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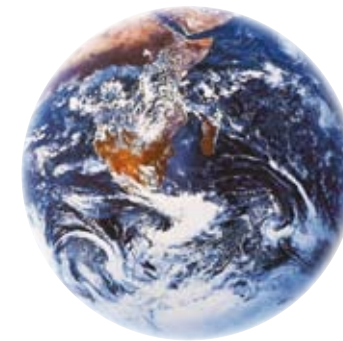
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Question everything

## AN INTRODUCTION FROM OUR DIRECTOR

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Professor Lord Kumar Bhattacharyya founded WMG (then Warwick Manufacturing Group) in 1980 with the aim of reinvigorating UK manufacturing through industry focused cutting edge research and effective education and knowledge transfer.

Lord Bhattacharyya has just cause to be proud of the Group that now runs an internationally renowned programme of research and education worth over £100 million annually with over 450 individuals involved in delivering innovative activity through a global network of centres. He said: “When I founded this Group things were very different. Global car production had been damaged by deep recession and the UK auto sector was hampered by lack of innovation and investment.

“Now we have a manufacturing industry in this country to be proud of with some of the most high-tech manufacturing companies that are successfully competing on the world stage.

“WMG itself has constantly changed in the years since I set it up. We are taking the knowledge and expertise we have built in the manufacturing sector and applying it innovatively to new areas. So we are improving the patient experience and efficiency of our hospitals; we are using virtual reality to enable better product design; we are using e-security to help organisations protect data and equipment; and we are even working in the field of neuro-imaging to better understand and predict the needs and experiences of customers. And we are transferring all of this valuable knowledge to our students all over the world.”

**'WE WILL ALWAYS STRIVE TO GENERATE NEW THINKING AND TO FIND INNOVATIVE WAYS TO APPLY IT WHERE IT'S MOST NEEDED'**



*S.K. Bhattacharyya*

PROFESSOR LORD KUMAR BHATTACHARYYA, KB, CBE  
DIRECTOR OF WMG AND PROFESSOR OF MANUFACTURING,  
UNIVERSITY OF WARWICK

## GLOBAL QUESTIONS

The map shows examples of our international reach of our work. For a more in-depth look at what the map represents go to Google maps and search for 'WMG Map of the World'.

### KEY

- WMG Headquarters
- Major research collaborations
- Education programmes
- Projects to be finalised
- Government relationships

WMG's overarching goal is to create and apply rigorous academic research to make a difference in the real world.

We do this through research and education programmes run in many countries around the world and through international collaboration with industrial, business and public sector partners.

These partnerships are at the core of how WMG works. Whether we are creating new ways to improve consumer products, helping Thai graduates to become better managers, or improving the way patients are cared for in hospitals, we are always working with partners on the ground – wherever they are in the world – to ensure our research is relevant and adds value.

- |  |   |   |
|--|---|---|
| ● WMG, Coventry, UK  | ● TVS, Chennai, India   | ● VTC, Hong Kong                                  |
| ● Airbus, Toulouse, France   | ● UAE National Identity Authority, Abu Dhabi  | ● The Government of India, New Delhi, India       |
| ● Bharat Forge, Pune, India  | ● Chulalongkorn University Bangkok, Thailand  | ● The Government of South Africa, Capetown, SA    |
| ● Brüel & Kjær, Denmark  | ● Confederation of Indian Industry, New Delhi, India                                | ● The Malaysia Government, Kuala Lumpur, Malaysia |
| ● China Aerospace, Beijing   | ● European University of Lefke, Cyprus  |   |
| ● Daffault Systèmes, Paris, France                                 | ● GE Aviation, Michigan, USA  | Examples of our UK projects                       |
| ● Exim Bank, Mumbai, India   | ● GE Aviation, Ohio, USA  | ● Arup  |
| ● Ford, Michigan, USA  | ● Georgia Tech, Georgia, USA  | ● Barclays Bank                                   |
| ● GE Healthcare, Wisconsin, USA                                    | ● Hong Kong Polytechnic University, Hong Kong                                       | ● Corus   |
| ● Michelin, Clermont Ferrand, France                               | ● IIT, Kharagpur, India   | ● GSK   |
| ● NEC, Tokyo, Japan  | ● SAFEA, Wuhan, China   | ● IBM   |
| ● New Zealand Institute for Crop & Food Research, Christchurch, NZ | ● Singapore Institute of Management   | ● Jaguar/Land Rover                               |
| ● PTC, Boston, USA   | ● Universiti Teknologi, Malaysia, Kuala Lumpur                                      | ● RBS Group                                       |
| ● Siemens AG, Frankfurt, Germany                                   | ● The Bonch-Bruевич Saint-Petersburg State University of Telecommunications, Russia | ● Rolls Royce                                     |
| ● Tata, Mumbai, India  |   | ● Astra Zeneca                                    |
| ● TAFE, Chennai, India   |   | ● BAE Systems                                     |
|  |   | ● Network Rail                                    |



## OUR PEOPLE



WMG now employs over 300 people engaged in research, education and knowledge transfer together with an extensive network of industrial associates. We excel in a wide range of specialisms including robotics and automation, lasers, sustainable materials, visualisation, e-business, e-security, hybrid technology, process and systems management, modelling and simulation, product life-cycle management, high-tech measurement, metals and alloys, materials science and neuro-imaging. But where we really add value is in bringing these experts together to provide novel and practical solutions to the opportunities and threats facing organisations and society.

Most of our staff have extensive experience of working in or with companies and other organisations which ensures that our research and education is both relevant and accessible.

At WMG we believe in giving our employees room to explore new ideas, freedom to experiment, build new partnerships, and then to deliver. This is what makes a partnership with us so productive.

**'WMG IS A REALLY VIBRANT PLACE. IT'S ALWAYS CHANGING AND I DO GET EXCITED ABOUT WORKING HERE. I FEEL LIKE I AM MAKING A DIFFERENCE WHETHER THAT'S HELPING TO CREATE THE LEADERS AND ENGINEERS OF THE FUTURE OR WORKING WITH COMPANIES ON NEW TECHNOLOGY. WE DELIVER REAL BENEFITS HERE, IT'S NOT ALL BLUE-SKIES RESEARCH.'**

Roger Bull,  
Chief Technician, WMG

## RESEARCH PROFILE

**'THE UNIVERSITY OF WARWICK IS RANKED IN THE TOP 10\* UK UNIVERSITIES AND TOP FIVE FOR RESEARCH'**

\*The Times Good University Guide 2008

WMG's work is always based on finding innovative solutions to challenging real world problems. That's why all our research is done in collaboration with industry or other partners.

We don't believe in research for its own sake – although this doesn't mean we don't engage in some blue-skies thinking.

Although we are trying to solve real problems, our questioning nature and the relative freedom provided by academia means we are able to look beyond the direct question and often ask an entirely new and more relevant question ourselves.

The University of Warwick is ranked in the top 10 UK universities and top five for research. We have ambitions to raise these rankings even higher with a specific goal to be amongst the top 50 universities in the world by 2015.

In WMG we typically have around 90 doctorate students engaged in research projects such as: Power-control Design of Resonant Converters; and Pressure Pulse Propagation in the Human Spinal System. Some of these are following our Engineering Doctorate programme which aims to prepare students more specifically for a commercial or academic career in an engineering or technology field. Warwick was one of the first universities to offer the Eng Doc.





**'WHEN WE TALK ABOUT GROUND-BREAKING SCIENCE WITH PRACTICAL APPLICATIONS, WE NEED LOOK NO FURTHER THAN THE WEST MIDLANDS. THE WARWICK DIGITAL LAB WILL PROVIDE A HIGH QUALITY RESEARCH ENVIRONMENT FOR MULTIDISCIPLINARY TEAMS'**

Former UK Prime Minister, Tony Blair

#### **WARWICK DIGITAL LABORATORY**

WMC is currently spearheading a major new £100m initiative to exploit the opportunities that emerging digital technologies offer to business, society and the economy. We have established a new facility – the Warwick Digital Laboratory – to enable major collaborative research and development and create effective application in industry, healthcare and digital media. Such application will have pervasive benefits to business, society and the economy.

We have attracted international research leaders to four major new professorships as part of the initiative. These are in visualisation, e-security, digital product lifecycle management and neuro-imaging.

It includes a 5000m<sup>2</sup> state of the art facility, built next to WMC's International Manufacturing Centre at the University of Warwick. Opened in summer 2008, it is the first facility of its kind in the world.

#### **USING MANUFACTURING EXPERTISE TO BOOST DRUG DEVELOPMENT**

A WMC team, led by robotics expert Professor Ken Young, created robotic systems for improving the development of new drugs for pharmaceutical giant GlaxoSmithKline.

Developing a new drug from scratch can take as long as 15 years, but Prof Young's system should speed that up meaning patients get the drugs they need to beat today's illnesses much more quickly.

Prof Young explains: "In order to get new drugs right, companies have to try thousands of different variants of compounds. Once the right combination is found, it can be quite hard to repeat it precisely."

A further development is to use flow synthesis to increase the speed of development: a technique borrowed from WMC's manufacturing expertise. The technique means that the method of development is close to the method used in full production, just on a smaller scale.

The techniques developed during the research were successfully employed in the development of drugs at GlaxoSmithKline resulting in major cost savings and reduced lead times in getting new drugs ready for market. Four new patents were generated from the innovative technologies developed in the project.

**'OUR ROBOTIC SYSTEM DRAMATICALLY IMPROVES THE RELIABILITY AND REPEATABILITY OF THE PROCESS OF DRUG DEVELOPMENT'**

Professor Ken Young, Head of Robotics, WMC



**'IT IS IMPORTANT IN TODAY'S HIGHLY COMPETITIVE AUTOMOTIVE MARKET THAT WE ARE ABLE TO OFFER A SIGNIFICANTLY DIFFERENTIATED PRODUCT. TO MEET THAT DEMAND WE NEED TO BE ABLE TO DRAW ON A WIDE RANGE OF SPECIALIST SUPPLIERS WHO UNDERSTAND THE CHALLENGE. BEFORE PARD IT MIGHT HAVE BEEN DIFFICULT TO GUARANTEE THAT THOSE SUPPLIERS WOULD BE AVAILABLE TO US WITHIN THE UK. NOW WE CAN SAY WITH CONFIDENCE THAT THE SKILLS AND CAPABILITIES WE NEED ARE RIGHT HERE AND ARE ACCESSIBLE'**

Al Kammerer, Former Director of Product Development, Jaguar and Land Rover



## COLLABORATION

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Everything we do is driven by the future needs of industry, business and other organisations. Some of our most important and far-reaching work has involved working with a diverse range of businesses in order to find solutions to industry-wide problems.

For example, the £72 million Premium Automotive Research and Development Programme (PARD), the operational phase of which was completed in Spring 2008, brought together the automotive sector in the West Midlands to enable a range of new technical and business opportunities through collaborative R&D.

We worked with Jaguar and Land Rover and over 400 suppliers and as a result much of the supply chain is now stronger and more competitive. Small and medium sized companies are now investing in R&D and starting to work with their competitors on common issues. Relationships between suppliers and customers have changed, with even the smallest component suppliers more fully tuned in to where the industry is going and to the future needs of two of the most prestigious automotive brands in the world. In many cases the technology and knowhow developed under the programme has applications in other sectors.

This is just one example of how our work leads to significant change in the way business is done. We also work in close collaboration with public sector partners such as hospitals and government departments.





'OUR GOAL AT NETWORK RAIL IS TO DEVELOP WORLD CLASS LEADERS WHO CAN TAKE THE RAIL INDUSTRY FORWARD. IT WAS CLEAR TO US THAT WMC AT THE UNIVERSITY OF WARWICK COULD OFFER US WORLD CLASS STANDARDS IN LEADERSHIP DEVELOPMENT BACKED BY THE FANTASTIC ACADEMIC STANDARDS AT THE UNIVERSITY'

Iain Coucher, Chief Executive, Network Rail

## NETWORK RAIL: DEVELOPING LEADERSHIP

A programme devised to overhaul the ethos of the company which owns and maintains track, bridges, signal boxes and stations, is already paying dividends.

WMC worked with Network Rail to develop the Stepping Stones leadership development programme and has been running the programme since 2006. By the end of 2008 over 1,000 of the company's best people will have gone through the programme.

With WMC's help Network Rail acquired and remodelled the former Cable and Wireless building at Westwood to become its Leadership Centre. Since then, staff from all levels have joined the programme run by WMC.

Mark Pickering, WMC's Director of Development, says: "Network Rail had identified the competencies they felt they needed and one area was that of getting people to take more responsibility.

"Working together we identified what their business need was and looked at how we could tackle it. We took all that was already good in the business and worked together to improve the set-up. As well as developing the company we develop the people by giving them this chance for accreditation. It is proving very successful and is one that will run and run."

**WE HAVE STRENGTHENED THIS RELATIONSHIP EVEN FURTHER BY ADDING A ONE-YEAR MSc IN PROJECT MANAGEMENT DEVELOPED FOR NETWORK RAIL'S NEW RECRUITS.**



## WMG's GLOBAL INFLUENCE

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Lord Bhattacharyya and senior members of WMG are involved at the highest levels of government and industry in the UK and throughout the world.


Lord Bhattacharyya is a well-known parliamentarian and a passionate advocate of UK manufacturing and technology. Former UK Prime Ministers Margaret Thatcher and Tony Blair sought his advice on innovation and technology issues and Gordon Brown's first visit after being confirmed as Britain's Prime Minister was to WMG. Lord Bhattacharyya has advised governments from South Africa to Malaysia on science and technology policy and holds honorary professorships in numerous countries.

WMG works very closely with UK regional development agencies to support the delivery of their economic strategies. We work with global corporations in training their executives and to develop technologies for markets worldwide and have partnerships with research institutes and innovative companies around the world. WMG professors are recognised as global experts in their respective fields.

**'THIS IS A SUPERB PERSONAL ACHIEVEMENT. EVERYWHERE I GO, WHETHER IT'S INDIA, CHINA, MALAYSIA, THAILAND OR SOUTH AFRICA, PEOPLE TALK TO ME ABOUT THE SUCCESS OF WMG'**

Rt Hon Gordon Brown,  
Prime Minister, UK





**'WE MEASURE THE REACTION OF EVERY COHORT WE SEND TO WMG AND WHEN WE ASKED IN 2007 WHETHER EMPLOYEES FELT THE PROGRAMME MET THE NEEDS OF TODAY'S PROCUREMENT BUSINESS, 99 PER CENT INDICATED A HIGH LEVEL OF SATISFACTION. THROUGH WHAT EMPLOYEES HAVE LEARNED ON THE COURSE THE SAVINGS RUN INTO TENS OF MILLIONS OF POUNDS'**

Russ Armitage, Corporate Procurement Director, BAE Systems

## PART-TIME PROFESSIONAL PROGRAMMES

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Our entire education programme is founded on the part time courses for professional people that we began running in 1981. Now we deliver the programme to over 1,000 post-graduate and post-experience students a year in six international centres.

Our courses are founded on industrial and business relevance as they have been developed in close collaboration with partner companies and are taught by lecturers who have significant industry experience.

Many of our students are taking part in a bespoke programme that we have developed specifically for their company. For example we deliver the procurement development programme for BAE Systems' rising stars. We are able to deliver cutting edge knowledge resulting from our research and collaboration with industry that is tailored to the objectives of the company.

But rather than aim to simply train people to do their jobs better, we are proud of the fact that we educate them to both understand the bigger picture within their companies and encourage them to introduce new thinking; thereby raising the bar for management of UK and global businesses as a whole.

The sponsor company gets more rounded managers with much greater potential to become successful leaders. Forward-thinking companies will get the best from these employees by facilitating them to challenge the status quo while taking the lead on company best practice gained from their course.

Companies can also get involved with the programme by joining us as a guest speaker or helping us shape the content of our courses – whether or not they choose to sponsor their employees to study with us.

## FULL-TIME MASTERS COURSES

**'THERE IS SO MUCH COMPETITION IN THE JOB MARKET THAT YOU NEED TO GO THE EXTRA MILE IN ORDER TO STAND OUT FROM EVERYONE ELSE. STUDYING AT WMG HAS GIVEN ME THE EXTRA EDGE I NEED TO GET AHEAD'**

Varun K Ramaswamy,  
MSc in Electronic  
Business Management

Around 450 students from around the world come to WMG every year to take part in our full time Masters programme. These students are destined for high-flying careers in a wide range of sectors including manufacturing, logistics, technology, e-business, transportation, healthcare and project management. We feel it is vital to their success that they become deeply engaged with industry from the moment they join us.

There are a number of ways businesses can get involved and benefit from their involvement with the programme. For example:

- » Many businesses offer a graduate trainee programme that includes an MSc with WMG; instead of funding a part-time programme, companies may choose to fast-track their best people to achieving an MSc within a year.
- » Companies who work with us on a collaborative R&D project or who sponsor students can benefit from the fresh perspective our full time students can contribute to the research.
- » Businesses can also recruit from our pool of exceptional students.
- » Organisations can also showcase their own operations to potential recruits by hosting an industrial visit or joining us as a guest speaker.



- » A large number of our full time students are from overseas, many of whom return home once they have completed their studies. This means corporations have a global recruitment opportunity to attract returning students while they are still in the UK. And because all our students are exposed to a multi-national multi-cultural environment, they are well suited to international postings.
- » We also run an internship programme, leveraging the relationship we have with our many industrial partners. It is a growing programme that is intended to evolve into an on-campus global recruitment opportunity for our students.
- » All WMG's courses are endorsed by the Institution of Engineering and Technology and can contribute to the competencies required for Chartered Engineer status.

## FINDING ANSWERS TO THE BIG QUESTIONS

WMC is constantly anticipating and seeking answers to the big questions. But we also work to define the future. Often, we are in a position to see and exploit a new way to look at the opportunities and threats facing organisations.

We work with organisations, companies and governments to jointly find solutions that build institutional capability and have far-reaching impacts leading to the creation of economic wealth and improvements to quality of life.

We also look at the small questions – those details that sometimes make a big difference to how things work.

So, if you have a question, big or small, or if you're not even sure what question you should be asking, talk to us.

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