“No manufacturer is an island...”

Why partnership and collaboration are essential to innovation and success

Professor Lord Bhattacharyya
Chairman, WMG
Challenge: What will “manufacturing” become?

No divide between “Construction” "Manufacturing" & "Service“

**Systems**: creation of, reliability, resilience, and interoperability of ecosystems becomes key

**Tablet** requires technology and software systems to be “useful” to consumers. “Systems and software” costs key to manufacturing, and must be constantly renewed

**Modular manufacturing** makes manufactured homes, infrastructure possible, while personalisation make it individual

**Consumption modes**: Consumption of products will change. Purchase, lease, by hour?
WMG

Founded in 1980 at University of Warwick

We use world leading academic research to help businesses innovate through long term collaborations

Began with automotive focus, now expanded to digital healthcare, systems, design, imaging, ALM, biotech.

Modular undergraduate and postgraduate courses

Over 450 staff including industrial secondees

£180m annual programme, < 10% from HEFCE
80% of Warwick University’s strategic and applied research

Partnerships with > 1000 global companies: Bharat Forge, China Aerospace, GE Healthcare, Goodrich, IBM, Nikon, Larsen and Toubro, PTC, Siemens and TVS Motor Company.
Challenge: innovation is never finished

DIGITAL DESIGN
VALIDATION
PHYSICAL AND SOFTWARE
SMART PRODUCTS
INTERNET OF THINGS
FEEDBACK, NEW APPLICATIONS AND NETWORKS
Global R&D spend increasing, driven by Asian economies

While western nations have larger spend as share of GDP, sheer size of developing economies gives greater scale

Key issue: Where will next generation of disruptive technologies be identified and exploited?
Anticipating the Future?

Personalised manufacturing

“Businesses will spend a great deal of time and effort discussing with the customer its requirements – before creating the goods it needs.

Manufacturing managers will increasingly resemble physicians.”

Peter Marsh, "New Industrial Revolution"

Distributed Manufacturing

“Today, anyone with an invention or good design can upload files to a service to have that product made, or make it themselves with increasingly powerful digital desktop fabrication tools.

Would-be entrepreneurs are no longer at the mercy of large companies to manufacture their ideas.”

Chris Anderson, “Makers”

Challenge: How do we integrate data on product use into innovation while retaining consumer privacy?

How our products are being consumed, replaced, treated, fail?

Internet of things creates opportunity for total communication: but who owns, accesses, controls data: How do consumers/customers feel about monitoring?

SOLUTION? Hub of all things: A digital data vault to store consumer data, allowing data to be accessed only by those who agree to usage standards.
Collaboration: Digital Design and Validation

Digital design and experiential engineering allows you to understand consumer response to products at pre-prototype stage, and understand consumer desires and deliverability challenges.

Design to manufacture

Technologies to support best in class design to include materials & manufacturing processes that deliver premium design intent without compromise and uses new technologies to enhance aesthetic appeal.

Here Mr Ratan Tata observes WMGs 3D digital design and feedback studio.

Next generation 1st class seats: virtual prototypes
Opportunities: Smarter Products

Smarter Vehicles at JLR

Increase in driver assistance and active safety features enabled by all-round sensing, electronic actuation of steering and braking etc.

Increase in sensors, data and on board processing enables the vehicle to interact with customers in a smarter, more human way.

Connectivity

Vehicle in a connected world:
- Near-field and remote vehicle communications will provide the platform for an almost unlimited set of features and applications
- Ability to ‘download’ to the car dramatically changes relationship with customer and business models: implications from personalisation to security
Collaboration: Connections and networks

Technologies find new functions when knowledge is connected and networked

“In the new era, it’s not enough to know about different technologies, you have to be able to combine them”
Omar Ishrak, CEO, Medtronic

Polli-Brick combines recycled PET plastic bottles with modular building techniques and CAD

UK National synchrotron facility being used to develop synthetic vaccine for hand, foot and mouth disease.

Self repairing plastic skin, also useful in extreme pipeline environments
Collaboration: tap into global knowledge eco-systems

**University-Business Partnerships:**
“Bridging the ‘valley of death’ through shared innovation: e.g. MIT/CALTECH & new US manufacturing investment

**Global Knowledge Clusters:**
globally networked expertise e.g. WMGs joint industry focused programmes with IIT on innovative materials

**Physical innovation eco-systems:**
e.g. High Value Manufacturing Catapult
Developing novel technologies for low carbon mobility
National Automotive Innovation Campus

Scale:
- £100million Campus
- 900 staff
- 30,000m² Building

Partners:
- Jaguar Land Rover
- Tata Motors
- UK automotive council
- Supply chain
- Intel

Facilities:
- Engineering labs
- Virtual labs
- Design studios
- Teaching and lectures

Research areas:
- Electric Vehicles (including energy storage and e-drives)
- Carbon Reduction (including hybrids, light-weighting and composites)
- Smart and Connected Vehicles (including on-vehicle competence, driver assist and cyber-security for connected vehicles)
- Research at whole system (vehicle in society), vehicle system (integrating technologies) and sub-system (e.g. electric powertrain) levels, pulling through underpinning science (e.g. novel battery chemistries)
Opportunities: Cleaner and smarter

The next 10 years will see move to multi-material structures in advanced mass manufacturing.

Further ahead, polymer composites will open up opportunities for introducing multi-functionality (e.g. energy storage/harvesting, electrical integration).

This links into drive towards smart, connected vehicles, integration of IT and smart resource management.

Lola-Drayson B12 developed with WMG
International Institute for Nanocomposite Manufacturing

£4.1 million Institute for functionalisation of nanoparticles, and development of production of nanocomposite materials and products

Facilities will include characterisation laboratories, a wet chemistry laboratory, and processing hall

Functional nanomaterials include carbon nanotubes, graphene/graphene oxide, nano-cellulose and many more

These can have functional properties (e.g. electrical conductivity, high current carrying density, thermal conductivity, strength, stiffness, magnetic, optical)

Such functional materials can be translated to a matrix material to form a nanocomposite material with multifunctional properties

Selected Research Areas

- Nanocomposites for electromagnetic applications
- Alignment of nanoparticles in electrical and magnetic fields
- New manufacturing methods for functional ceramics
- Synthesis and functionalization of graphene/graphene oxide
- Nanocomposite scaffolds for bone tissue engineering
- Tissue engineered bioscaffolds for medical implants/devices
- Composites of inorganic nanowires and polymers
- Light weighting of aluminium alloys using carbon nanotubes
- Reprocessing of plastics and polymer blends
- Ionic liquids as functional fillers for medical polymers
Collaboration: Skills and People

Skills for employees through in-work collaborative modular education:

Employees need exposure to new technologies, resources and techniques

Also: chance to create networks and leverage university expertise

Firms need specific skills in Business relevant technologies

Limits prohibitive costs for business (time and money)

Route needs to give global quality qualifications

JLR apprentices encourage female pupils into engineering

WMG Masters Graduation
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