Institution of MECHANICAL ENGINEERS

Improving the world through engineering

Role of Manufacturing in Atmanirbhar Bharat Abhiyaan

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Let us invoke spiritual blessings to our viewers before we start today

Agenda

- About manufacturing sector
- Opportunities to replace imports
- Opportunities to export
- Opportunities in new technologies
- Some successful entrepreneurs
- Benefits of institutional membership

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How a Mechanical Engineer can contribute

- Design, manufacture, installation, commissioning, testing, quality control/ISO, inspection, project management - of equipment and assets in several sectors including –
- Energy, water, transport, defence, healthcare equipment, agriculture, educational institutions
- Technical appraisal of projects for funding bodies - UNDP/world bank/pvt. firms/governments
- Business development, risk assessment
- Technical consultancy and report writing, training, CAD, analysis of data, up-skilling the workforce in theory and practice
- Technical reviews/interviews, developing new technologies

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Part One:

Manufacturing Sector

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Three-Sector concept

- Extraction (primary)
- Manufacturing (Secondary)
- Services (tertiary)

- Manufacturing sector
  - – comprises transformation of materials into new products
  - – through mechanical, physical or chemical processes

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Some areas in manufacturing

- Industrial machinery and plant, Tools and Dies, in all sectors
- Machines for wood cutting, paper, printing, furniture
- Metal products, casting, forging, fabrication
- Rubber and plastic products
- Assemblies, sub-assemblies, components for Transport sectors
- Medical equipment, teaching aids – health and education
- Gauges for Quality control and Inspection jobs
- Cement and steel manufacturing plants
- Agri machines – sowing, harvesting, crushing, packaging
- Waste to energy plants

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Possibilities in manufacturing contd.

- Equipment for clean air technologies and monitoring
- Clean water technologies (aquguard, RO) and rain water harvesting plants (drilling equipment)
- Sewage treatment plants, online analysers
- Electro-mechanical appliances and components
- Electronics, computers, sensors (Industry 3.0)
- Robotics and process automation (Industry 4.0)
- Building and construction materials
- Kitchen machines for Food & beverages, bakeries
- Textiles, leather and apparels

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Part Two:

Opportunity to replace imports

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Manufacture for Defence

- Funds for domestic manufacturing - Rs 4,00,000 crores by GOI between 2021 to 2027 (101 weapons, platforms, equipment)
- Assault rifles, artillery guns, corvettes, sonar systems, transport aircraft, light combat helicopters, radars
- Wheeled armored fighting vehicles – 200
- Light combat aircraft - Rs 85,000 crores (123)
- Submarines - Rs 42,000 crores (Six)
- Domestic defence purchase outlay -in FY 2020-21 Rs 52,000 Cr.
- Import embargo shall be introduced beyond 2027
- Technologies available from DRDO or any other may be adopted

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Manufacture bio-fuels

- India spent rupee NINE lac Crore in 2018-19 for crude import (USD 120 Billion),
- Ban on import of Bio-fuels, Ethanol and pet-coke (cement industry). Opportunities for setting up bio-fuel plants, with GOI finance
- Guaranteed pricing and off-take by GOI
- Goal set by GOI is 20% ethanol blending in petrol, by 2030
- Goal set by GOI is 5% bio-diesel blending in diesel

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Opportunities in Petroleum Products (contd.)

- Bio-Ethanol from: biomass eg, sugarcane, beet, sorghum, corn, rotten potatoes, algae, cellulose materials eg, bagasse, wood waste, agri-residues, forestry residues, industrial waste
- Bio-diesel from: methyl or ethyl ester of fatty acids from non-edible oils, cooking oils, animal fat, rice straw, wheat straw, 2G ethanol, 3G bio-fuels, bio-CNG, bio-methanol, DME dimethyl ether, bio-hydrogen, MSW municipal solid waste,
- Drop-in-fuels from: MSW, solid waste, plastic waste, industrial waste, agri-residues, bio-mass. (These fuels do not require changes in engines etc.)
- Bio-CNG from: purified bio-gas, animal dung, food waste, MSW, sewage water

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Some other Imports by India every year

- **Telephones:** USD 11 Billion
- **Vehicle parts:** USD 3.5 Billion
- **Semi-conductors:** 3.6 Billions

- Manufacture telephones, vehicle parts, computer parts in India

- **Gold:** USD 23 Billion import - we need to explore new mines in India, make them competitive
- **Copper:** USD 2.5 Billion (use alternate materials)
- **Diamonds:** USD 19 Billion (20% of world share)

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Part Three:

Opportunities to export

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Exports from India

- To USA $ 42 Billion, UAE $ 30 B., Hong Kong $ 13 B.
- Refined petroleum USD 25 Billion (05% of world share)
- Jewelry USD 13 Billion (29% of world)
- Packed Medicines USD 12 Billion (20% of world share)
- Rice USD 05 Billion (27% of world share)
- Frozen bovine meat USD 4 Billion (6% world share)
- Leather footwear USD 2 Billion (3.3 % world share)
- Cars USD 07 Billion (22nd country in value)
- We need to increase existing exports

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Opportunities in Manufacturing for Mass Transport systems

- About 17 metro systems are in different stages of construction/commission
- Opportunities to develop and manufacture sub-systems, assemblies, components
- Solar energy (rooftops of infra/waste-lands)
- Use of CNG, LNG, Fuel-Cells, Hydrogen fuel, methanol, ethanol for transport

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Manufacture of EVs (electric vehicles)

- Car manufacturers are making EVs
- EV Road vehicle market includes buses, cars, mobikes, and E-bicycles with battery power.
- Amazon needs ten thousand EVs in four years for distribution of couriered goods
- These EVs have created demand for manufacture, supply, lease, and maintenance services
- Instead of Lithium-ion batteries, research on sodium-ion batteries is being done at University of Denmark

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Part Four:

Opportunities in New Technologies for entrepreneurs

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Opportunities in New Technologies, Fourth Industrial Revolution

- Artificial Intelligence - Computer systems that mimic human intelligence. Demand is 23 Million jobs, skills unavailable
- Machine Learning – 9 billion dollar industry. Discovery of patterns and insights, through data analytics and data mining. Skills not available. Amazon is giving free e-training
- Virtual Reality (VR) and augmented reality (AR) – demos for marketing and sales
- Cloud Computing – pvt., public, gov., hybrid
- Data Centres – WFH and virtual meetings need data storage

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Industry 4.0 contd.

- Internet of Things (IoT) – 30 billion devices for data, home appliances, cars, and 3 billion mobile devices
- Cyber Security - software to police the network and systems to prevent unauthorized entry/data tampering
- Robotic Process Automation - For higher productivity, precision, lesser human intervention and less errors
- Block Chain - these are automated systems, which need no human interference, in banking, governance once the policies/ rules are input for usage. All data entries, modifications to data are recorded
- Apps - navigating apps, streaming devices, home personal assistants, replace Chinese apps 59+47 and 250 more clones

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Sanctioned projects with New Technologies

- Solar powered transport – Cochin solar passenger boat, solar light bi-planes, Light Rail Transport
- Urban passenger ropeway - MMRDA has sanctioned a rupee 500 crore project in Mumbai from Mumbai Port
- Hyperloop - (Elon Musk) Mumbai govt has sanctioned Mumbai to Pune in 15 minutes at 1000 kmph, in a partial vacuum tube
- Metrino pods - Sanctioned project from Ambience Mall to SPR , Southern Peripheral Road
- Uber-Elevate – autonomous drone. Digital Sky portal. Sanctioned in Maharashtra

(Fuel cell trains are operating at 140 kmph, Lower Saxony, Germany. We need to develop this as pollution is zero)

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Technologies for meeting specialized demands with reduced costs

- Demand for manufactured goods is Thirty Trillion dollars from India and China alone
- 3D printing for replacement of human organs
- Bio-engineering for customized pharmacy products
- Big data analytics and ML to analyze customer trends and to guide product development
- Carbon-fibre industry (M/s. Kineko Goa) and industry for light weight aluminium titanium alloys
- Robotics for process automation and productivity
- Nanotech industry for micro-electronics

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Bottlenecks for Make in India

- Inadequate support for scientific research and academia
- Top management gives only a year or two to develop new technology, which is inadequate
- Lack of self motivation
- Inadequate skills in existing and futuristic technologies - AI, ML, Cyber Security, Block chain, Cloud computing, RPA
- Too much time to manufacture prototype
- Foreign specifications during purchase - CEN, ASME, JSME instead of BIS
- Land acquisition time/law and order/political interference
- GOI has lengthy procurement procedure (PSUs are flexible)

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Part Five:

Some successful entrepreneurs

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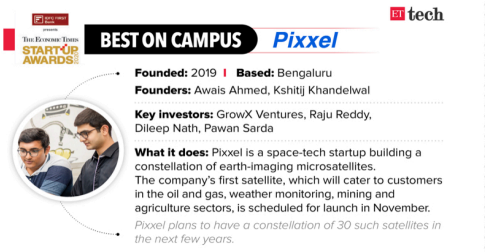
ET Startup Awards- entrepreneurs



Within one year of starting up in 2019, Pixxel is sending up microsatellites

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ET Startup Awards- entrepreneurs

ET tech

BEST ON CAMPUS — *Nocca Robotics*

Founded: 2017 | **Based:** Pune
Founders: Nikhil Kurele, Harshit Rathore

Key investors: Indian Angel Network, GrayCell Ventures, Asia Novasoft Info Technology

What it does: Nocca Robotics is a developer of industrial robots for solar panel cleaning solutions and, more recently, a manufacturer of ventilators, demand for which has surged amid the Covid-19 pandemic.

The company's robots offer a waterless solar-panel cleaning solution for large solar power farms, saving thousands of litres of water.

Within 3 years of starting up, they have Robots for waterless cleaning of solar panels

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ET Startup Awards- entrepreneurs

ET tech

BEST ON CAMPUS — *Aether Biomedical*

Founded: 2017 | **Based:** Poznan (Poland), New Delhi
Founders: Dhruv Agrawal, Faith Jiwakhan

Key investors: Chiratae Ventures, Sunfish Partners, Joyance Partners

What it does: Aether Biomedical is a medical robotics company that is developing bionic limbs for amputees.

Its first product Zeus is targeted as a low-cost, multi- functional robotic hand prosthesis that offers functionalities seen only in expensive devices – inaccessible to the majority of amputees in the developing world and even in

Within 3 years of start-up, they have made low cost Robotic hand prosthesis for amputees

ET Startup Awards- entrepreneurs

ET tech

COMEBACK KID — *Mobile Premier League*

Founded: 2018 | **Based:** Bengaluru
Founders: Sai Srinivas Kiran, Shubh Malhotra

Key investors: Sequoia India, Times Internet, GoVentures, RTP Global, BeeNext, Base Growth

What it does: Mobile Premier League, or MPL, is a mobile gaming platform that has over 40 million users and is one of the biggest beneficiaries of the Covid-19 pandemic.

It is the second venture of Kiran and Malhotra, who previously founded Creo, a consumer electronics startup that was sold to Hike in 2017.

Within 2 years of starting up their mobile gaming platform, they have 40 million users

ET Startup Awards- entrepreneurs

ET tech

COMEBACK KID — *Khatabook*

Founded: 2018 | **Based:** Bengaluru
Founders: Ravish Naresh

Key investors: Sequoia, B Capital, GGV, Tencent, Falcon Edge

What it does: Khatabook is a merchant services platform that offers digital ledger services, invoicing and payment solutions for small businesses. It serves more than 8 million merchants with a presence in nearly every district.

Its localised user interface and regional language presence have helped merchants adopt its solutions.

Within 2 years of starting up, 8 million users (merchants)

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ET Startup Awards- entrepreneurs

ET tech

COMEBACK KID — *Winzo*

Founded: 2018 | **Based:** New Delhi
Founders: Paavan Nanda

Key investors: Kalaari Capital, Hike, AngelList, Origami Next

What it does: Winzo is a mobile e-Sports gaming platform with more than 12 million users and over 35 games from leading studios such as Tencent, Garena and Warner Bros Entertainment for deeper distribution into India.

It is the second venture of Paavan Nanda, who previously founded Zostel Hospitality, which had competed directly with Oyo Rooms.

Within 2 years of starting up, they have 12 million mobile gaming users

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Part Six:

The Future - from 2020 to 2040

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The Future from 2020-2040

- New Tech skills to master the virtual medium for presentations/ interactions/transactions
- Next twenty years till 2040 there will be no change in :
  - 5IR fifth industrial revolution; convergence of man &m/c
  - Virtual education and education services
  - Virtual and physical heath services and medical aids
  - Digital gaming; 165 billion $ market; 260 B. $ by 2023
  - CO_2 capture, storage, utilization, and apps for the same
  - Clean efficient sustainable technologies

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Collaboration is the Future

- 14 Billionaires Bill Gates, Jeff Bezos, Jack Ma, Michael Bloomberg, Richard Branson and ten others have launched **BEV** in 2018 (Breakthrough Energy Ventures)
- Investment in energy efficiency and clean-air technologies is predicted to be 35 trillion USD by 2030
- Global investment in renewables will be 9 trillion USD by 2050
- One billion USD fund in BEV will forgo short-term returns battery and grid storage technologies to companies developing better geothermal energy & fusion energy generation systems

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Social Responsibilities of an Engineer

- Safety of society – in design, manufacture, maintenance
- Environment - No damage to air, water, land, due to the processes used
- Sustainability – development using minimum resources. Reduce waste in materials. Reduce water usage and energy usage. Recycle and reuse
- ELS - ethical, legal, societal issues, code of conduct, values
- CPD - Continuing professional development, to update knowledge and skills. **Lifelong learning**
- 5IR – converging technologies between man and machine, to service humanity, to evolve superior beings, clean-technologies

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Life long Learning

- Self-Learn, unlearn and then **relearn** new things
- Technology changes every 3 years - commit to life long Learning to stay relevant and employable
- 130 million new roles – due to machines and new algorithms combined in the workplace
- 4IR – AI, ML, AR, VR, 3D printing, Robotics, cloud tech
- PG Diploma programs - IIT-Bombay has celebrated successful completion of courses in Data Science, AI, Blockchain, robotics
- Working professionals with 8 years work experience from Fortune 500 companies were also trained
- ML – Amazon is giving free virtual classes on ML

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IMechE membership is open to all engineers

There is No fee – for engineering students and apprentices to become affiliate members

Graduates from any Engg. discipline can become Associate Member, for a small fee (as low as 2400/- rupees for those below 25 years age)

For corporate membership - demonstrate adequate mechanical engineering involvement in at least ONE of EACH of the Four following areas to be eligible :

- Scientific principles – development OR application
- Involvement – research OR teaching OR practice OR leadership
- Problem solving & optimization – design OR production OR operation OR decommissioning
- Mechanical elements – devices OR machines OR structures OR processes OR systems

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Benefits of IMechE membership

- Accreditation as Chartered Engineer or Incorporated Eng, is an international affiliation, recognized in 144 countries
- CEng is essential requirement in tenders in Europe/USA
- IMechE provides free access to 16 journals on engineering
- Professional Engineering monthly magazine for latest news on technology & careers worldwide
- Free access to a virtual library of **40,000** books, reports, standards, handbooks, conference proceedings since **1847**
- Support in Continuing professional development, through webinars, industry tours, conferences on new technologies

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Benefits of IMechE membership contd.

- Support from 1,15,000 volunteers/experienced members and from IMechE registered mentors
- Network with senior professionals, through technical/ social events held in different cities in India & abroad
- 130 different awards for members to attend practical and theoretical courses to improve knowledge/skill/language
- Cash awards in competitions - SOFE/GED/essay and others
- More than 70 business & technical courses, with reduced fees, to give you success in your career
- Benevolent fund for financial support of needy members

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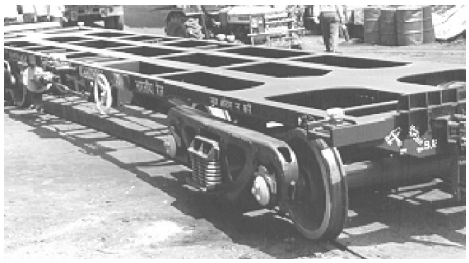
Container Flat Rail Car

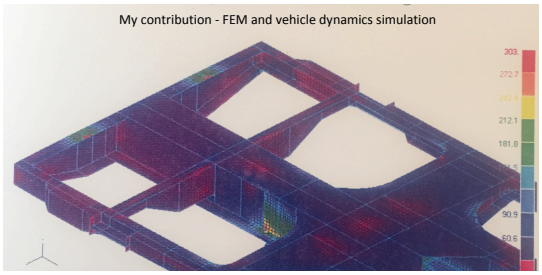
17th IAVSD Symposium, Copenhagen, 2001



My contribution - FEM and vehicle dynamics simulation

FEM of 45 feet container B-car wagon (FEMAP software)

My contribution - FEM and vehicle dynamics simulation



Development of Virtual Prototype Domestic Container Flat Rail car, 16th European MDI Users Conference , Berchtesgaden, Germany, 2001

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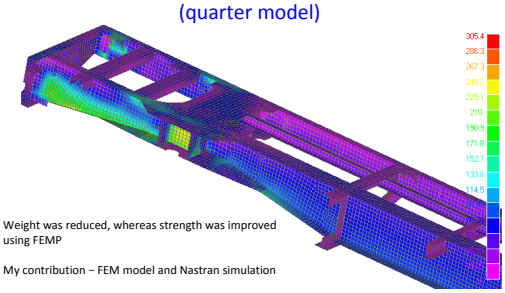
Metre Gauge Container Wagon for Bangladesh

(quarter model)



Weight was reduced, whereas strength was improved using FEMP

My contribution – FEM model and Nastran simulation

Dynamics & Simulation of Rail Cars, Manchester Metropolitan University, 1998

Crashworthy Air Conditioned Double Decker

(03.07.2009 to 31.03.2010)

My contribution as Chief Design Engineer, RCF Kapurthala - to successfully lead a team of 60 designers and ensure **paper concept to product in NINE months**

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Institution of MECHANICAL ENGINEERS

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Bharat Ratna Dr. A.P.J.Abdul Kalam said:

Dream Big
Sweat and work hard (Genius is 99% perspiration)
Perseverance (keep knocking)
Determination (to succeed)

Thank You

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your questions (through whatsapp)

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