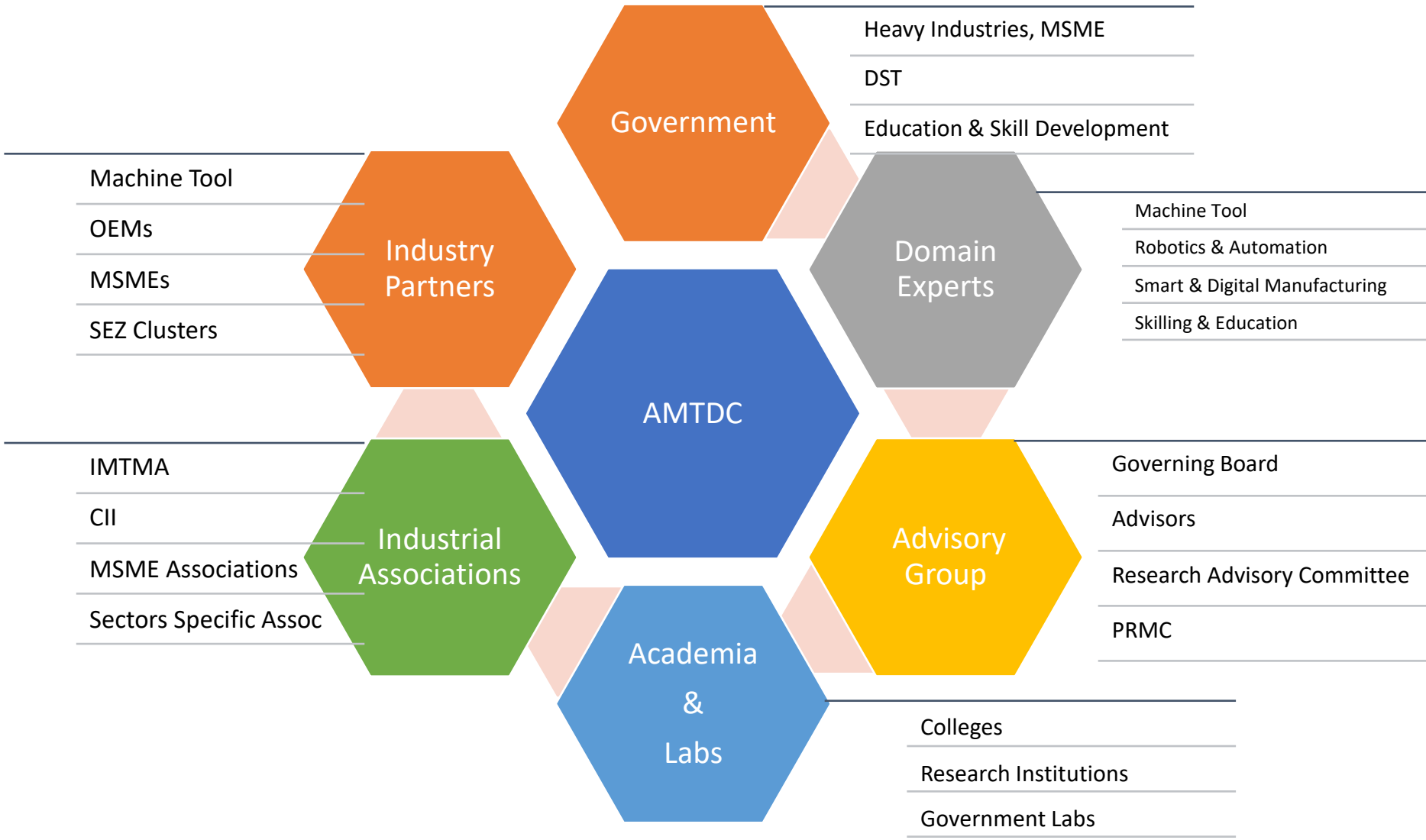
Micromatic Grinding TECHNOLOGIES LTD.
Reliable customer friendly grinding solutions

INDIAN INSTITUTE OF TECHNOLOGY MADRAS · सिद्धिर्भवति कर्मजा ·

Enabling Platform
Enhancement of
Capital Goods Sector

Developing an Ecosystem

Advanced Manufacturing Technology Development Centre



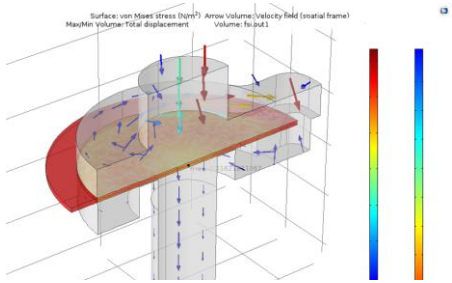
Integrating Knowledge

Core Capabilities

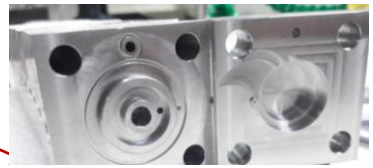
5-axis Micro Machine

High Precision Grinder

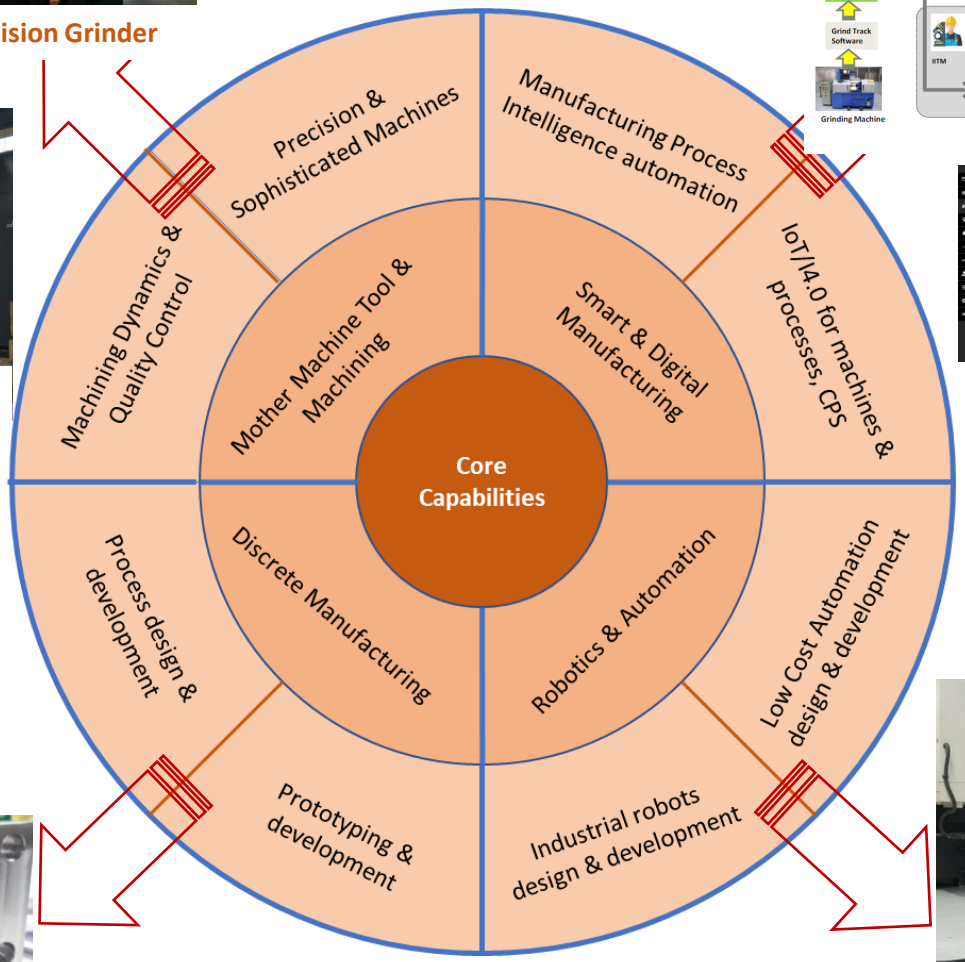
Sophisticated Multi-tasking M/c

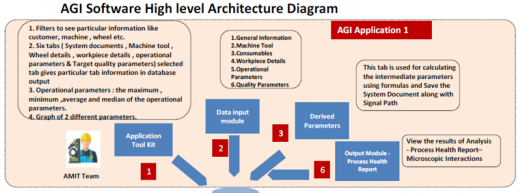


Process Simulation & Engineering



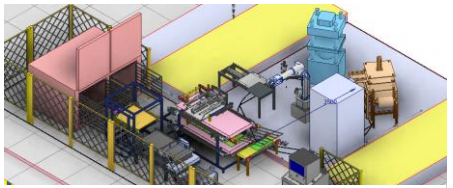
New Technology Precision Application



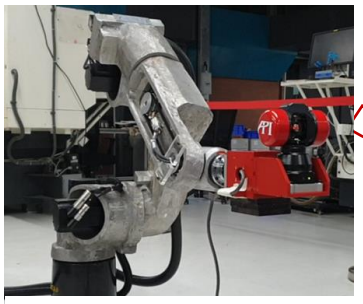


Manufacturing Process Intelligence

Smart & Digital Manufacturing



Robot based automation line

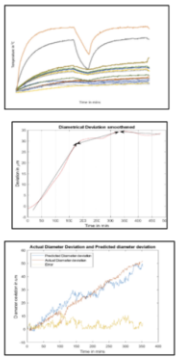


Robotic System

Creating and Leveraging Core Capabilities to Create New Solutions

Science, Engineering & Management

(e.g.) Thermal Compensation System for Machine Tools



Capturing Thermal Behaviour under various working conditions

Analysis of data – Predicted behaviour

Mathematical modelling – Prediction of TCP Drift

Compensating positioning of Cutting tool

Training Data

Prediction Algorithm

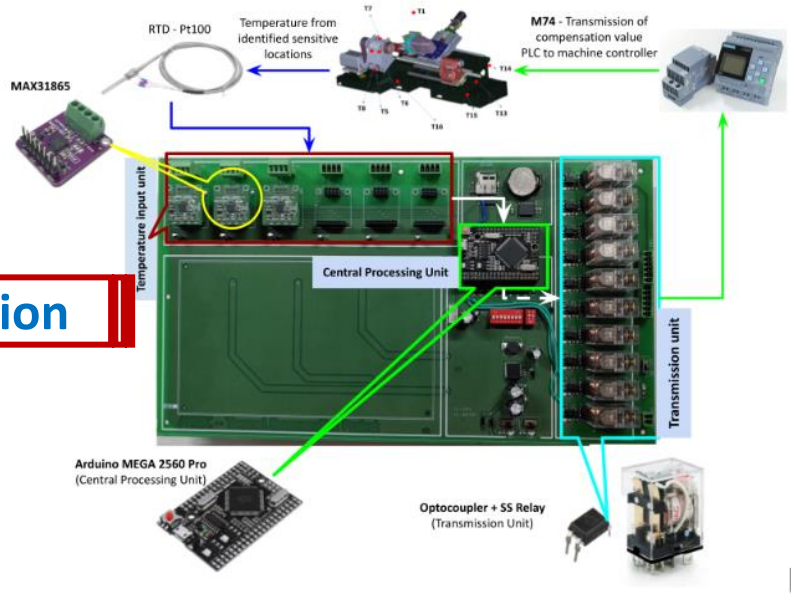
Electronics Module

Machine Controller

Real time error compensation

Science

Engineering



New Solution

Management

Thermally Compensated Higher Precision Machine Tool

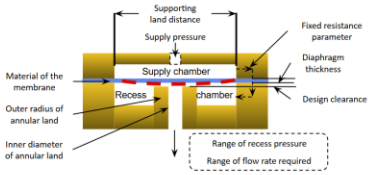
Component error reduction 60 microns to 5 microns – increase precision at low cost

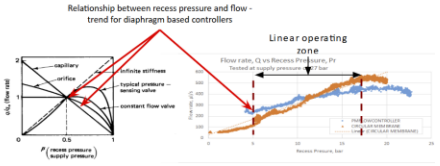
Higher Precision, Reduce rework, scrap, Lower production cost

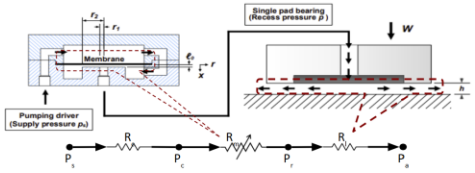
Science, Engineering & Management

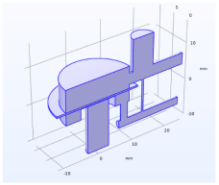
High Precision Technology and Machine

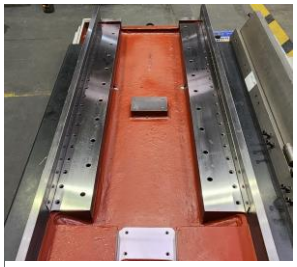
Design and Simulation Hydrostatic System

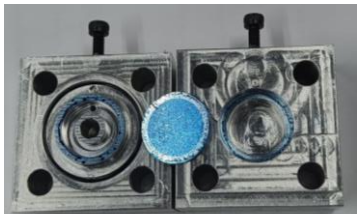


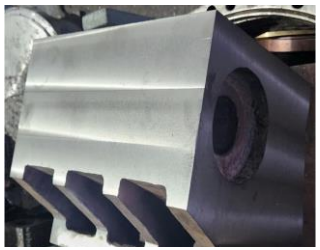






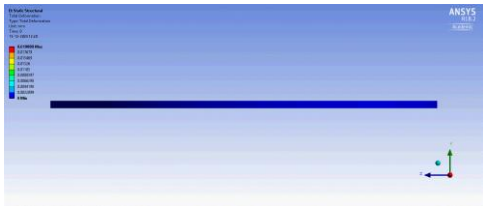


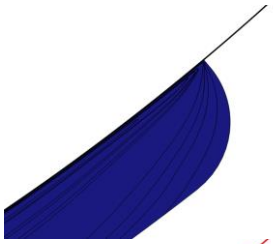


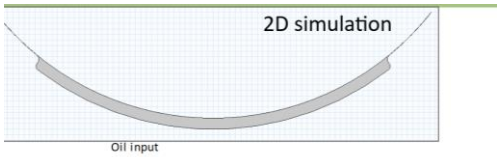


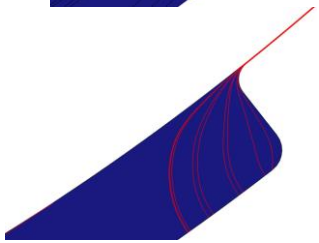
Slideways Flow Controller Spindle

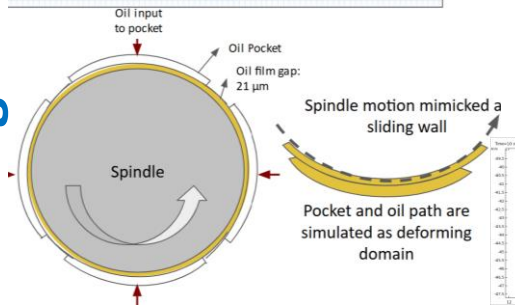
High Precision Technologies

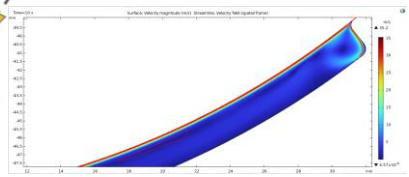


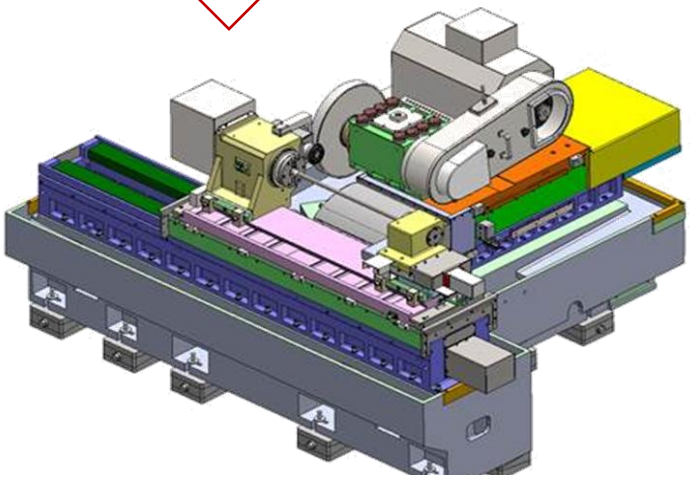










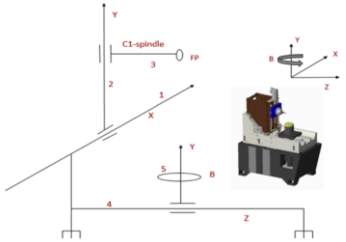


Fully hydrostatic Cylindrical Grinding Machine

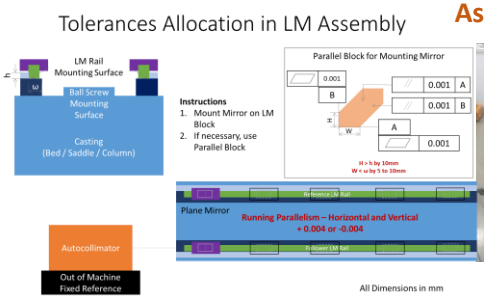
Technology = Science x Engineering x Management

Science, Engineering & Management

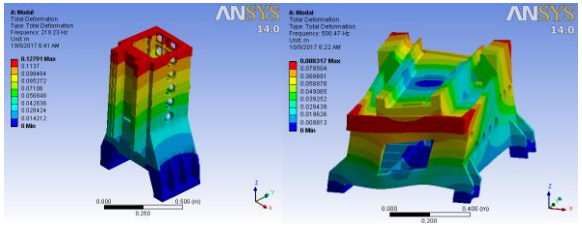
High Precision Machines



Kinematic Analysis & Tolerancing

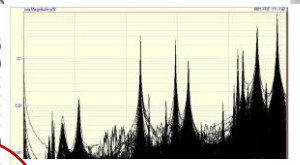


Assembly Procedure & Practice

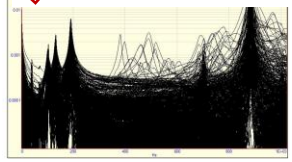


Dynamic Analysis

Casting Filled with Polymer Concrete



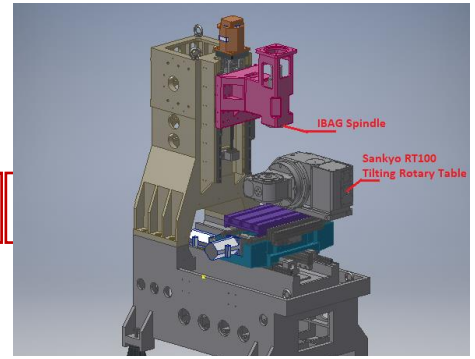
Change in Dynamic Characteristics



Low Cost 5-axis Micro Machine

New Solution

Machine with Indigenously built precision 4th & 5th Axis



New Design for 5-axis

Technology = Science x Engineering x Management

Technology Innovation Platform - kite

(knowledge integration for technology enrichment)

Digital Platform for engagement of *industry to academia*, *students to professors*, *engineers to managers*, *entrepreneurs to investors*

Developed by

Knowledge partner

TATA CONSULTANCY SERVICES

Grow Together

Bring together "PEOPLE"

- **Connect** *(Knowledge Resources Directory)*
- **Skill Forum** *(Self & Assisted Learning)*
- **Collaborative / Contract R&D** *(Forum for product development)*
- **Chat Bot** *(Chief Platform Navigator)*

Connectivity Platform

Bring together "KNOWLEDGE"

- **Data Miner & Database** *(Automate Search Engine to accumulate knowledge, information and store)*
- **Knowledge Representation** *(Tools to process knowledge and present as useful information to decision makers)*
- **Knowledge Exchange** *(Tools to promote collaboration)*

Knowledge Platform

Strengthen the roots of growth

Vision

Provide Connectivity & Knowledge Integration

Promote Collaborative and Contract R & D

Facilitate Skill Development

Kite Features

Built with graph database and reasoners

- kite knowledge exchange forum
- kite Skill development forum
- kite Knowledge repository
- kite Collaborative R&D
- kite Intelligent Chatbot
- kite Knowledge Integration

MHI kite internships at AMTDC (2021 - 2022)

400+ student interns

[From Aug 2021]

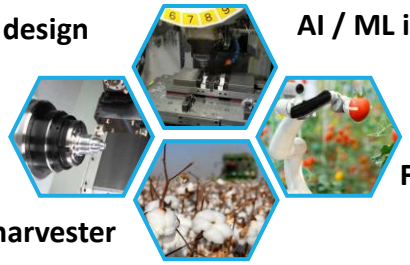
45+ mentors

[includes faculties from premier institutions (IITs, NITs..), scientists (DRDO, BARC..), working professionals (OEMs, SMEs, MSMEs) and retired experts]

kite

Spindle design

AI / ML in manufacturing



Fruit harvester

Cotton harvester

30+ challenges

[includes problems statements from agricultural sector to core manufacturing]

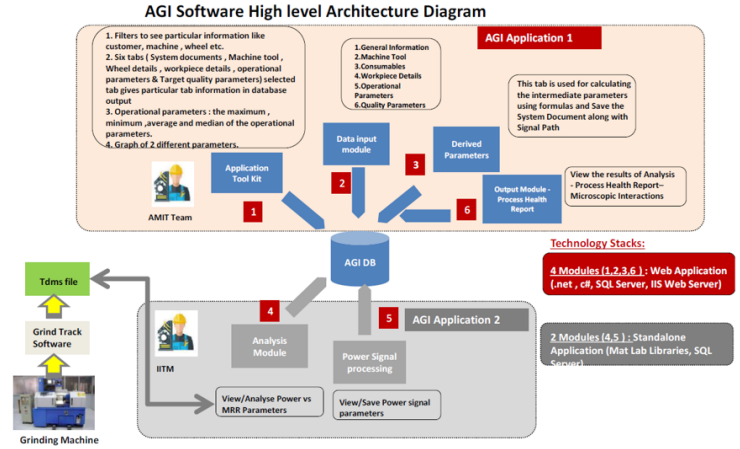
- 10,000+ applications for internships
- Pan India - Participation of students and mentors across the country
- Online virtual mode of internship

Collaborators and supporters in skill development efforts

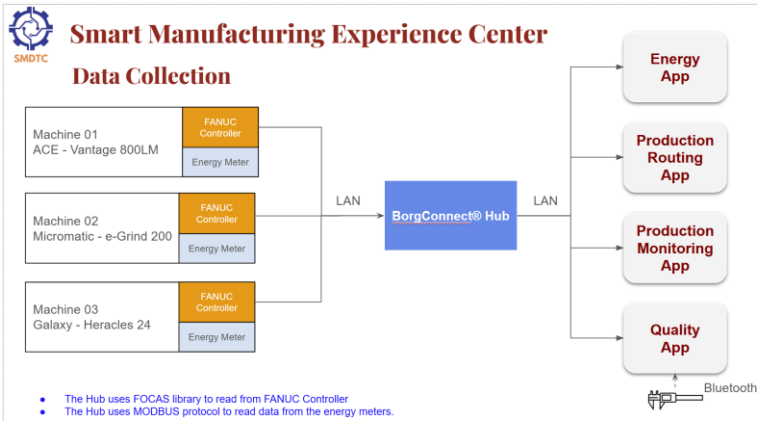
STIMS
Institute

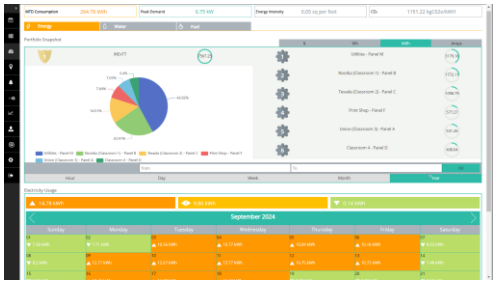
End to End Innovation

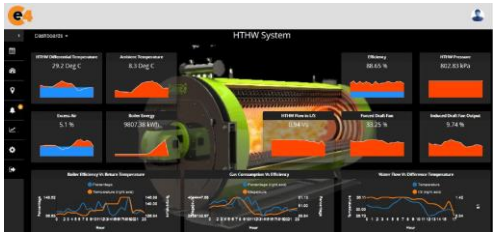
Leading to New Verticals

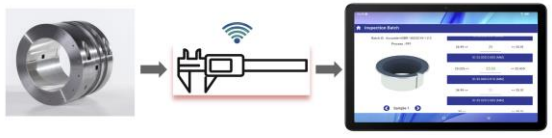


SMDTC







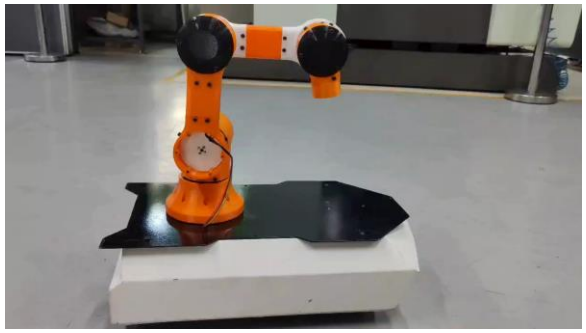


Experience Centre

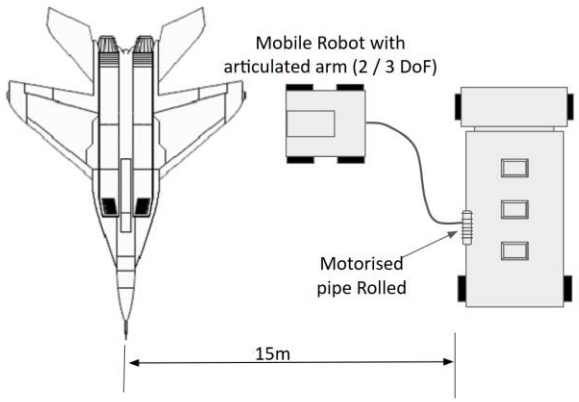
New Projects and Software

End to End Innovation

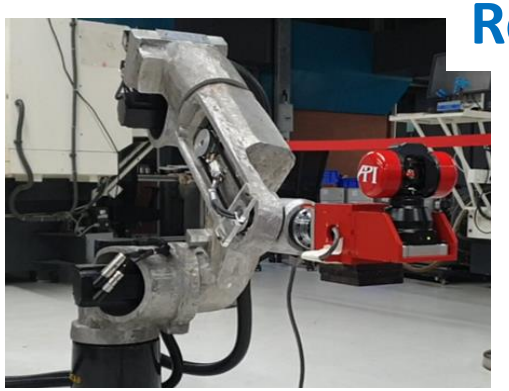
Leading to New Projects to Opportunities / Projects



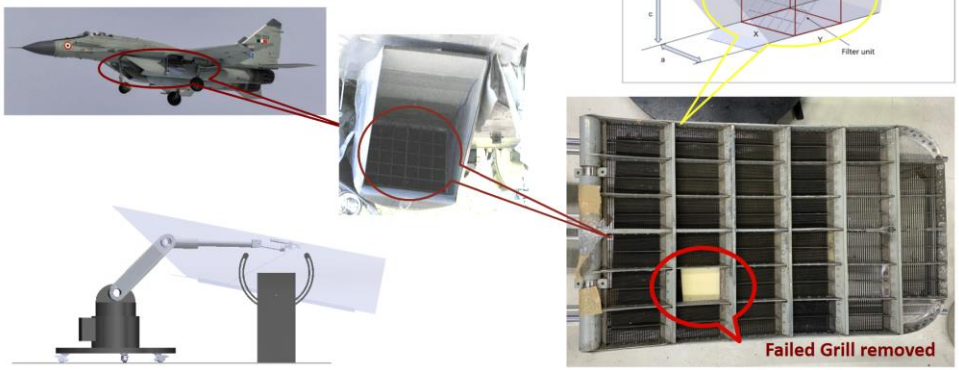
Robotic Refueling system



Robotic welding system for air intake

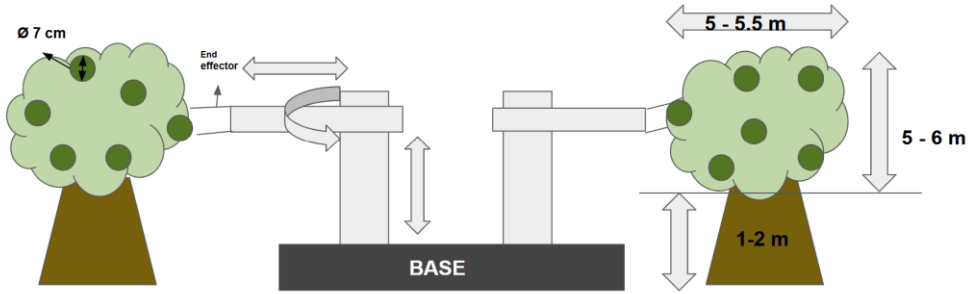


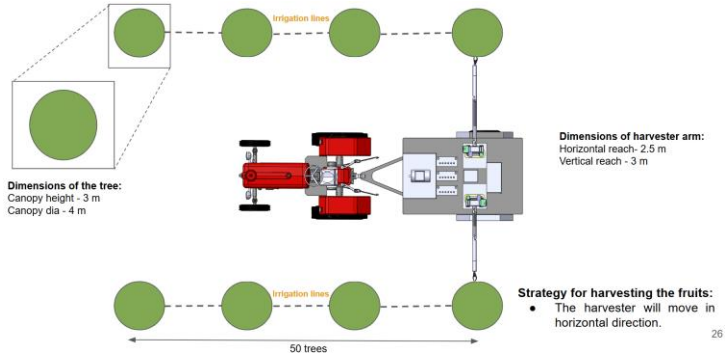
Robotic System



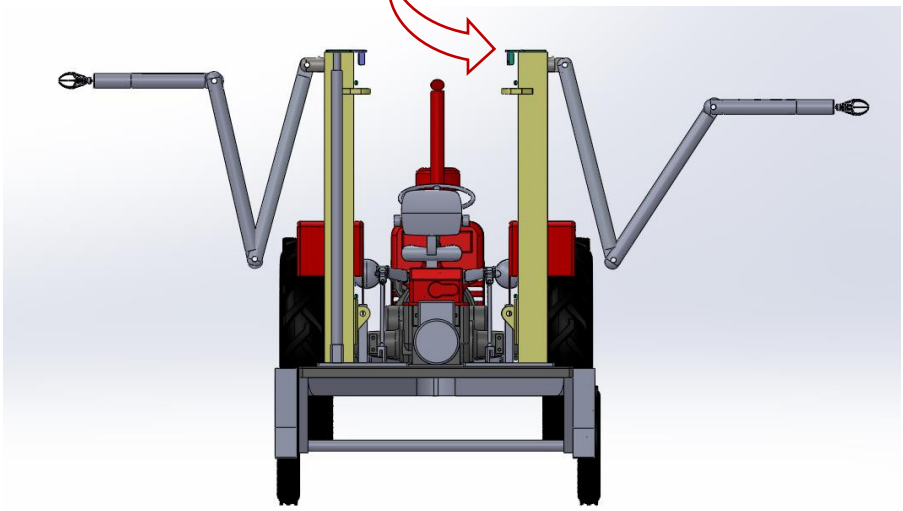
End to End Innovation

Leading to New Projects to Opportunities / Projects





Concept + Strategy



AI enabled Fruit Harvester

Realization

Industry Accelerator

Indigenous Development of Industrial Robots (4 - 200 kg)

- **Development of aggregates**

  Different types of gear box, electric motors & drives, Robot Controller, end effector, application software

- **Applications - machine tending, welding, glueing**

Aggregate developers

Prerana Engineering Works

PRAGATI Partnering Machine Tool Builders Worldwide

Bengaluru

System Integrator

m2nxt

Bengaluru

End users

TVS

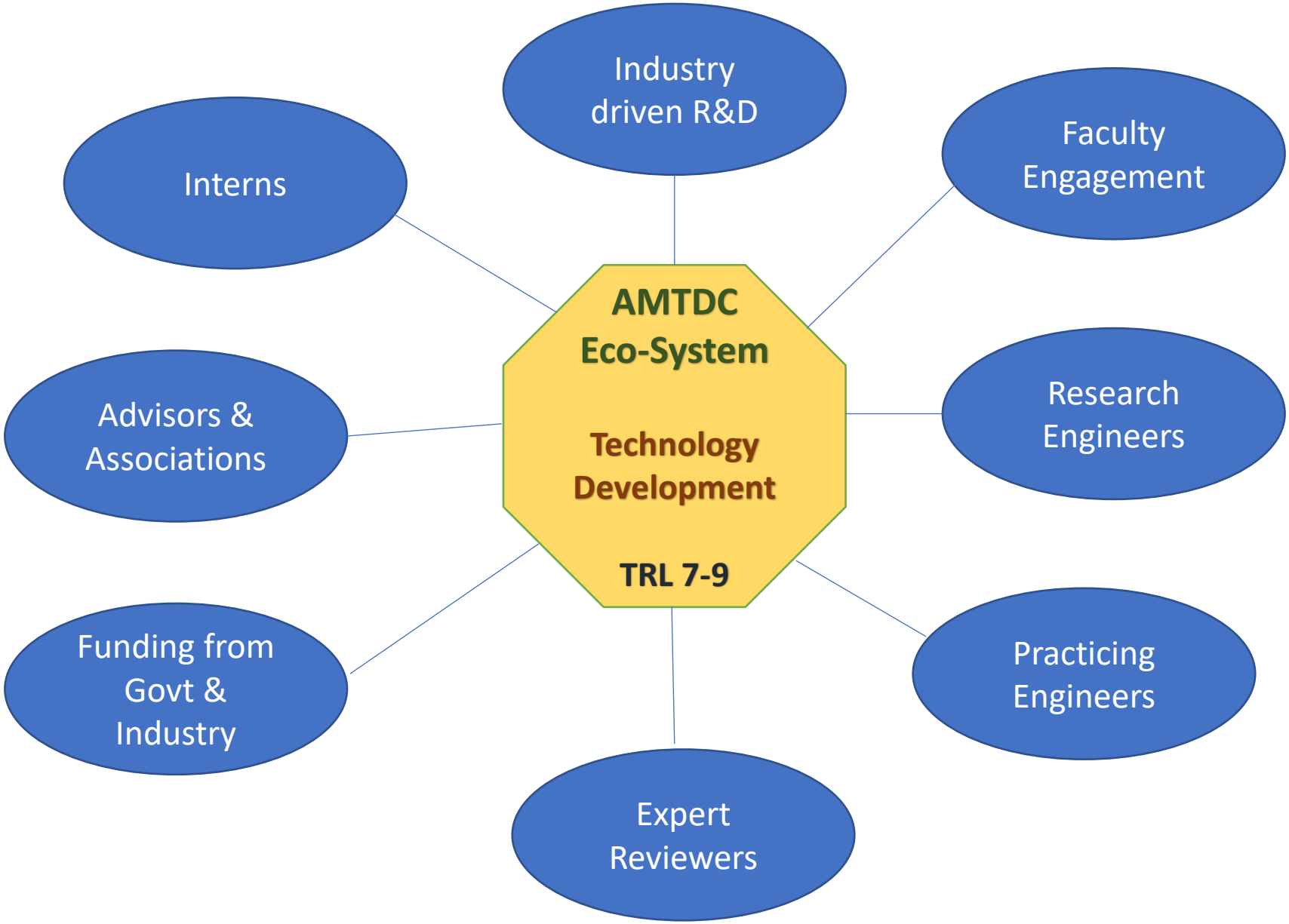
ASHOK LEYLAND

Mahindra

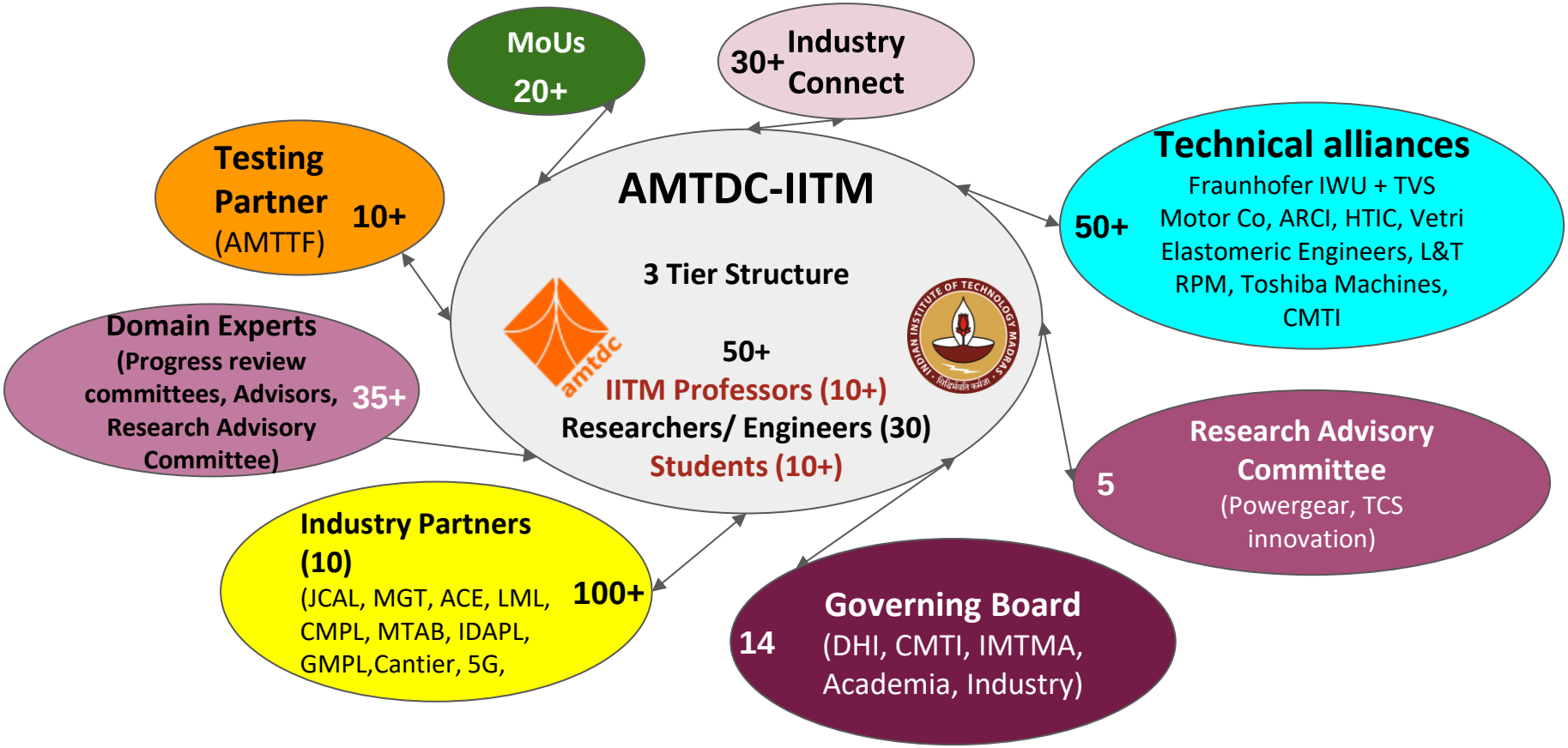
TATA MOTORS

VE COMMERCIAL VEHICLES

CAPARO


Industry driven R&D
Interns
Faculty Engagement
AMTDC Eco-System
Technology Development
TRL 7-9
Advisors & Associations
Research Engineers
Funding from Govt & Industry
Practicing Engineers
Expert Reviewers

AMTDC - Ecosystem



Future Directions

- **Hub and Spoke Model for talent pool development for**

  Industry Driven Research
  Skilled workforce development

- **Collaborative efforts for research on critical and emerging technologies**

- **Creation of physical platforms for training of faculty and talent pool development using digital and physical platforms**

- **Support of Industry, associations and research foundations for developing socially relevant Technologies**

- **Development of curriculum for enhancing the quality of faculty in tier 2 and tier 3 colleges**

- **Development of courses for imparting critical thinking and interpersonal skills**

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- many more …….

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Thank You

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