UK-Japan workshop on manufacturing and industrial policy

SUMMARY REPORT

University of Tokyo, Japan | 19 June 2014

This event was co-organised by:

- **The University of Tokyo**
- **Institute for Manufacturing, University of Cambridge**
- **The British Embassy Tokyo**

Rapporteurs: Dr Carlos López-Gómez and Dr Yu Morishita

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UK-Japan workshop on manufacturing and industrial policy

"We were delighted to find so many areas of common interest and agreement together with a shared enthusiasm for developing a better understanding of the changing face of global manufacturing and identifying areas for future partnership"

- Professor Sir Mike Gregory

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BACKGROUND & WORKSHOP AIMS

The role of manufacturing in national economies has been receiving much greater attention in recent years. The context however is changing rapidly not least with the emergence of newly capable manufacturing nations and regions and new technological developments. It is timely therefore to revisit both the context of, and approaches to manufacturing strategies and policies.

Japan and the UK find themselves facing similar challenges but from different starting points. Japan has developed a spectacularly successful manufacturing industry but now faces considerable challenges from new competitors. The UK, whilst historically strong in manufacturing had lost momentum but in very recent years has seen the need to re-invigorate this section of its economy.

Both countries enjoy strong education and research infrastructures but seek to be more effective in the translation of new science into innovations and wealth creating companies and industries.

The workshop summarised in this report is the second in a series designed to build closer links between industrialists, officials and academics involved with manufacturing in the UK and Japan. In particular, the workshop aims were to:

- Identify cooperation opportunities between the UK and Japan in the development of high value manufacturing.
- Share processes and findings concerning manufacturing futures.
- Gain a mutual understanding of the national manufacturing policy landscapes including industrial and sectoral strategies and research interfaces with industry.
- Develop frameworks to enable continuing dialogue between the UK and Japan.

Workshop attendees

KEY THEMES & OBSERVATIONS

The workshop brought together key stakeholders from UK and Japan to share thinking in both countries about the key drivers influencing the future of manufacturing, the consequences for national industrial competitiveness, and the implications for policies to support manufacturing-based solutions to societal challenges. Clear themes of common interest emerged as a basis for future engagement and there was a remarkable alignment of UK and Japanese perceptions. A summary of key themes and observations emerging from the workshop presentations and follow up discussions is presented below. Opinions were expressed by participants in a personal capacity and therefore do not necessarily represent the views of their affiliated institutions.

Re-conceptualising manufacturing

There was general agreement that there is a need to 'reconceptualise' manufacturing to include the full value chain from understanding markets through design, production distribution and service, beyond the realm of material and technology. Extending the definition beyond the core physical production activity provides a much clearer exposition of the nature of manufacturing industries, the opportunities for value creation and capture and the potential role of manufacturing activities within economies.

There was also lively discussion about the nature and configurations of modern manufacturing with a strong agreement that further research is needed to better communicate the relevance of manufacturing in the wider economy and society. A key task is to articulate the role of manufacturing in tackling global and societal challenges – not least the growing need to produce more with less, tackle climate change, develop cleaner energy sources, and provide solutions for aging societies.

Future of Manufacturing

There is growing international interest in the future of manufacturing and several countries are preparing industrial and manufacturing foresight reports. These reports taken together are likely to have a significant influence on manufacturing, practice and policy around the world. Given the strong industrial ties between the UK and Japan, there are many opportunities to share perceptions of the future of manufacturing and to discuss the required policy responses.

The recently published UK Government Office for Science's Future of Manufacturing Project was amply discussed during the workshop. Reflecting the UK's renewed interest in manufacturing, the project aimed at providing ongoing robust and objective evidence to inform the strategies of agencies across the UK government. Japan's substantial experience carrying out exercises addressing the future of manufacturing and its accumulated expertise in practices and methods was also discussed.

Progress was made to better understand contextual similarities between UK and Japan, and comparative studies should provide broader yet deeper understanding of each societal issue that both countries currently face. Sharing of analysis and perspectives on the future of manufacturing as part of an ongoing programme of collaboration would provide an excellent foundation for the identification of areas of mutual research and technical interests.

Policy development for manufacturing

The workshop provided an opportunity to address some of the main challenges faced by manufacturing industries in both the UK and Japan and discuss the type of policy responses required to address them. While some of the challenges faced by these countries vary significantly, there were also areas of strong mutual interest.

One of the key areas of concern for both countries is the difficulty faced by manufacturing firms to attract and employ people with the required skills. Participants from both countries believed that a negative image of manufacturing in society is particularly unhelpful and thus incentives across the education system may be required to improve the understanding of manufacturing. In Japan, the need to train "high-level" personnel in manufacturing was recognised, particularly in areas such as new business models, marketing, and international strategy. In the UK, new reforms to the apprenticeship system are being promoted to simplify it and increase its quality while ensuring that apprentices are equipped with the skills required by the industry.

The coordination across government agencies in designing and implementing manufacturing-relevant policies was recognised as another common challenge. In the UK, one of the key principles sought after by the new national industrial strategy is the adoption of a "whole-of-government" approach to integrate technology and sectoral-specific policies. In Japan, the Council for Science, Technology and Innovation (CSTI), Cabinet Office, has recently established a Strategic Innovation Promotion Program (SIP) to coordinate cross-ministerial R&D efforts in prioritised societal issues (in the areas of energy, next-generation infrastructure and local resources).

Public research and innovation in the manufacturing value chain

Competitiveness in modern manufacturing increasingly relies upon the rapid adoption of science and engineering developments to enable the manufacture of new products or the manufacture of existing products in new ways. In this context, the role of the public research base is being re-assessed in a number of countries as part of broader efforts to address growing international competition. New institutes have been recently established, including the Institutes for Manufacturing Innovation (IMIs) in the US and the Catapult Centres in the UK. Even in Germany and Japan, countries with a long tradition of funding manufacturing research, there is renewed emphasis on the contribution of publicly funded technology institutes to the competitiveness of domestic industries.

Policies will need to recognise, however, that innovations that can occur along the whole value chain and new approaches to supporting innovation in manufacturing might be required. One such approach discussed during the workshop is the development of human-centric, user-supplier interactive co-creation processes to ensure that innovations satisfy the desired market impact.

Developing the opportunities for collaboration: UK-Japan Manufacturing Roundtables

Workshop participants have agreed to celebrate a series of future UK-Japan collaborations in a form of roundtable meetings, which will comparatively investigate some of the common societal challenges identified during the workshop. The proposed approach is to establish a small core working group sponsored by the Universities of Tokyo and Cambridge to develop continuing dialogue on common priority themes around the key drivers influencing the future of manufacturing, the consequences for national industrial competitiveness, and the implications for policies to support manufacturing-based solutions to societal challenges.

A modest start is envisaged involving small numbers of highly engaged individuals with a commitment to develop a structured but 'open' dialogue facilitated by annual roundtables designed to share thinking and to identify opportunities for collaboration. It is anticipated that the "network of knowledge" and participants from both countries will be expanded in future workshops.

A number of themes with strong common interest have been identified, including the following:

- Societal challenges – including people's needs and social aspirations – where manufacturing might play an important role in addressing (what, where, when to make?).
- Education of (in) manufacturing
- Skills and capability development
- Future (next generation) manufacturing
- Value capture in global value chains
- Management of (energy) resources
- Public infrastructure for innovation and 'translational' activities to take science and engineering developments to industrial applications
- Industry-academy collaboration
- Challenges to manufacturing policy making: policy in a more complex world; policy coordination and learning; government-industry engagement.

RECONCEPTUALISATION OF MANUFACTURING

Welcome and Introduction

Elizabeth Hogben, Head of Science & Innovation Section, British Embassy

Ms Hogben welcomed the workshop participants and thanked the University of Tokyo, Institute for Industrial Science, for hosting the event. Ms Hogben highlighted some of the key objectives of the workshop: identifying opportunities for collaboration between Japan and UK, sharing processes and mechanisms, and forging relationships between both countries. She welcomed recent evidence of a recovery of UK strength in manufacturing industries such as automotive and encouraged participants to explore complementary strengths between the UK and Japan.

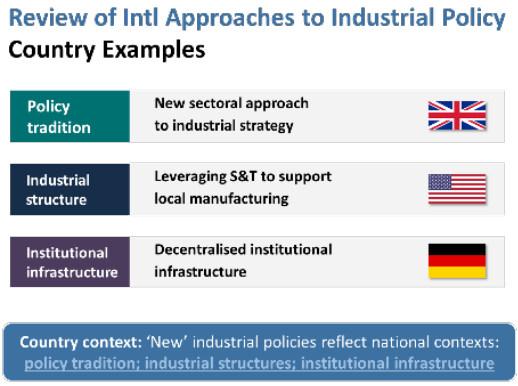
Reconceptualisation of Manufacturing: An Industrial Systems Perspective

Prof. Sir Mike Gregory, Head, Institute for Manufacturing, University of Cambridge

Prof. Gregory's presentation argued for the need to develop more integrated approaches to manufacturing, recognising its importance to the economy and in informing national industrial strategies.

There is an increasing concern among practitioners that manufacturing may not receive sufficient attention in the policy agenda. Part of the difficulty is related to a lack of agreement as to how 'manufacturing' should be understood. Narrow definitions of manufacturing might result in a lack of understanding of its significance across sectors and the broad set of activities it entails. Product technology, for example, tends to attract more attention than process technologies.

Different definitions of manufacturing exist across countries and disciplines and as a result institutional arrangements and policies to support it are diverse. Recent work conducted at the Institute for Manufacturing (IfM) has highlighted key differences in approaches found in important manufacturing countries including Japan, UK, Germany and the US .



In the UK, manufacturing is having a "renaissance", which has been accompanied by a new national approach to industrial strategy. Part of this "renaissance" has been supported by Japanese firms, not least in the case of the automotive industry.

The new approach to industrial strategy in the UK involves strategic "partnerships" between industry and government in eleven strategic sectors in the fields of advanced manufacturing (aerospace, automotive, life sciences), knowledge-intensive traded services (professional/ business, ICT, education), and enabling industries (energy, construction). One of the first "partnerships" established was in the aerospace industry, which has led to the creation of the Aerospace Technology Institute (ATI), a virtual organisation embedded in key research institutes in the UK which will oversee over £2 billion of investment in aerospace R&D over the next few years.

Based on a discussion on a variety of definitions across academic disciplines and countries, Prof. Gregory emphasised the need to recognise of the broad set of activities involved in manufacturing that have the potential to capture economic value, including:

- Activities related to product development
- Activities related to production capability configuration
- Activities related to material transformation and supply chain capability development

Prof. Gregory's presentation concluded by arguing that a key challenge for industrial policy making is to extend 'traditional' definitions of manufacturing in order to better understand how value is created & captured.

[1]O'Sullivan, E., Andreoni, A., López-Gómez, C., & Gregory, M. (2013). What is new in the new industrial policy? A manufacturing systems perspective. *Oxford Review of Economic Policy, 29*(2), 432–462.

Macroscopic Service Theory: Reconceptualization of Manufacturing

Prof. Hiroyuki Yoshikawa, Director-General, Centre for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST)

Positioning today's manufacturing within the societal context, this presentation provided a perspective according to which manufacturing is part of service industry and its value network.

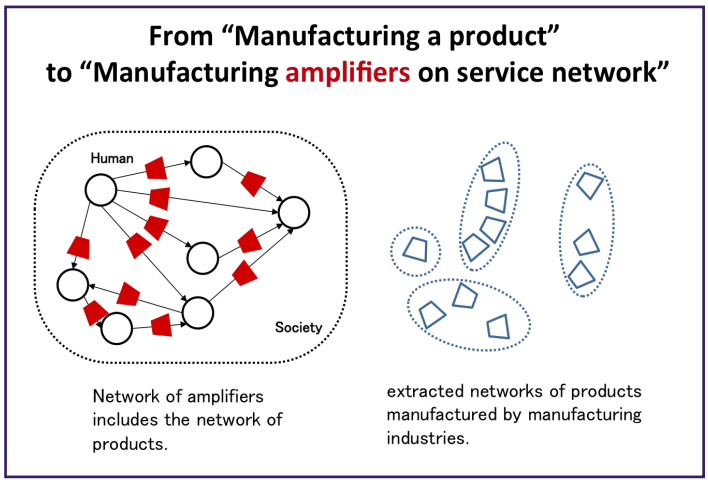
Prof. Yoshikawa identified that manufacturing industry is a part of service industry, where service is the basic societal necessity for human beings. There manufacturing industry designs or manufactures a function, which is embedded into entities whereas simultaneous and direct delivery of function may be identified as flow of service. This embedding process differentiation service and manufacturing industry.

This perspective to manufacturing redefines concept of "manufacturing a product" into "manufacturing amplifiers on service networks", where some of the amplifiers within the service network may be provided by the manufacturing industries. There are "message-type" amplifiers such as TVs (that amplify broadcasting) and "massage-type" amplifiers such as mechanical massage chairs (that amplify the massage service). Some of the categories of service amplifiers are;

- Tools: instruments, machineries, database, software
- Circumstances: structure, space, layout, network
- Social Systems: regulation, rule, organization, institution
- Complex vehicles: compositions

Prof. Yoshikawa identifies that eventually, this perspective can be used to redefine the wealth of a nation by measuring the total rate of service instead of product-based GDP. In this perspective, manufacturing is an amplification factor within the total system where it mediates transformation of primitive services into amplified services.

During the Q&A session, he further commented on the issue of sustainability, where material and technological concerns may be necessary. An important issue is to stimulate research on measuring functionality.



Genba-Based Manufacturing Strategy

Prof. Takahiro Fujimoto, Professor, Faculty of Economics, The University of Tokyo / Executive Director, Manufacturing Management Research Center, The University of Tokyo

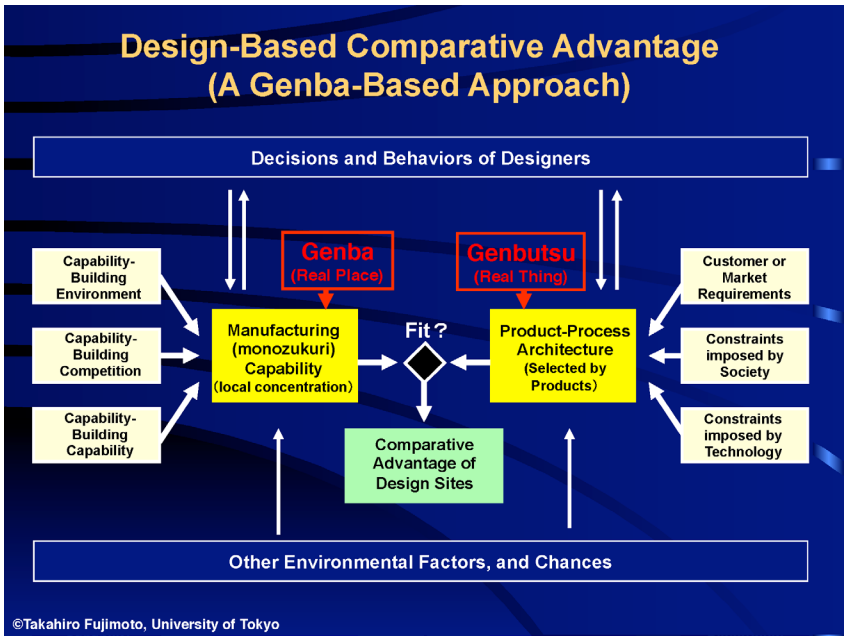
This presentation introduced a field-based perspective to the analysis of manufacturing industry, identifying the actual value-productive capabilities within the manufacturing landscape of Japan.

Prof. Fujimoto highlighted the importance of analyzing manufacturing from Genba (production field) perspectives, which reflects the management of design information (=value) within the company. Two pillars of field-based view/analysis of industries and firms are 1: organizational capability in manufacturing (the way a firm creates good flows of design information to customers better than rivals), and 2: architecture (the way design elements are divided and connected to the whole). Comparative advantage of design is derived from the fitting between the Genba (manufacturing capability) and Genbutsu (product-process architecture).

He presents even within Japan's 20-year low growth era, its manufacturing sectors has continued its productivity improvement, while non-manufacturing (service) sectors did not improve its productivity. Historical perspective of Japanese Genba and today's problems are identified as follows.

- 1945-50: Restoration period when Japan's trade strategy restarted
- 1950s-60s: Rapid growth without massive immigrants: "Economy of Scarcity" enabled coordination-rich sites (Genba) with teamwork of multi-skilled workers
- 1970s-80s: Global competition with advanced countries under Cold War: capability building, productivity increase, trade surplus, lean manufacturing, coordination-intensive production
- 1990s-2000s: Global competition with emerging countries after Cold War: emergence of China (1/20 wage rate), digital innovations, handicap for Genba, yet capability-building continued
- 2010s-2030s: Wage handicap vs. emerging nations decreases: darkness before dawn for Genba?

In the shifting landscape of manufacturing capabilities in Japan, Prof. Fujimoto identifies the significance in 1: establishing comparative advantage of design (architecture-capability fit), 2: capability-building competition, 3: evolutionary learning capability, and 4: strong strategies and strong operation. He gave an example of the University of Tokyo Manufacturing Instructor's School where initiatives are taken in educating instructors who can teach lean manufacturing across the industries.



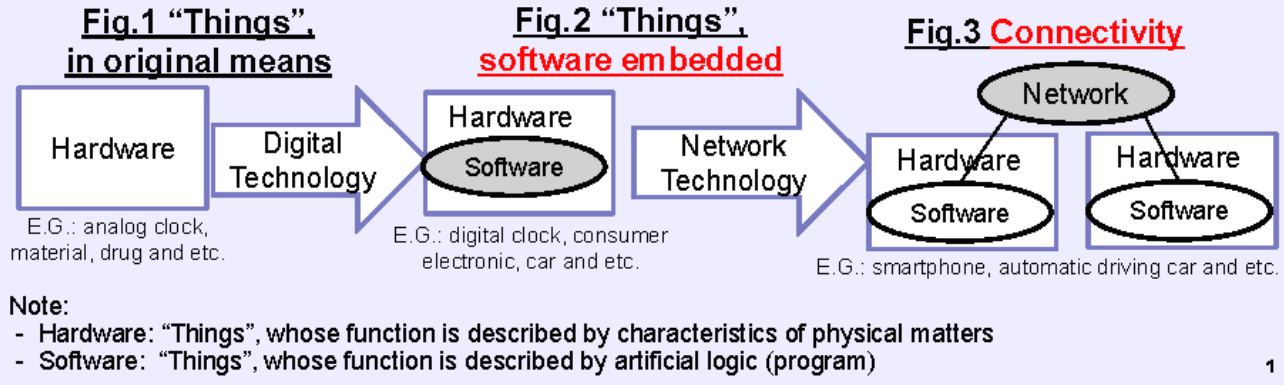
Technology development: A driving force to diverse the function of "things"

Dr. Michiharu Nakamura, President, Japan Science and Technology Agency (JST)

This presentation introduced a network technology-based perspective to manufacturing, where further potential in network connectivity may be utilized toward capturing capabilities of Japanese Manufacturers.

Dr Nakamura identified the potential connectivity that network technology may give to the function of "things". He discussed the development of software embedded "things" enabled by digital technology, to network connectivity embedded "things" enabled by network technology.

He argued that industries have been leading the manufacturing sector in Japan through large scale investment, whereas the role of public sector is to reshape the understanding of manufacturing.



The Future of Manufacturing: A new era of opportunity and challenge for the UK

Paul McCaffrey, Project Leader, Future of Manufacturing Project Foresight, UK Government Office for Science

Mr McCaffrey provided an overview of the key findings of the recent Foresight Future of Manufacturing Project led by the UK Government Office of Science and discussed the implications for policy development.

The aims of this cross-agency project were to analyse important long term changes, out to 2050, affecting the UK manufacturing sector; and to advise how policy needs to evolve to support the future growth and resilience of UK manufacturing.

The project found that manufacturing makes a "powerful" contribution to the UK economy: it represents around 10% of GDP (£139 billion in 2012) and 53% of exports (£256 billion in 2012), employs around 3m people, has a faster productivity growth than other sectors of the economy, and provides resilience in face of recession.

Mr McCaffrey explained that the foresight project put emphasis on trends and uncertainties related to the manufacturing activity. The project findings provide five headline messages about how manufacturing will change towards 2050:

More than making a product and selling it	A "wider value chain" will be used to create revenue though activities such as integration of services with products, sale of technical know-how by firms not necessarily involved in production, and remanufacturing.
Faster, more responsive and closer to customers	Growing demand for mass personalisation of products, increasingly distributed production (big high-tech, modular, home, mobile), greater design freedom, and more digital connections along value chains. New primary and secondary technology developments will play a central role in driving change in manufacturing.
Exposed to new market opportunities	New patterns of global trade and investment will reshape the importance of countries as markets of manufactured products, with the BRICs and the 'Next 11' likely to become increasingly important destinations. Changes to personal wealth / ageing populations will affect the location of markets and the global 'fragmentation' of the value chain is likely to continue.
More sustainable	It is expected that growing / urban populations will raise resource demand. Meanwhile, climate change will increase global supply chain vulnerability which might in turn result in volatility in price of commodities. The concept of the circular economy – including reuse, remanufacturing, and recycling – will become increasingly important.
Increasingly dependent on highly skilled workers	Ageing population will further increase the already strong demand for manufacturing workers, while the need to accommodate more older workers will become more evident. The importance of STEM qualifications and blending of technical & commercial 'hybrid' skills will provide further potential for human enhancement in manufacturing.

Mr McCaffrey concluded that as manufacturing evolves, policy makers will need new approaches to account for its changing nature in policy development. The Foresight Future of Manufacturing Project provides an ongoing robust and objective evidence base that will need to be reflected in the strategies of agencies across the UK government.

Redefining Circular Manufacturing: reorganizing the efforts to implement the sustainable manufacturing business

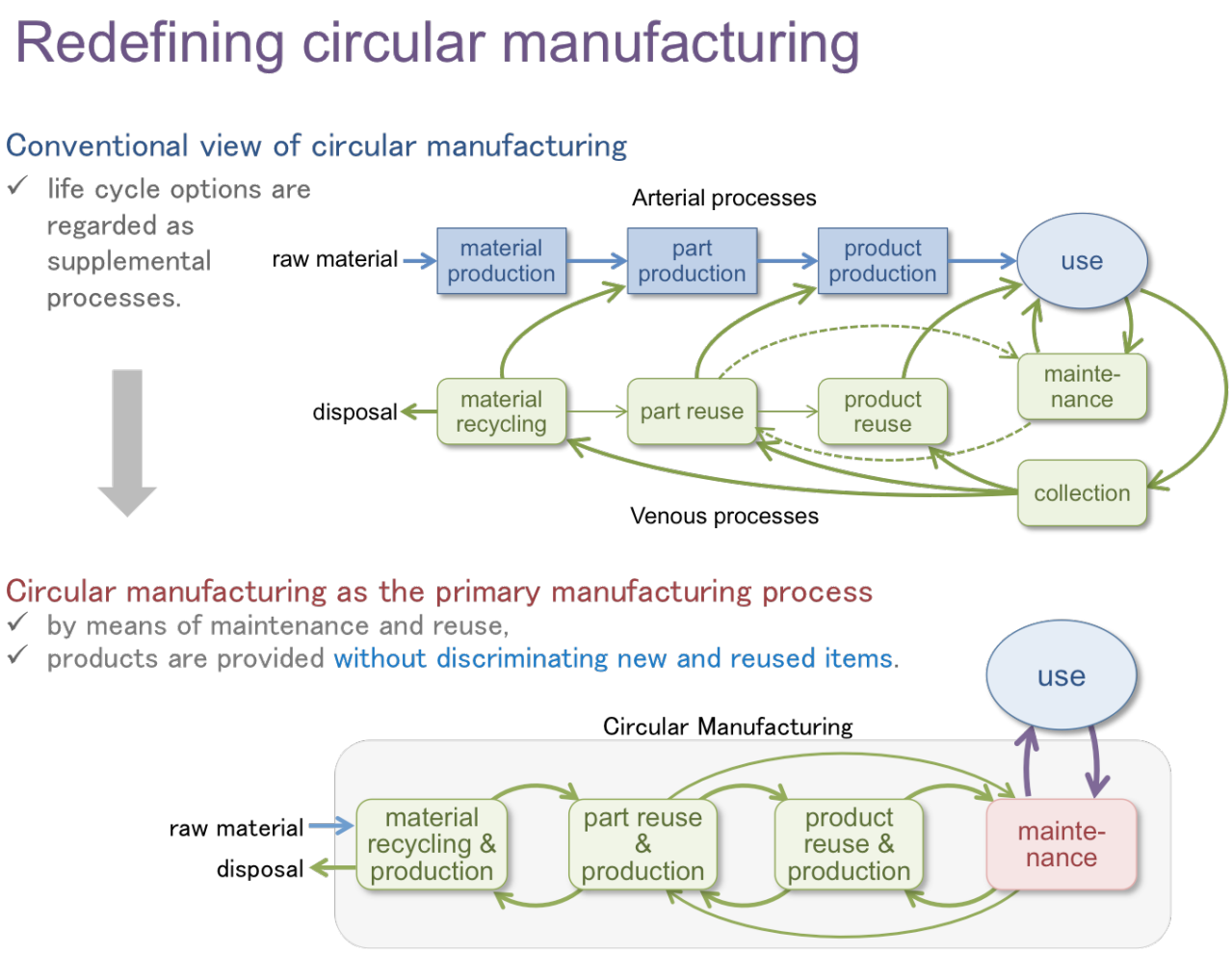
Prof. Shozo Takata, Professor, Department of Industrial and Management Systems Engineering, School of Creative Science and Engineering, Waseda University

This presentation focused on embedding sustainable manufacturing processes into the primary and de facto manufacturing process. The urgency in integrating the sustainable manufacturing processes is systematically argued.

Since 2005, METI (Ministry of Economy, Trade and Industry) has continued to develop technological strategy map for 31 technology areas of 8 domains, within the area of design, production, and processing listing 186 technical issues in 64 categories. Each issue is forecasted with expected time of practical use. Circular manufacturing, global networks in manufacturing systems, CAE and simulation within design, minimal processing and advanced process within processing technologies were identified as 5 top prioritized issues. Efforts has been undertaken in the past two decades to implement circular manufacturing in Japan.

Currently, dissemination of the circular manufacturing is limited to certain types of products.

Development in 3R technologies has been continuing including closed-loop mixed plastic recycling separation technology, concept of Remanufactured New (RN) machinery production, module reconfiguration, remanufacturing and so on. There are many opportunities to capture these potentials through redefining circular manufacturing as the primary process in manufacturing and not as one of the optional process in manufacturing. In order to do so, simultaneous development of components that enable goal-oriented approach are necessary, focusing on product life cycle evaluation, life cycle scenario development, and LCE technology development.



POLICY DEVELOPMENT FOR MANUFACTURING

UK Manufacturing Policy

Chris Carr, Deputy Director Manufacturing, Services & Electronics, Department for Business, Innovation & Skills (BIS)

Mr Carr offered an overview of the current UK government approach to manufacturing as well as next steps in the policy agenda.

Manufacturing "punches above is weight" in terms of its contribution to the UK economy but also politically. Manufacturing is still important to the UK and has been recognised as a key sector with the potential to drive growth across the economy. As a result, the government has adopted a new approach to industrial strategy with the aim of giving businesses the confidence to invest. While a key focus is on those areas of advanced manufacturing where the UK has the clearest competitive advantage, the strategy considers a spectrum of support for all sectors.

<table>
<tr><th>Light touch</th><th>Action</th><th>Sustained dialogue</th><th>Strategic Partnership</th></tr>
<tr><td colspan="4">Government sets the environment through horizontal policies (e.g. tax, IPR, skills)</td></tr>
<tr><td></td><td colspan="2">Government takes action to respond to specific issues (e.g. tourism in 2012)</td><td></td></tr>
<tr><td></td><td></td><td colspan="2">Sustained dialogue and action e.g. sector councils, joint strategies</td></tr>
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The key principles of the UK industrial strategy are long termism; partnership with business; and the adoption of a whole-of-government approach. It considers actions across five themes:

- Supporting emerging technologies including the "8 Great";
- Working to improve access to finance for businesses;
- Working with business to help develop skills that businesses will need;
- Publishing public sector procurement pipelines worth £175bn to help businesses plan for future government contract opportunities.

Mr Carr explained that skills is possibly the single biggest policy issue that UK businesses emphasise. The difficulty to attract talent is often related to a negative perception of manufacturing in society. To address this situation, the Advanced Manufacturing Growth Review contains a package of measures to help change perceptions of manufacturing. New reforms to the apprenticeship system will also be introduce to simplify it and increase its quality while ensuring that apprentices are equipped with the skills required by the industry.

Additional policy initiatives recently established in the UK are described in the figure below.

Recent Policy Actions in the UK

- The Prime Minister announced Reshore UK – a one-stop service to help companies bring back production to the UK.
- The Advanced Manufacturing Supply Chain Initiative – up to £245m to improve competitiveness of UK supply chains by supporting innovative projects where UK is well placed to take a global lead.
- More than 14,800 firms have received specialist support from the Manufacturing Advisory Service.
- 9 world-leading Catapult Centres were set up to foster the UK's capability for innovation (7 operational). These are addition to 16 new university-based Centres for Innovative Manufacturing set up to support emerging science in areas of strategic opportunity and address the long-term research challenges.
- A total of 50 University Technical Colleges have been announced.
- Foresight Manufacturing Project – published on 30 October and work is being considered on better intelligence, targeting of support and capability.

Next steps in the UK industrial strategy include continuing to engage with the whole range of sectors to develop appropriate implementation plans and further examination of what more we need to do to support manufacturing supply chains.

Summary of the Manufacturing Industrial Policy (Monodzukuri White Paper 2014)

Nobuyuki Hiratsuka, Director, Manufacturing Industry Policy Office, Ministry of Economy, Trade and Industry (METI)

This presentation gave an overview toward current situation of Japanese manufacturing industry and the challenges it faces.

In the past years, business performance of Japanese manufacturing industry has improved in terms of rise in wages and benefits, however the surplus in the current account has continued to decrease for three consecutive years. Aging society also fuels the situation where appropriate measures are required.

Under such conditions, a number of future directions toward strengthening the competitiveness of Japan's manufacturing industry are considered.

- Improvement of domestic production bases and exports power and infrastructure development for increasing earning overseas. This includes shift in focus toward emphasis on business model and productivity improvement from R&D. For example, Fujitsu Limited has succeeded in reducing the number of personnel for production to one-tenth of that in China. Daikin uses suppliers in other sectors to manufacture high value-added products at low cost by taking advantage of the production concentration.
- Fostering new exporters outside of manufacturers of assembled products and large enterprises. Government support is necessary in manufacturing industry toward creation and development of venture companies. Capturing the global market share in niche market or investment in new technology domains such as bio-venture are some of the examples.
- Bringing in the global demand and promoting the capitalization of earnings from overseas in order to maintain the current balance is necessary. The public and private sectors need to cooperate to ensure that wealth acquired through the accelerating overseas business expansion will reliably return to Japan for domestic investment.
- Improvement of earning power despite the changes in the business environment through building profitable business models will be necessary. The shift identified as polarization between high value added fields and low value added fields has been brought with new digital manufacturing methods and advance modularization.
- The shift in the business environment also challenges securing human resource in many divisions of the company who can foster value-capturing capabilities. The necessities toward IT investments and utilization of external resources (M&As, etc) should be considered.

The National Program for Manufacturing Innovation

Naofumi Moriya, Director for Nanotechnology and Materials, Council for Science, Technology and Innovation (CSTI), Cabinet Office, Government of Japan

This presentation exemplified one of the key governmental actions toward promoting the innovation within Japan that aims to foster cross-boundary innovation and brings attention to specific societal issues.

Current Japanese revitalization strategy and its economic policies are closely linked with comprehensive science, technology and innovation (STI) strategy. CSTI stands to promote effective measures in cross-ministries, cross-disciplinary, cross-sector collaboration toward innovation. In the cross-ministerial strategic innovation promotion program (SIP), CSTI allocates themes to address societal issues that will lead to economic growth. FY2014 gives priority toward, energy, next generation infrastructures, and local resources. Appointed program directors are both from the institutions and industries.

The aim of SIP is to add what Mr. Moriya defines as "delight manufacturing", where conventional, quality and performance-based manufacturing is paralleled by satisfaction-based manufacturing. SIP aims for 1: delight design, 2: agile production and manufacturing, and 3: innovation style to deliver commercialization of high-value-added products and services and exploitation of market.

Public research and innovation in manufacturing value chains

Dr Carlos López-Gómez, Centre for Science, Technology and Innovation Policy, University of Cambridge

Dr Lopez's presentation dealt with the question "Why does public research policy matter for manufacturing jobs & innovation in high wage economies?" and introduced the case of the Catapult Centres, translational research institutes recently established in the UK

Competitiveness in modern manufacturing increasingly relies upon the rapid adoption of science and engineering developments to enable the manufacture of new products or the manufacture of existing products in new ways. As a result, the importance of public research policy in supporting manufacturing competitiveness is increasingly recognised. Broadly speaking, public research in high wage economies can support either:

- process innovation & high quality jobs through R&D underpinning manufacturing technologies, or
- emerging technology innovation & future jobs through R&D for 'manufacturability' of high value emerging technologies

Why Does Public Research Policy Matter for Manufacturing Jobs & Innovation?

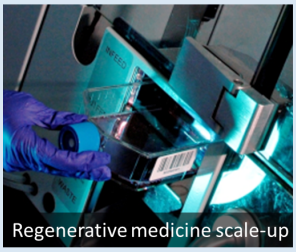
Process Innovation & High Quality Jobs

R&D underpinning **manufacturing in high wage economies**

Hybrid machine tool systems

Emerging Technology Innovation & Future Jobs

R&D for 'manufacturability' of **high value emerging technologies**



Regenerative medicine scale-up

Eoin O'Sullivan

Given the increasingly complexity of manufacturing activity, however, new concepts are required linking production, platform and infrastructural technologies to help identify the public role in the innovation process. For example, the combinations of functions/services that public research institutes should provide in supporting innovation is being revisited in a number of countries such as the UK, US, Japan and Germany.

There is a growing recognition among such countries of the need to improve 'translational' arrangements that facilitate the application of emerging developments in science and technology into actual industrial activity. In the UK the Catapult Centres have been recently established with the aim of improving this translation process – alongside the Centres for Innovative Manufacturing supported by the Engineering and Physical Sciences Research Council. The Catapult Centres have been granted core public funding for investment in capabilities, know how, expertise skills and long term capital assets. Initial assessments suggest that the Centres have driven strong industrial engagement, support and impact.

Innovation in manufacturing value chains and networks

Prof. Tomonari Yashiro, Vice President, The University of Tokyo and Professor of Institute of Industrial Science, The University of Tokyo

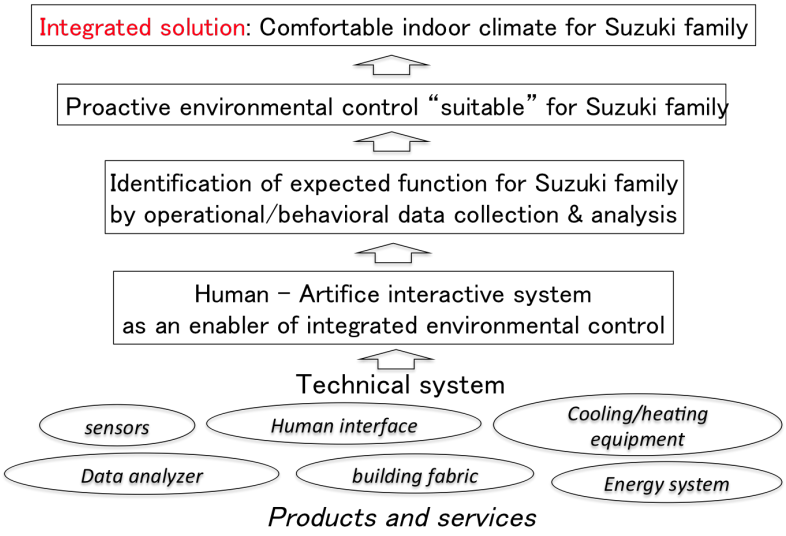
This presentation argued for the necessity of human-centric, user-supplier interactive co-creation processes, where modification of value chains is necessary to capture value through integrated solution within the innovation in manufacturing.

Prof. Yashiro pointed out the apparent gap between the invention and the resulting market impact. Referencing Prof. Ogawa's open/closed strategy research, Prof. Yashiro suggested that invention in Japan has not lead to enhanced core competence of the industry. Prof. Yashiro argued that more focus should be given to the servicing stage of the value chain, where users extract embedded service by operating onto the artefact. The pioneering area of the scope of work for the future manufacturing is identified in operational phase, user-based domain, shifting from sole design and production within the supplier-end.

The gap between the supplied products and available service is highlighted by cases where actual operational data shows the decline in serviceability compared to what is expected at the point of manufacturing. Prof. Yashiro proposes "reverse process" of manufacturing where human-artefact interface derives operational data to enable integrated solution provision. Such process will lead to coordinated control of artefact for customized service within the Internet of things.

In the perspective of service intensive manufacturing, the core capacity is derived from, 1: data collection and analysis to identify each user's expectation, 2: building user-supplier interactive co-creation process in operation, 3: design and provision of customized integrated solution beyond existing domains, 4: adaptable supply chain that could accept feedback from users, 5: business eco system such as global manufacturing partnership as an enabler of diversified service and benefit of economy of scale.

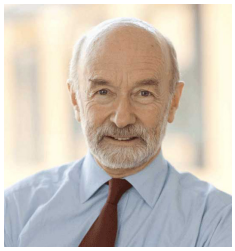
"Reverse process" of manufacturing by non linear model



AGENDA

09.30	**Welcome:** Elizabeth Hogben, Head of Science & Innovation Section, British Embassy
	Reconceptualisation of manufacturing:
09.45	Prof. Sir Mike Gregory, Head, Institute for Manufacturing, University of Cambridge
10.00	Prof. Hiroyuki Yoshikawa, Director-General, Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST)
10.15	Prof. Takahiro Fujimoto, Professor, Faculty of Economics, The University of Tokyo / Executive Director, Manufacturing Management Research Center, The University of Tokyo
10.30	Dr Michiharu Nakamura, President, Japan Science and Technology Agency (JST)
10.35	Q&A
	Manufacturing futures:
10.50	Paul McCaffrey, Project Leader, Future of Manufacturing Project Foresight, UK Government Office for Science
11.05	Prof. Shozo Takata, Department of Industrial and Management Systems Engineering, Waseda University
11.20	Q&A
11.30	*Refreshments*
	Policy development for manufacturing:
11.45	Chris Carr, Deputy Director Manufacturing, Services & Electronics Advanced Manufacturing and Services, Department for Business, Innovation & Skills
12.00	Nobuyuki Hiratsuka, Director, Manufacturing Industries Policy Office, Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry (METI)
12.10	Naofumi Moriya, Director for Nanotechnology and Materials, Bureau of Science, Technology and Innovation, Cabinet Office
12.20	Q&A
12.35	*Lunch*
	Public research and innovation in manufacturing value chains:
13.20	Dr Carlos López-Gómez, Centre for Science, Technology and Innovation Policy, University of Cambridge
13.35	Prof. Tomonari Yashiro, Vice President, The University of Tokyo / Professor of Institute of Industrial Science, The University of Tokyo
13.50	Q&A
14.00 - 15.30	**Plenary discussion: Emerging findings, areas for collaboration, future activities**

SPEAKER BIOGRAPHIES

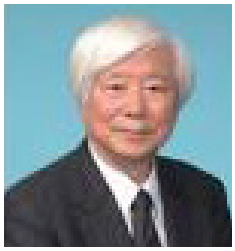


Professor Sir Mike Gregory *Head, Institute for Manufacturing, University of Cambridge*

Mike Gregory is Head of the IfM. Following an early career in industry, he founded the Manufacturing Engineering Tripos, a senior undergraduate programme linking engineering, management and economics and with very close industrial engagement.

Subsequent developments in research and collaboration with industry reflected this broad view of manufacturing and led to the establishment of the IfM in 1998. Mike's work continues to be closely linked with industry and government and he has published in the areas of manufacturing strategy, technology management, international manufacturing and manufacturing policy.

He served as Executive Director of the Cambridge MIT Institute from 2005– 2008 and was Springer Visiting Professor at UC Berkeley in 2008/9. He chairs the UK Manufacturing Professors' Forum and is a member of the UK government's Manufacturing Analytical Group. He is a Fellow of Churchill College and the Royal Academy of Engineering.



Prof. Hiroyuki Yoshikawa *Director-General, Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency (JST)*

Professor Hiroyuki Yoshikawa is now Director General of Centre for Research and Development strategy, Science and Technology Agency Japan where he is leading to design national research programmes for realising the sustainable prosperity in society by integrating sciences, natural, medical, technological, social and literal. Through his recent positions: President of University of Tokyo, President of Open University, President of National Institute of Advanced Industrial Science and Technology, he developed a method of integration of different disciplines for sustainability research. His academic subject is General Design Theory, which is common through different engineering disciplines. He was President of ICSU, 1999~2003, and worked for its reformation.

Prof. Takahiro Fujimoto *Professor, Faculty of Economics, The University of Tokyo / Executive Director, Manufacturing Management Research Center, The University of Tokyo*

Expertise / Research Field: Economics / Business Administration

Current Research Interests / Projects: Technology and Operations Management

Educational Background: D.B.A (Doctor of Business Administration) Harvard University, USA (1989); B.A. (Economics) University of Tokyo, Japan (1979)

Professional Activities (academic and others)
Executive Director, Manufacturing Management Research Center (2004 -); Professor, Faculty of Economics, The University of Tokyo (1998 -); Senior Research Associate, Harvard Business School (1997 -); Visiting Professor, Harvard Business School (1996); Visiting Researcher, INSEAD (1996); Visiting Professor, Lyon University (1996); Associate Professor, Faculty of Economics, University of Tokyo (1990-1998); Research Associate, Harvard University (1989); Mitsubishi Research Institute (1979-1990)

Selected Publications:
Coping with Complex Artifacts (in Japanese),Yuhikaku(2013); Japanese Process Industries (edited with K. Kuwashima, in Japanese),Yuhikaku(2009); Competing to Be Really, REALLY Good -House Press (2007); Open Manufacturing Management (edited with MMRC in Japanese), Kobunsha(2007); A Philosophy of Monodukuri (in Japanese), Nihon Keizai Shinbunsha (2004); Capability Building Competition (in Japanese), Chuokoronshinsya(2003); Introduction to Production Management 1&2 (in Japanese), Nihon Keizai Shinbunsha (2001); Successful Product Development (in Japanese), Yuhikaku, Tokyo (2000); Coping with Variety: Flexible productive Systems for Product Variety in the Auto Industry (edited with Y. Lung, J. Chanaron and D. Raff), Ashgate Publishing, Aldershot (1999); The Evolution of a Manufacturing System at Toyota, Oxford University Press, New York (1999); Transforming Automobile Assembly (edited with K.Shimokawa and U.Jurgens), Springer, Berlin, (1997); Readings on Supplier Systems (edited with T.Nishiguchi and H.Itoh, in Japanese), Yuhikaku, Tokyo (1997); Product Development Performance (edited with Kim B Clark) Harvard Business School Press, Boston(1991).

Dr Michiharu Nakamura, *President, Japan Science and Technology Agency (JST)*

Dr. Nakamura graduated from the University of Tokyo and joined Hitachi Central Research Laboratory in 1967, where he was engaged in compound semiconductors and optoelectronics research. He was a pioneer of semiconductor DFB laser development. In 2004, he was appointed Executive Vice President and Executive Officer of Hitachi Ltd., and then assumed a position of Board of Director till September 2011. He was responsible for corporate technology development and new business incubation. He was a visiting Researcher at California Institute of Technology in 1972-73.

Since October 2011, he has been serving as President of Japan Science and Technology Agency (JST), where policy-driven R&D funding is a major mission. Also, the dissemination of scientific information, science education for young generation, and science communication are among current activities.

He has been actively working on national science and technology strategy. He has served for Industrial User Society for Neutron Application, Industrial R&D Committee of the Japan Business Federation, Council of Competitiveness Japan, Management Committee of Tsukuba Innovation Arena, Nanotechnology Business Creation Initiative and Council for Science and Technology of Minister of Education, Culture, Sports, Science and Technology (MEXT).

He is entitled IEEE fellow, JSAP fellow, and IEICE fellow.

Paul McCaffrey *Project Leader, Future of Manufacturing Project Foresight, UK Government Office for Science*

Paul has been leading the manufacturing project for Foresight, a team based in the UK Government Office for Science, which uses the latest evidence combined with futures analysis to tackle complex issues and help policy makers make decisions affecting our future.

Prior to his role in Foresight, Paul held various roles in the Department for Business, Innovation and Skills and its predecessor Departments relating to energy policy, finance and strategy, and communications.

He also spent time working with Lord Mandelson, when he was Secretary of State, on industrial and postal services policies. He will shortly be starting a secondment to the Rolls-Royce plc Nuclear Sector, working as Manufacturing Programme Manager.

Prof. Shozo Takata *Department of Industrial and Management Systems Engineering, Waseda University*

Shozo Takata is a Professor at the Department of Industrial and Management Systems Engineering at Waseda University in Tokyo, Japan. He received his Doctor's in Engineering in the Department of Precision Machinery Engineering at the University of Tokyo, Japan. He worked at Toyo University as a lecturer and associate professor from 1978 to 1990, and at Osaka University as an associate professor from 1990 to 1992 before moving to Waseda University.

His research interests are in life cycle engineering focusing on design and management of reuse and recycling system for the circular manufacturing, life cycle maintenance focusing on integrated planning of operation and maintenance, and business design for facilitating the implementation of circular manufacturing and product life cycle management.

Chris Carr *Deputy Director Manufacturing, Services & Electronics Advanced Manufacturing and Services, Department for Business, Innovation & Skills*

Chris Carr is a career civil servant with experience across the public sector, having worked in four departments, an independent review, a local council and a quango. He has also worked at a big-name consultancy firm and at a very small one.

His expertise is in the area of organisational development – variously called continuous improvement, change management, business process re-engineering, Lean, Six Sigma and various other lucrative brands. He combines this with a classic policy skillset and is therefore doomed forever as a "generalist" – old-fashioned, unimaginative and lacking in drive. Nothing could be further from the truth.

His current role is to lead policy on Manufacturing, Services and Electronics – combining sponsorship of the UK electronics and professional & business services sectors with a wide-ranging manufacturing brief covering technology, financing and skills.

Nobuyuki Hiratsuka, *Director, Manufacturing Industries Policy Office, Manufacturing Industries Bureau, Ministry of Economy, Trade and Industry (METI)*

1992: BA (Law) University of Tokyo

1992: Joined MITI (currently, METI)

1992-1994: General Division, Japanese Patent Office

1994-1995: Deputy Director, Budget Planning Division, Minister's Cabinet

1995-1997: Deputy Director, Policy Planning Division, Small and Medium Enterprise Agency

1997-1999: Deputy Director, Tax Affairs Division, Economic and Industrial Policy Bureau

1999-2001: MA (International and Public Affairs), School of International and Public Affairs, University of Columbia L.L.M, Harvard Law School

2001-2003: Deputy Director, International Economic Affairs Division, Trade Policy Bureau

2003: Dispatch of Iraq Coalition Provisional Authority (Basra, Republic of Iraq)

2004-2008: Secretary General, Japan Business Council in Europe (Brussels Belgium)

2008-2012: Director, Corporate Accounting, Disclosure CSR Policy Office Economic and Industrial Policy Bureau

2012-present: Director, Manufacturing Industry Policy Office, Manufacturing Industry Policy Bureau

Naofumi Moriya, *Director, Cabinet Office*

Date of Birth: 7th June, 1958

Educational Background:
March 1982 B.A. of Economics (The University of Tokyo)

Professional Career:
April 1982:Kokusai Denshin Denwa Co. Ltd. (KDDI Corporation, at present)

October 2003 : General Manager, KDDI Hong Kong Ltd.

April 2008: Director, Sales Planning, Chubu Sales Headquarter, KDDI Corporation

April 2012: Director for Nanotechnology and Materials, Bureau of Science, Technology and Innovation, Cabinet Office, the Government of Japan

Overseas Background:
From 1986 to 1987 Department of Advertising, Michigan State University (MI, USA)

Dr Carlos López-Gómez, *Centre for Science, Technology and Innovation Policy, University of Cambridge*

Carlos is a research associate at the Centre for Science, Technology & Innovation Policy (CSTI), University of Cambridge. He formerly worked in the automotive and engineering service industries, both in Mexico and the US.

His current research focuses on manufacturing strategies and industrial policies, with emphasis on the aerospace and software industries in East Asia and Europe. He has over the last years collaborated with institutions such as the United Nations Industrial Development Organisation (UNIDO) and the European Commission. Carlos holds a PhD from the Engineering Department of Cambridge University.

Carlos has been closely involved with the Manufacturing Working Group of the Aerospace Growth Partnership, the collaboration between government and industry leading the UK aerospace sector strategy.

Prof. Tomonari Yashiro *Vice President, The University of Tokyo / Professor of Institute of Industrial Science, The University of Tokyo*

Education:
1980 B.E. The University of Tokyo, Japan in Architecture and Building Engineering; 1982 M.E. The University of Tokyo, Japan in Architecture and Building Engineering; 1985 Ph.D. The University of Tokyo, Japan in Architecture and Building Engineering

Professional experience:
1985-1991 Building Research Institute, Ministry of Construction Japan; 1991-1998 Associate Professor, Musashi Institute of Technology, Japan; (1994-1995) Visiting Research Fellow, University of Reading, UK; 1998-2001 Associate Professor, The University of Tokyo, Japan; 2001-present Professor, The University of Tokyo, Japan; 2007-2008 Deputy Director, Institute of Industrial Science, University of Tokyo; 2009-2012 Director General, Institute of Industrial Science, University of Tokyo; 2013-present Vice President, Institute of Industrial Science, University of Tokyo

Academic interests:
Sustainable building and construction; Innovation Management

Academic/social contribution:
1: Convenor, ISO/TC59/SC17/W4
2:Affiliated member, Science Council of Japan
3: Academic Secretariat in World Sustainable Building Conference 2005 (SB05)
4: President, General Incorporated Associations for Real Estate Sustainability & Energy Efficiency Diffusion

ATTENDEES

UK Speakers

Professor Sir Mike Gregory
Head, Institute for Manufacturing
University of Cambridge

Mr Paul McCaffrey
Project Leader, Future of Manufacturing Project
Foresight
UK Government Office for Science

Mr Chris Carr
Deputy Director Manufacturing, Services & Electronics
Advanced Manufacturing and Services
Department for Business, Innovation & Skills (BIS)

Dr Carlos López-Gómez
Policy Research Associate, Centre for Science,
Technology and Innovation Policy
University of Cambridge

Japanese Speakers

Prof. Hiroyuki Yoshikawa
Director-General, Center for Research and Development
Strategy (CRDS)
Japan Science and Technology Agency (JST)

Prof. Takahiro Fujimoto
Professor, Faculty of Economics, The University of Tokyo
/ Executive Director, Manufacturing Management
Research Center, The University of Tokyo

Dr Michiharu Nakamura
President
Japan Science and Technology Agency (JST)

Prof. Shozo Takata
Department of Industrial and Management System
Engineering
Waseda University

Mr Nobuyuki Hiratsuka
Director, Manufacturing Industries Policy Office,
Manufacturing Industries Bureau
Ministry of Economy, Trade and Industry (METI)

Mr Naofumi Moriya
Director for Nanotechnology and Materials, Bureau of
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Cabinet Office

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of Institute of Industrial Science / Executive Board
Member, Engineering Academy of Japan
The University of Tokyo

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Chiba University

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Japan Science and Technology Agency

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United Nations Industrial Development Organisation
Investment and Technology Promotion Office

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Hosei University

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The University of Tokyo

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Assistant Professor, Institute of Industrial Science
The University of Tokyo

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Japan Science and Technology Agency

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Environmental Leaders Program
Tohoku University

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Junior Manager, Cloud Development Center
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National Institute of Science and Technology Policy

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Japan Business Federation (Keidanren)

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Principal Research Manager, Research Center for Ubiquitous MEMS and Micro Engineering
National Institute of Advanced Industrial Science and Technology (AIST)

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The Engineering Academy of Japan

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Ms Elizabeth Hogben
Head, Science & Innovation

Mr Patrick Bannister
Consul, Science & Innovation, British Consulate-General Osaka

Mr Seiichi Asano
Senior Science Officer, Energy & Advanced Technology

Ms Seiko Oya
Project Officer, Energy & Advanced Technology

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UK-Japan workshop on manufacturing and industrial policy

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