

Technology Management

The newsletter of the Centre for Technology Management (CTM)

July 2013

Digital fabrication - getting behind the hype

CTM's Technology Enterprise Group has been awarded funding from the ESRC and EPSRC for a new research project to examine the reality and the potential of digital fabrication for the UK economy.

If some commentators are to be believed, manufacturing is on the brink of a revolution. It will be caused, they say, by digital fabrication (which includes processes referred to as 'additive manufacturing' or '3D printing') with its promise of on-demand, mass personalisation and more localised, flexible and sustainable production.

These technologies certainly have the potential to disrupt the organisation of manufacturing and the ways in which companies – both incumbents and new entrants – create and capture value. However, there is a danger that digital fabrication in all its forms is becoming overhyped.

A cross-disiplinary approach

This new - and very timely - research considers the interconnected technological, commercial and policy issues that characterise the emergence of digital fabrication. The aim is to provide the academic, industrial and policymaking communities with responses to the most pressing questions, and a structure for ongoing debate and knowledge sharing.

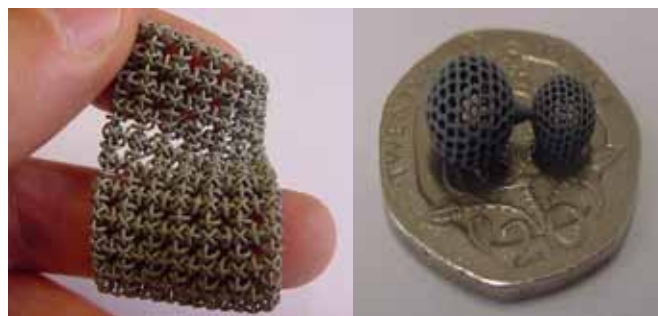
A cross-disciplinary Cambridge team from across the Institute for Manufacturing, the Judge Business School, and the Department of Politics and International Studies will focus on three key questions:

- How will digital fabrication affect the manufacturing landscape?
- What impacts will this revolution have on manufacturing in the UK?
- How can UK firms become global leaders in this new age of digital manufacturing?

An emerging industry perspective

This project will apply a framework developed by CTM researchers and colleagues across IfM in earlier EPSRC-funded work on emerging industries. This industry-emergence approach will concentrate on three key areas:

- **Emergence:** how did digital fabrication emerge? Identification of trends, patterns, barriers and enablers in the emergence and diffusion of digital fabrication to date.
- **Business model disruptions:** how is value captured from digital fabrication technology? How has value capture changed? What traditional/disruptive business models have they enabled?
- **Scenarios:** what future scenarios may result from the diffusion of digital fabrication technologies? What will be the possible associated business models, their barriers and enablers?



Two examples of digital fabrication: a flexible stainless steel mesh (left) made by inkjet printing on to a powder bed, followed by sintering and (right) a polymer microcomponent, made by scanning a focused light beam in a bath of photopolymer

Creating a community

To support these three research stages the project team will help to connect the diverse members of the 'digital fabrication community'. This community will bring together academics (from technology, management, economics and policy), practitioners (from start-ups to multinationals, and support service providers) and policymakers. Events will be run throughout the project that will support the development of a national digital fabrication roadmap. An academic-industrial advisory group has been formed to help the project connect with relevant stakeholders.

The project will start in September 2013. For more information, please contact Simon Ford, Letizia Mortara or Tim Minshall.

You can also keep in touch with the project and digital fabrication trends at www.dfab.info

Inspiring research through industrial collaboration

The Engineering Department has a superb reputation for good research. But how much of that research makes it into practice, and how could we improve? That's the question at the core of the Department's pan-divisional research theme "Inspiring Research from Industrial Collaboration". From there the questions multiply – what are the best ways to design, manage and disseminate research so that researchers across the Department can bring their work most quickly and effectively to industry and society?

The theme, led by Tim Minshall of CTM and Rob Miller of the Whittle Laboratory, has grown over the last two years from the germ of an idea to an active community with three strands of work. The first of these is 'Investigate'. We don't want to re-invent the wheel so we explore good practices pursued already within the University and from other institutions. In this we work closely with Eoin O' Sullivan's team from the Centre for Science, Technology & Innovation Policy as we learn from past experience and customise ideas to the needs of the Department. The second strand of activity is 'Inspire

and Inform'. Having gathered ideas and examples and talked with researchers who are good at working with industry we run workshops that bring people together to discuss and learn from each other. The third strand of activity, 'Implement', lies in pragmatically helping researchers



CUED Social Media Workshop
June 3rd 2013



across the Department. We help research teams to design research programmes and industrial consortia to maximise the value of their work, to define and articulate the impact of their research and make links between researchers and interested industry. HEIF funding has underpinned the research theme and enabled us to be much more effective in combining the three strands of work and take them to a wider audience.

The three Visiting Professors of Innovation bring an invaluable industrial perspective and impetus

to the theme. Sam Beale, ex of Rolls Royce, Peter Knook bringing a background from Microsoft and Vodafone, and Rick Mitchell who was part of the Cambridge Phenomenon in Domino inkjet printing have helped in workshops and mentoring researchers and students. That dose of industrial reality has been of great value to those they've worked with.

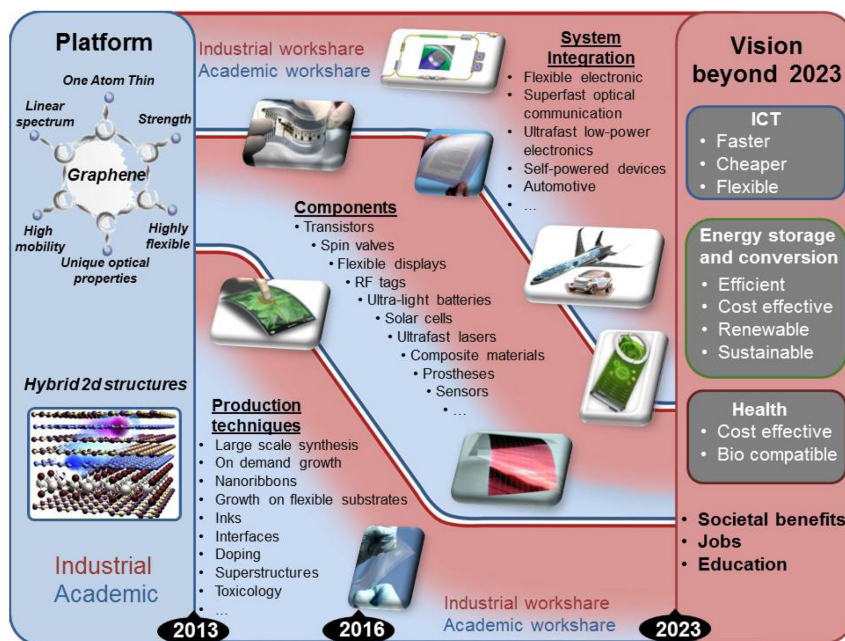
Because the topic of the theme is so close to the heart of CTM, managing technology, it's been great to build on the work of people such as Rob Phaal, Clive Kerr and Tim Minshall, putting some of their experience, research and tools into practice in engaging and working with people from across not only the Department of Engineering but also, increasingly, other Departments and Schools. Recent workshops have attracted participants from across Cambridge and even visitors from other universities. Our ambition now is to broaden and deepen the research theme, working yet more closely with researchers and companies to build programmes that maximise the value of the University's research capabilities.

www.engineerimpact.info

Visual design of the graphene roadmap

For the Graphene Future Emerging Technology flagship, a €1,000 million programme, Dr Clive Kerr provided design guidance and facilitation support on the visual communication of their technology roadmap. The consortium required a set of visualisations to communicate the benefits and applications that could be achieved from exploiting the unique material properties of graphene.

Clive led a visual design workshop to prototype the necessary templates that structured the main messages and strategic narrative of the research proposal. The process employed a specific design methodology developed at CTM which focuses on tailoring the content embodied within a roadmap for communication to specific stakeholder groups. In the case of graphene, a high-level version was generated for the funding body and politicians and a detailed tactical version was developed for the industrial supply chain. This is a growing area of work for CTM, so enquiries are always welcome. Please contact Clive Kerr (civk2@cam.ac.uk) for more information.



Source: Graphene Flagship

EU-China exchange collaboration: the High Value Engineering Network project

Led by Dr Yufeng Zhang, now at Birmingham University and previously at IfM, this four-year project brings three European and four Chinese universities into a collaborative exchange programme. Building on current research interests, it provides an opportunity for researchers at all levels of experience to join in workshops and extended research visits at each other's institutions. The aim is develop joint reports, academic papers and lay the foundations for future collaborative research projects.

CTM researchers are well represented, with Dr Tim Minshall and Dr Letizia Mortara attending a June workshop in Tsinghua University, and PhD students Clemens Chaskel and Elliott More going to China for extended research visits later this summer. In September, we shall welcome Xiaohong (Michelle) Chen, a PhD student from Tsinghua, who will visit us for the academic year.

IfM Briefing Day

The annual IfM Briefing Day on 21st May attracted a record attendance of over 100 people. CTM research was presented in three distinct sessions, with a particular focus on the new 3D Digital Fabrication project (see front page), the opportunities to collaborate provided in the Strategic Technology and Innovation Management consortium, and selected PhD projects. Many delegates showed interest in linking up with one or more of these activities, and if you were not able to join us on the day, the presentations can be found at: www.ifm.eng.cam.ac.uk/resources/conference/briefing-day-2013/

Roadmapping portal

Roadmapping is a powerful and flexible management tool and framework for strategy and innovation, and has been a focus for CTM research and practice for more than a decade. A new roadmapping website has been recently launched to enhance dissemination and outreach in this area, bringing together IfM's roadmapping resources in one place: www.ifm.eng.cam.ac.uk/roadmapping. The new portal includes sections on:

- Overview: summary of history, concept and benefits of roadmapping for strategy and innovation
- Research: CTM research interests, activities and publications, with a link to the Visual Strategy Network
- Case studies: examples of CTM-developed methods in action, including example outputs
- Consultancy: direct support for application and transfer, delivered by experienced practitioners in IfM ECS Ltd

People



Nitish Gupta is a final year MBA student from Birla Institute of Technology & Science (BITS-Pilani), Pilani campus, India. He will be working on the technology leadership module of STIM consortium from May to July 2013 under the supervision of David Probert and Rob Phaal. Nitish holds a Bachelors of Technology in computer science engineering from Guru Gobind Singh Indraprastha University and has worked at Tata Consultancy Services Limited, India for a year after completing his bachelor's degree.

Julia Fan Li has completed her PhD research on financing global health with Dr Elizabeth Garnsey and is working on the topic in London with the Global Health Investment Fund.



Harald Overholm who was under the supervision of Elizabeth Garnsey passed the viva for his thesis, "Alliance Initiation by Technology-Intermediary Ventures in the US Solar Industry", with minor corrections on June 4th and has been recommended for the award of the PhD. Tim Minshall was the internal examiner and Prof Rolf Wüstenhagen from the University of St Gallen was the external examiner.

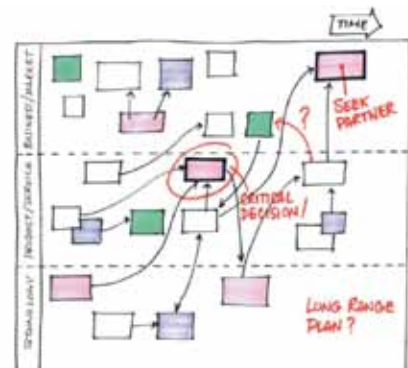
Congratulations to Manjusha Thorpe who has given birth to a baby boy. Declan was born on 1 May weighing in at 7lb 13oz, and they are both doing well.



- Executive education: public and in-company training, which can be customised as appropriate
- Resources: books, workbooks, briefing notes and podcasts

Building on this, a new web page on technology and innovation management tools has been developed, which includes links to related research areas, a publication list and links to a number of tool catalogues:

www.ifm.eng.cam.ac.uk/research/ctm/ctmtools



Contact: Rob Phaal at rp108@cam.ac.uk

Technology management research at Cambridge

- Strategic technology management
- R&D project selection
- Software sourcing in manufacturing
- Enhancing creativity in new product development
- New product introduction collaboration
- Technology management: a process approach
- Technology selection
- Technology evolution in hi-tech firms
- Innovation management in hi-tech firms
- Emergence of technology based industry
- Technology scanning and intelligence
- Technology acquisition
- Technology protection
- Strategic make-or-buy
- Industrial make-or-buy decisions
- Sustainability and technology insertion
- Technology valuation
- Technology foresight

New publications

Kerr, C., Farrukh, C., Phaal, R. & Probert, D., (2013), 'Key principles for developing industrially relevant strategic technology management toolkits.' *Technological Forecasting and Social Change: An International Journal*, Volume 80, Number 6, pp. 1050-1070. ISSN: 0040-1625.

Probert, D., Dissel, M., Farrukh, C., Mortara, L., Thorn, V. & Phaal, R., (2013), 'The process of making the business case for technology: A sales and marketing perspective for technologists.' *Technological Forecasting & Social Change: An International Journal*, Volume 80, Number 6, pp. 1129-1139. ISSN: 0040-1625

Routley, M., Phaal, R. & Probert, D., (2013), 'Exploring industry dynamics and interactions.' *Technological Forecasting & Social Change: An International Journal*, Volume 80, Number 6, pp. 1147-1161. ISSN: 0040-1625

Creating distributed generation: How solar financing ventures are built: A research summary for entrepreneurs, policy makers and technology firms, Harald Overholm, January 2013. See www.ifm.eng.cam.ac.uk/uploads/Research/CTM/20130131_Overholm_Guide_for_practitioners.pdf

Executive education

The annual calendar of CTM short courses continues to evolve, with new content and even new events generated from the research programme.

Two recent courses were the three day Technology and Innovation Management course, held in Jesus college from 9th to 11th April, and the Visual Approaches for Strategic and Innovation Management, held at the IfM on 14th May. Both courses were well attended with senior managers coming from a wider variety of company backgrounds - the latter particularly is an area of growth for CTM in research and teaching.

Our next course is Realising the Potential of Early Stage Technologies, to be run at the IfM on 10th and 11th September. This presents some of our newest research and proved very popular on its first run last year. See www.ifm.eng.cam.ac.uk/events/realising-the-potential-of-early-stage-technologies/.

Diary July to October 2013 www.ifm.eng.cam.ac.uk/events

September 2013

10 - 11	<i>Realising the potential of early stage technologies</i>	Two-day course IfM, Cambridge
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October 2013

15	<i>Strategic roadmapping</i>	One-day course IfM, Cambridge
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October 2013

16	<i>Technology Intelligence</i>	One-day course IfM, Cambridge
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