IfM Briefing Day

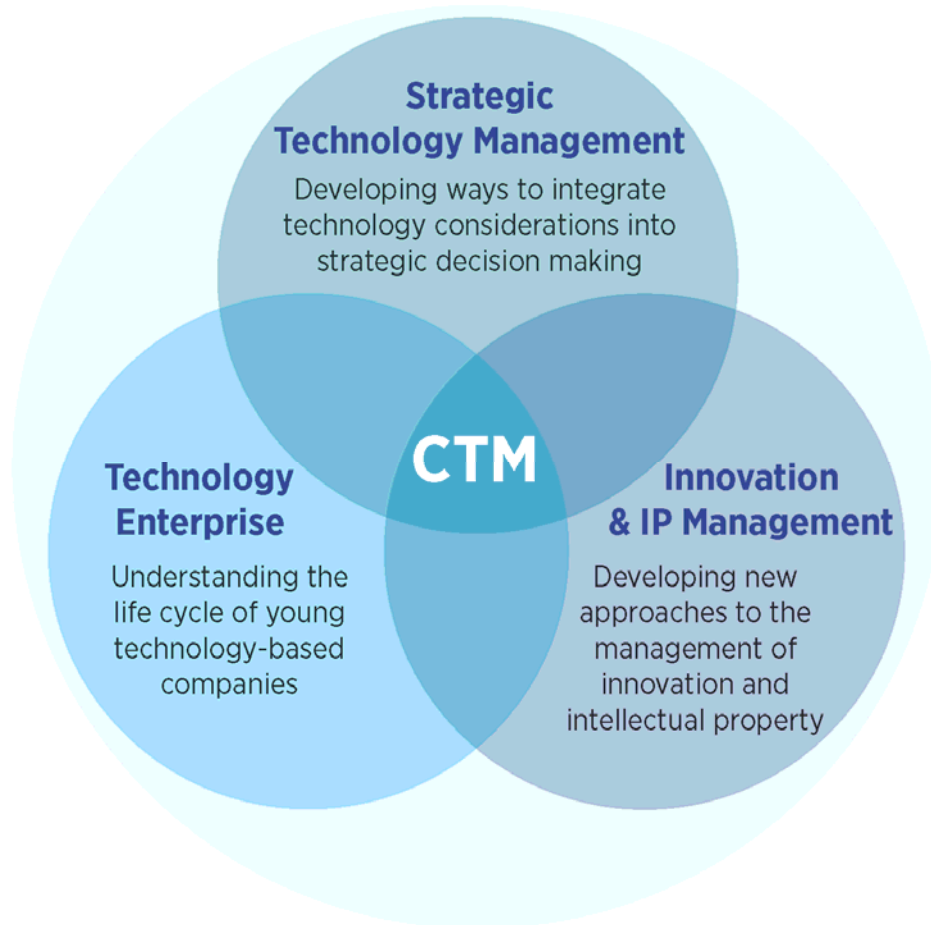## Technology and Innovation Management

David Probert, Rob Phaal, Mélanie Despeisse,
Clare Farrukh, Frank Tietze, Tim Minshall, Imoh Ilevbare

Centre for Technology Management

Agenda

- Introduction

    David Probert

- The Strategic Technology and Innovation Management Consortium

    Rob Phaal
    Mélanie Despeisse

    Clare Farrukh

- Intellectual property challenges for management

    Frank Tietze

- Understanding the potential and actual impact of 3D printing

    Tim Minshall

- Delivering and sustaining growth

    Imoh Ilevbare

- Questions and discussion

    All

CTM research

Strategic Technology Management
Developing ways to integrate technology considerations into strategic decision making

CTM

Technology Enterprise
Understanding the life cycle of young technology-based companies

Innovation & IP Management
Developing new approaches to the management of innovation and intellectual property
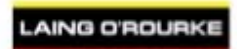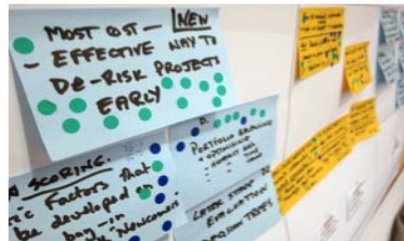
Objectives:

- Integrated understanding of science, engineering and business

- Better management of technology as a resource

- Help for managers facing practical problems

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Strategic Technology & Innovation Management (STIM) Consortium

A practice-oriented research and networking collaboration between industrial partners and the Centre for Technology Management, delivering a combination of practical and academic outputs

arçelik   AstraZeneca   bp   De Beers A DIAMOND IS FOREVER   gsk GlaxoSmithKline   GRUNDFOS   IHI   LAING O'ROURKE

LEGO   MARS   PETRONAS   QinetiQ   swisscom   syngenta   THALES   TWI   Waters THE SCIENCE OF WHAT'S POSSIBLE.

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2016 STIM Programme
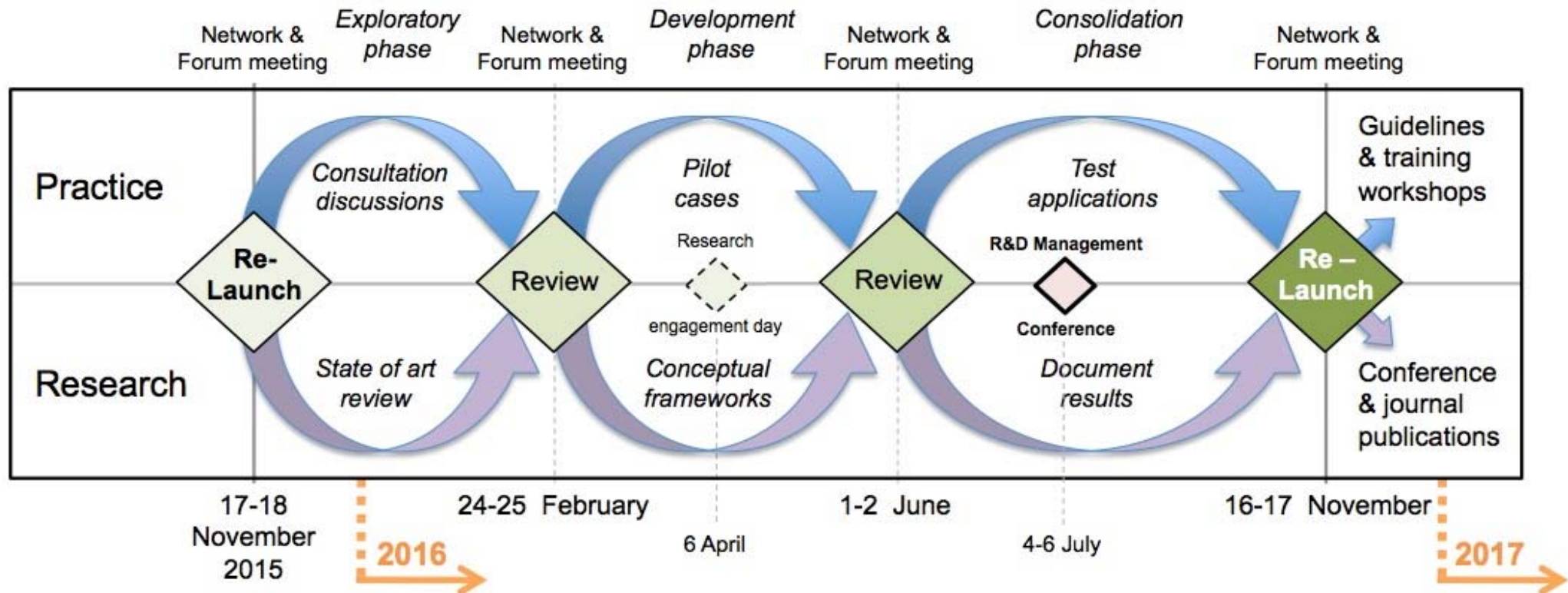
The 2016 STIM Programme comprises a portfolio of 18 diverse research projects, such as:
1) Toolkit for resource efficiency in manufacturing companies – Mélanie Despeisse
2) Roadmapping for strategy and innovation – embedding the process – Clare Farrukh

Toolkit for resource efficiency in manufacturing companies

Mélanie Despeisse

Decoupling value creation from negative environmental and social impact through eco-efficient manufacturing

FREE toolkit

What is your waste worth?
Learn to see waste and its value

How can you do more with less?
Identify strategies and practical solutions

What's the size of the prize?
Set ambitious targets to match the challenge

Where are you now?
Assess your strengths and weaknesses

Where to from here?
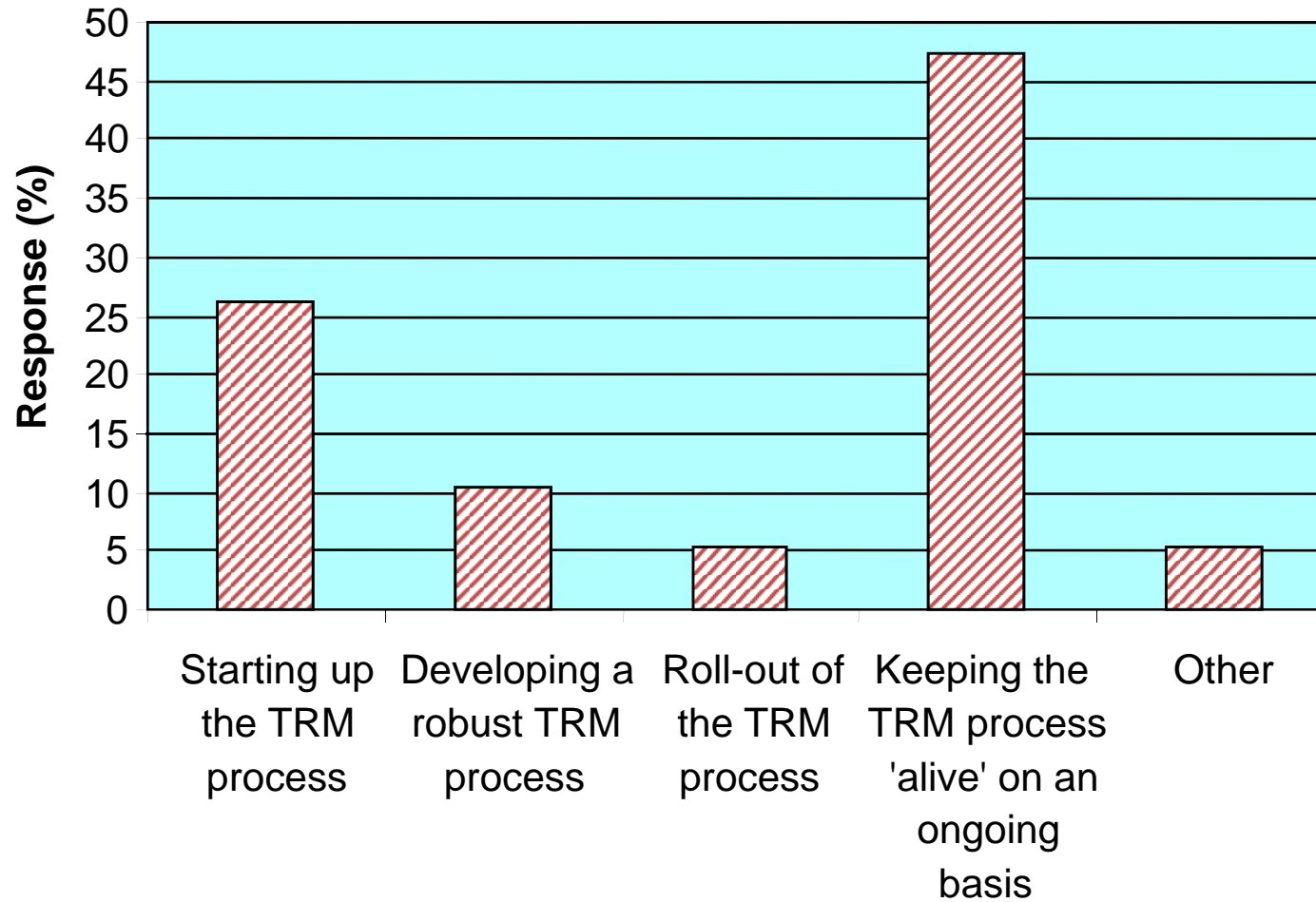Systematise by making eco-efficiency normal practice

For more information, please visit **industrialsustainability.org**
or contact Dr Mélanie Despeisse **md621@cam.ac.uk**

With thanks to the project team:
Aanand Davé, Lampros Litos, Simon Roberts,
Peter Ball and Steve Evans

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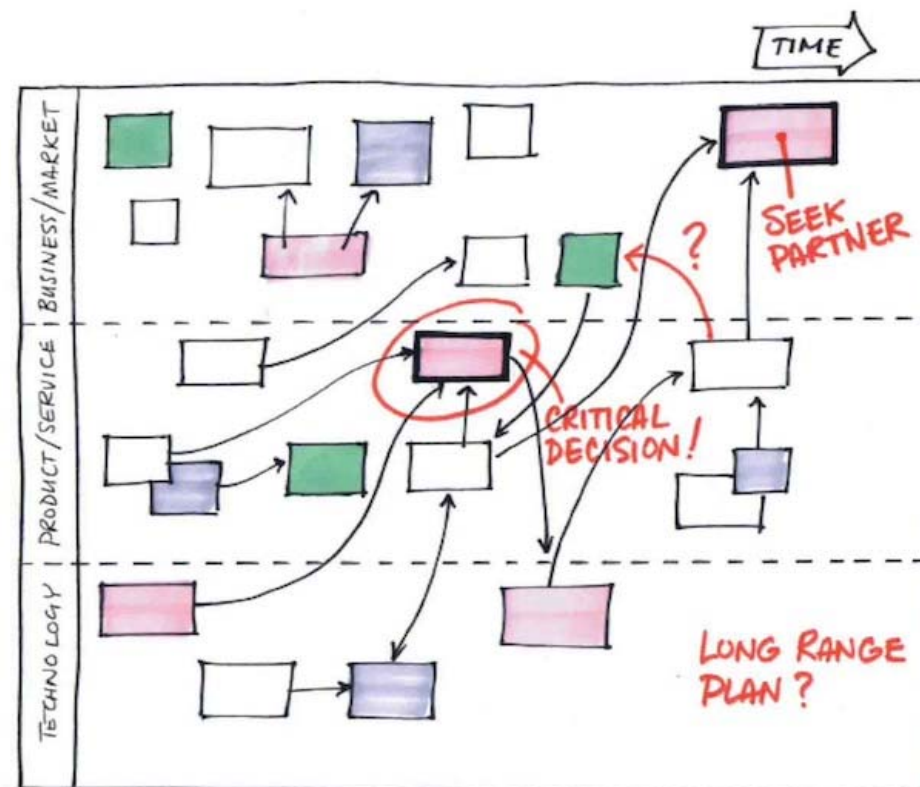
Roadmapping challenges

Source: CTM survey, 1999

Project Overview

The main aims of the project are to promote discussions between roadmapping companies, build up a repository of roadmapping case studies and start to build maturity/lifecycle model of experience and good practice.

Open Forum dates: 11th May, 6th July, 13th October.

COMPANY A?
Current performance and next steps...

Maturity Level	PROCESS (P)	MAP (M)	Roadmap development life cycle		
			a. Start-up	b. Roll-out	c. Establish
			Gerdsri 2009/ Dynamics of Implementation (who/what?)		
Maturity Level	PROCESS (P) Kappel 2001/ Roadmapping Influence (Roadmapping process capability)	MAP (M) Muller 2002/ Bootstrapping Roadmapping Albright 2003/ RM Scorecard (Roadmap maturity characteristics)	Initiation Role - Individual level idea champion as scholar and communicator Responsibilities: -networking and negotiating -individual learning -developing teams -prepare participants for TRM	Development Role – Team level facilitator, supporter Responsibilities: -managing TRM development processes, monitoring progress, allocating & controlling resources	Integration Role – Organisational level integrator, ongoing TRM, process manager Responsibilities: -compiling SBU roadmaps, integrating the roadmap into the current processes, sustaining the roadmap
Level 1 - *Initial* *Processes unpredictable, poorly controlled and reactive*	Understand -forecasting, competitor analysis, simplification Measures: accuracy & clarity	Facts as perceived by stakeholders -eye opener for many stakeholders, first overview of business and time context	**BU3**		
Level 2 - *Managed* *Processes characterised for projects and often reactive*	Persuade -project mgt, resource allocation, product planning Measures: aligned priorities and decisions	Serious attempt to obtain a consistent vision -shared understanding of product positioning and required technology investment		**BU2**	
Level 3 - *Defined* *Processes characterised for the organisation and are proactive*	Synchronise -program management, corporate planning, portfolio mgt Measures: ongoing co-ordination	First full blown RM – supporting docs limited -explicit forecast of people and process needs		**BU1**	
Level 4 - *Measured* *Processes measured and controlled*		Full blown RM – improved fundament			
Level 5 - *Optimising* *Focus on process improvement*					

Good practices
Key milestones
Next steps

Good practices
Key milestones
Next steps

Collaboration opportunities

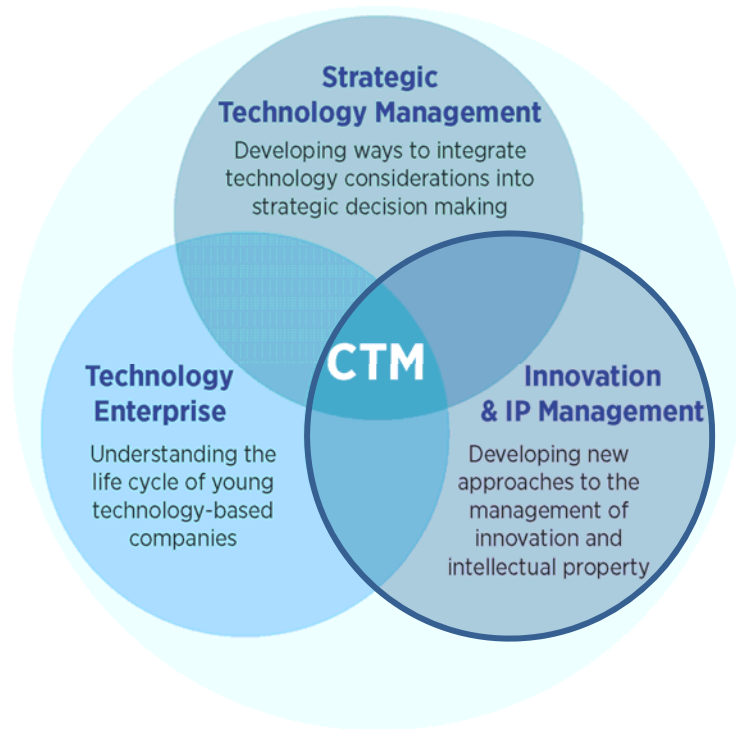The project seeks companies to provide case studies and comment on the emerging maturity model ideas.....

Please contact Clare Farrukh if you are interested in taking part in the project or attending the roadmapping open forum events:

cjp22@cam.ac.uk

Research approach

Strategic Technology Management
Developing ways to integrate technology considerations into strategic decision making

CTM

Technology Enterprise
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Innovation & IP Management
Developing new approaches to the management of innovation and intellectual property

A managerial level

and relational perspective

on all things' IP in

collaborative innovation processes

for emerging manufacturing technologies

Solving IP challenges and leveraging IP assets to optimize technology lifecycles

Performance

Emerging manufacturing technologies [1]

- radical novelty
- relatively fast growth
- coherence
- uncertainty
- prominent impact

CTM research

TRL_1

TRL_9

time

[1] Rotolo, D., et al. (2015). "What is an emerging technology?" Research Policy **44**(10): 1827-1843.
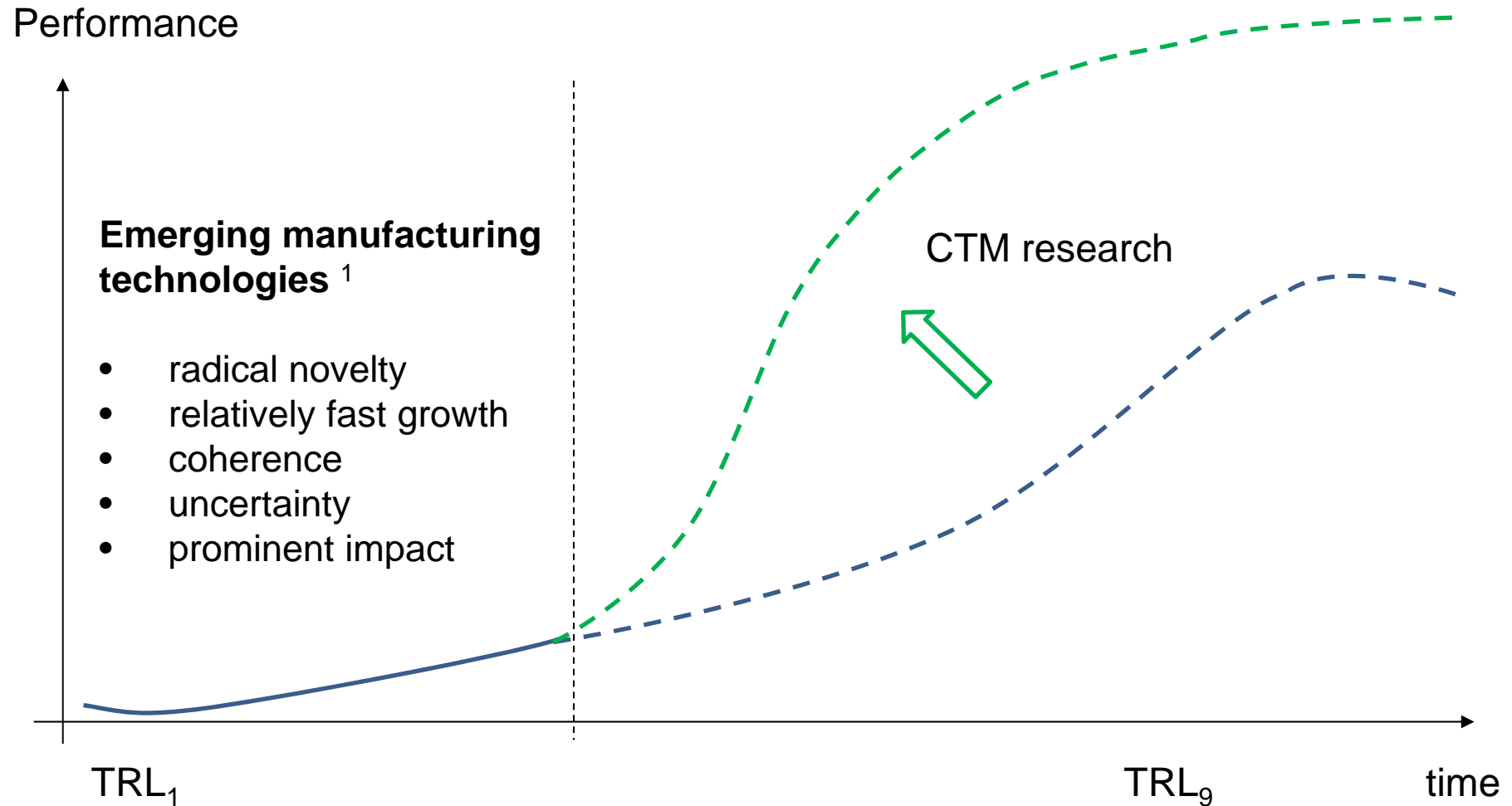
IP challenges in multi partner collaboration

To develop next generation of building integrated photovoltaic (BIPV) devices

Scale-up challenge
"needed to progress the technology from prototype to the manufacturing volumes" [1]

Selecting appropriation strategies different partners depending on:
- trust & reputation
- role in collaboration
- etc.

Performance

TRL$_1$

TRL$_9$

time

IP to accelerate the diffusion in later lifecycle stages

IP strategies for setting market standards

Performance

Patent pledge in 2014

"A number of companies are now using Tesla's open-source patents and it has some interesting implications" [1]

Managing IP in standard setting projects, i.e. standard setting bodies

TRL$_1$

TRL$_9$

time

[1] http://electrek.co/2015/11/10

Patent informatics for better decision making, strategic planning and foresight
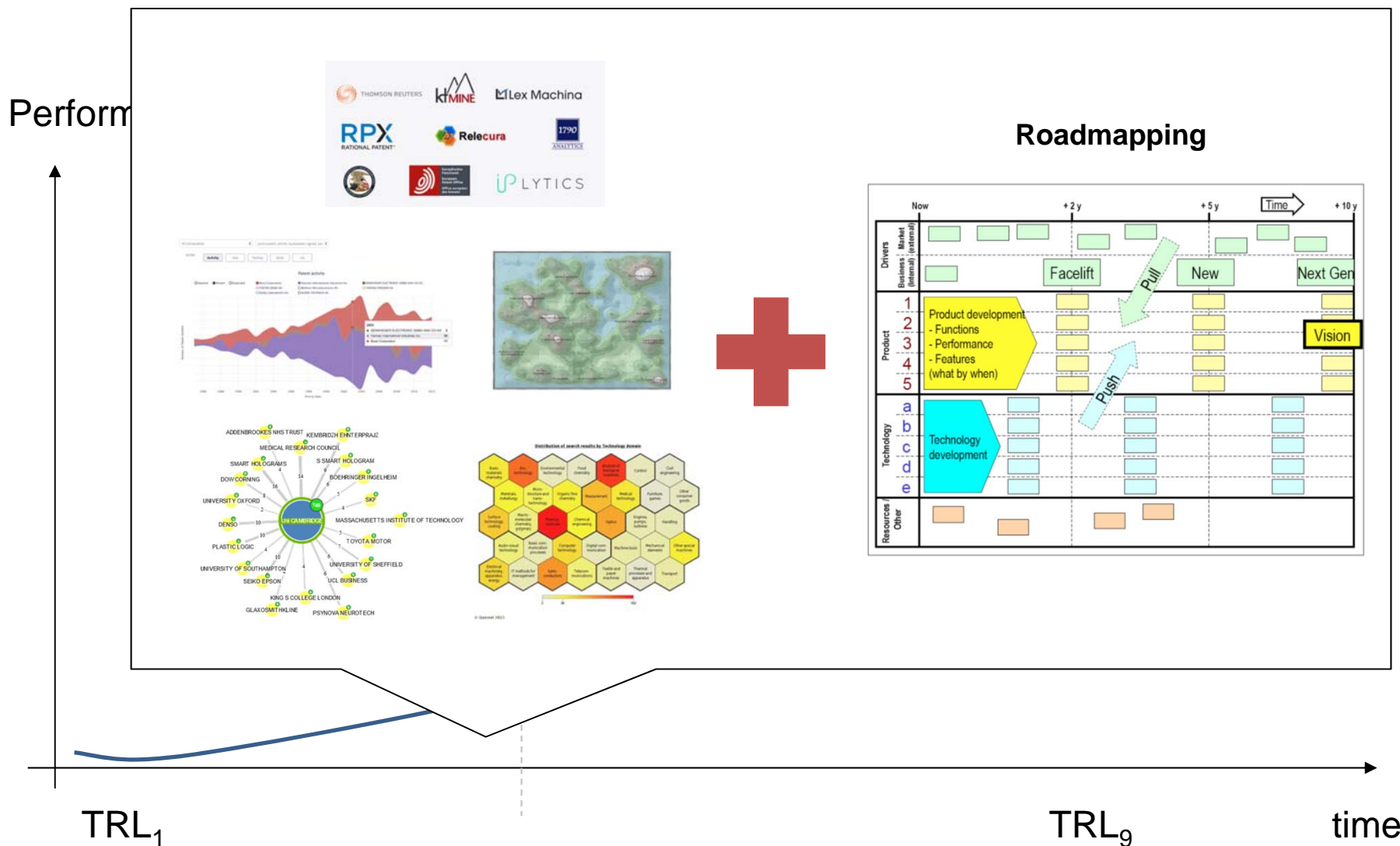
How to get involved?

We aim at developing industrial relevant methods and tools to support
   IP related management and decision-making for innovation processes

Talk to us

- if IP management is a challenge for you

- if you have recent examples of multi-partner collaborations

- if you want to discuss any other IP related management problems

Striving for excellence in IP education

Participate in our IP teaching workshop on 16 September 2016

In collaboration with

Participate in piloting an IP training game
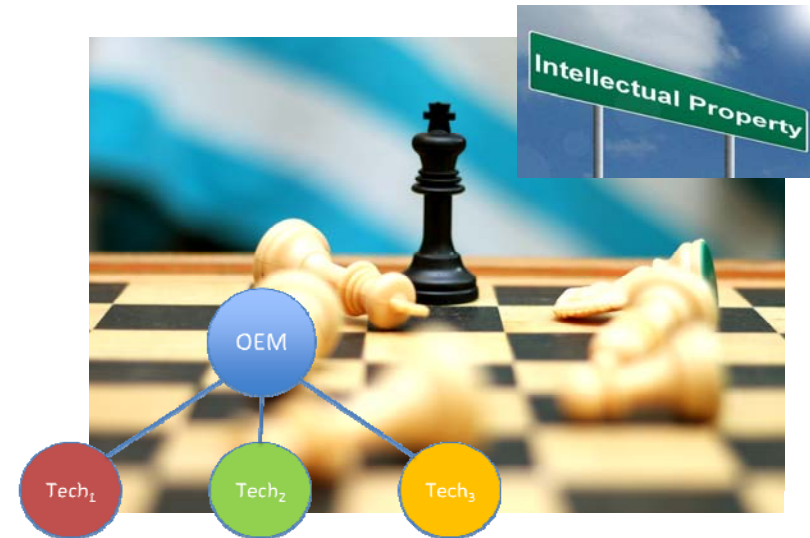
Join our IP interest group

- A trusted platform to discuss company specific, IP related topics in confidence with senior peers

- Members are senior managers (e.g. head of technology development) involved in IP related decision making

- ~3 meetings per year

- Currently 17 members, such as:

  Airbus, Caterpillar, Rolls Royce, Domino Printing, GSK, Rexam, TWI, Siemens, Williams F1, Landis+Gyr, IDEX
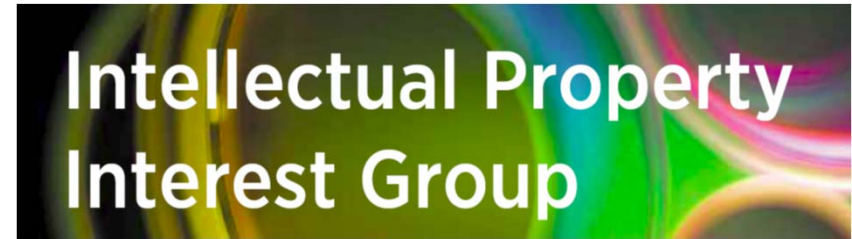
Strategic IP Forum on 24 May
for Portfolio Managers, VPs Technology, CTOs, Heads of Innovation/ IP/ licensing

Ian Anderson
Innovation Director - Bespak

Annie Brooking
CEO - Bactest

Stephan Wolke
Corporate Function Technology, Innovation & Sustainability Head of
Intellectual Property & Services - thyssenkrupp AG

Ian Harvey
Former CEO - BTG Plc

www.ifm.eng.cam.ac.uk/events/sipf-may

Understanding the potential and actual impact of 3D printing

Tim Minshall

Dominik Deradjat, Mélanie Despeisse, Phill Dickens, Serena Flammini, Simon Ford, Ian Hutchings, Finbarr Livesey, Tim Minshall, Letizia Mortara, Chander Velu

3D printing 'Bigger than internet'
FT 21.6.12

3D printing: 'The PC all over again?'
Economist 1.12.12

'3D printing [..] has the potential to revolutionize the way we make almost everything'
President Obama, State of the Union Address 2013
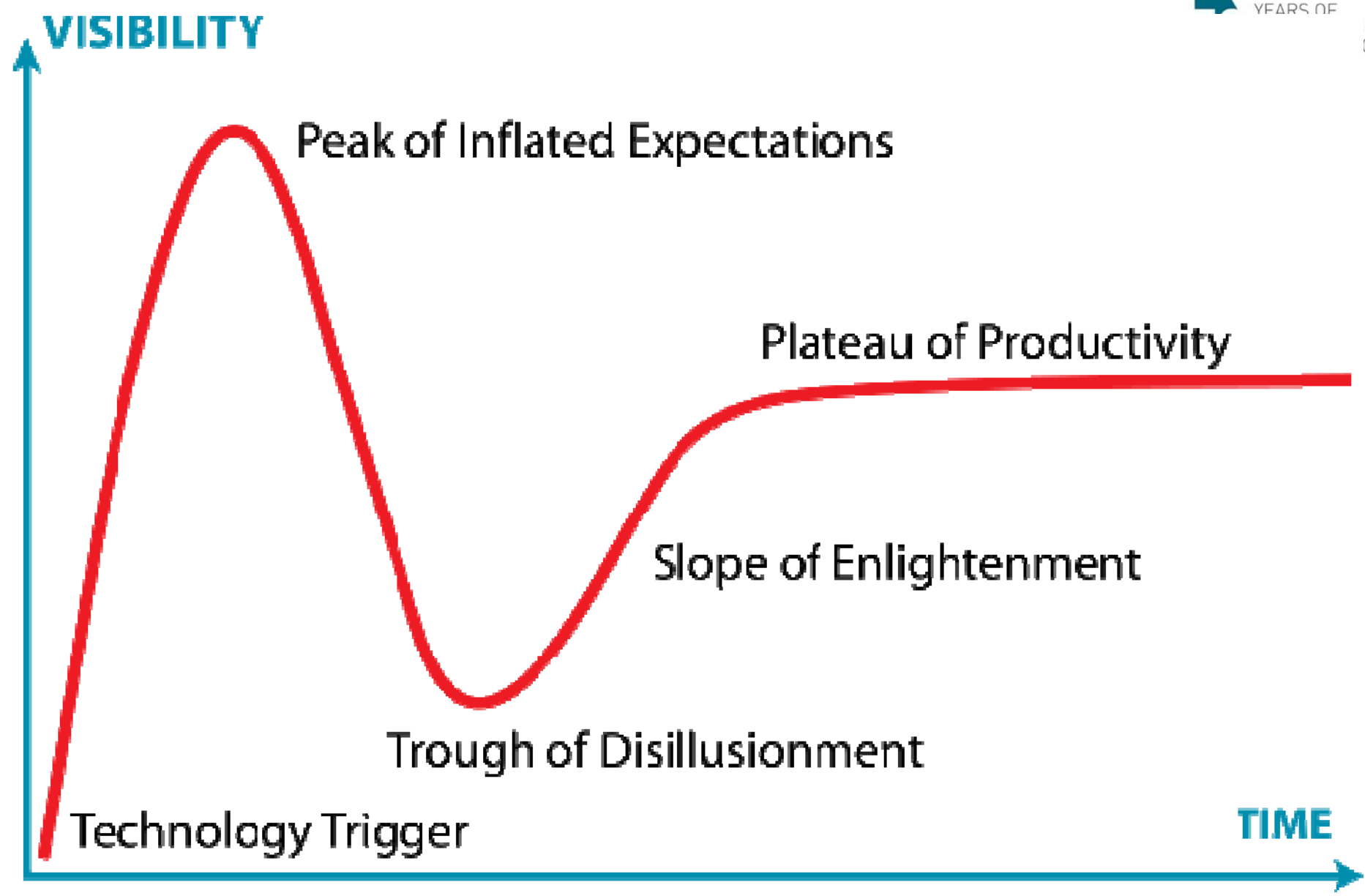
www.gartner.com

'3D printing [..] has the potential to revolutionize the way we make almost everything'
President Obama, State of the Union Address 2013

Flickr user luccawithcheese.

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The Bubble Bursts—3D Systems to Stop Selling 3D Printers for Consumers

Kyle Maxey posted on January 08, 2016 | Comment | 2735 views

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- More... (274)

3D Systems has announced that it will no longer produce its $999 consumer-grade printer named Cube. In addition to the shutdown of its Cube system, 3D

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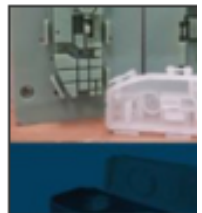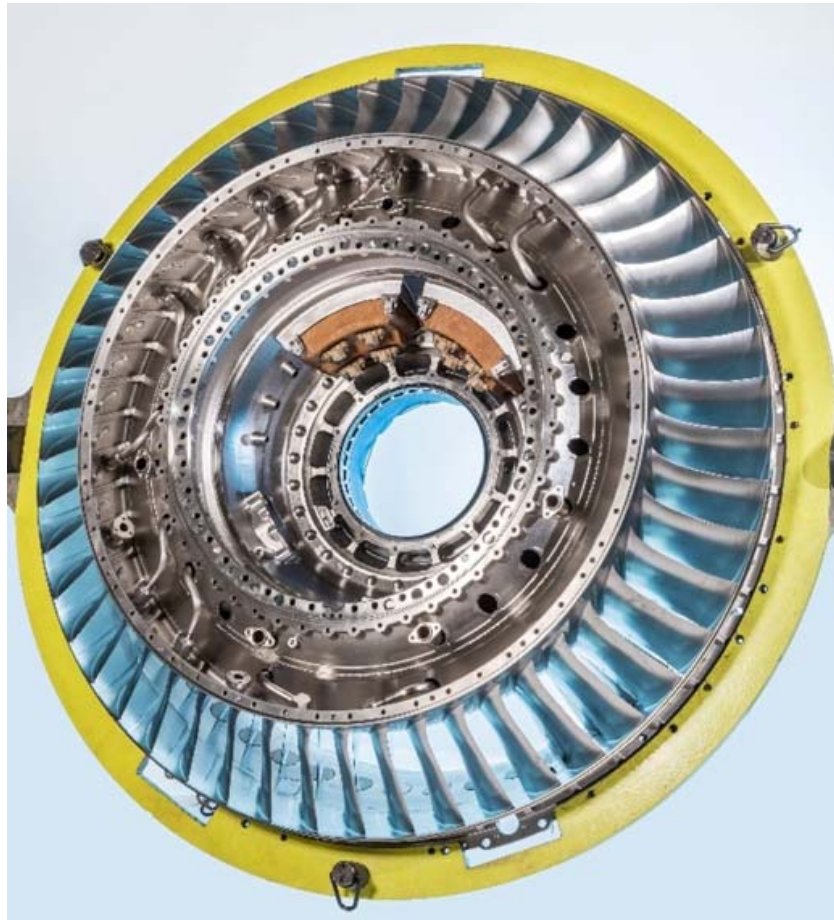
www.rolls-royce.com

www.geaviation.com

Potential for mass customisation

With thanks to Dominik Deradjat

BIT BY BIT
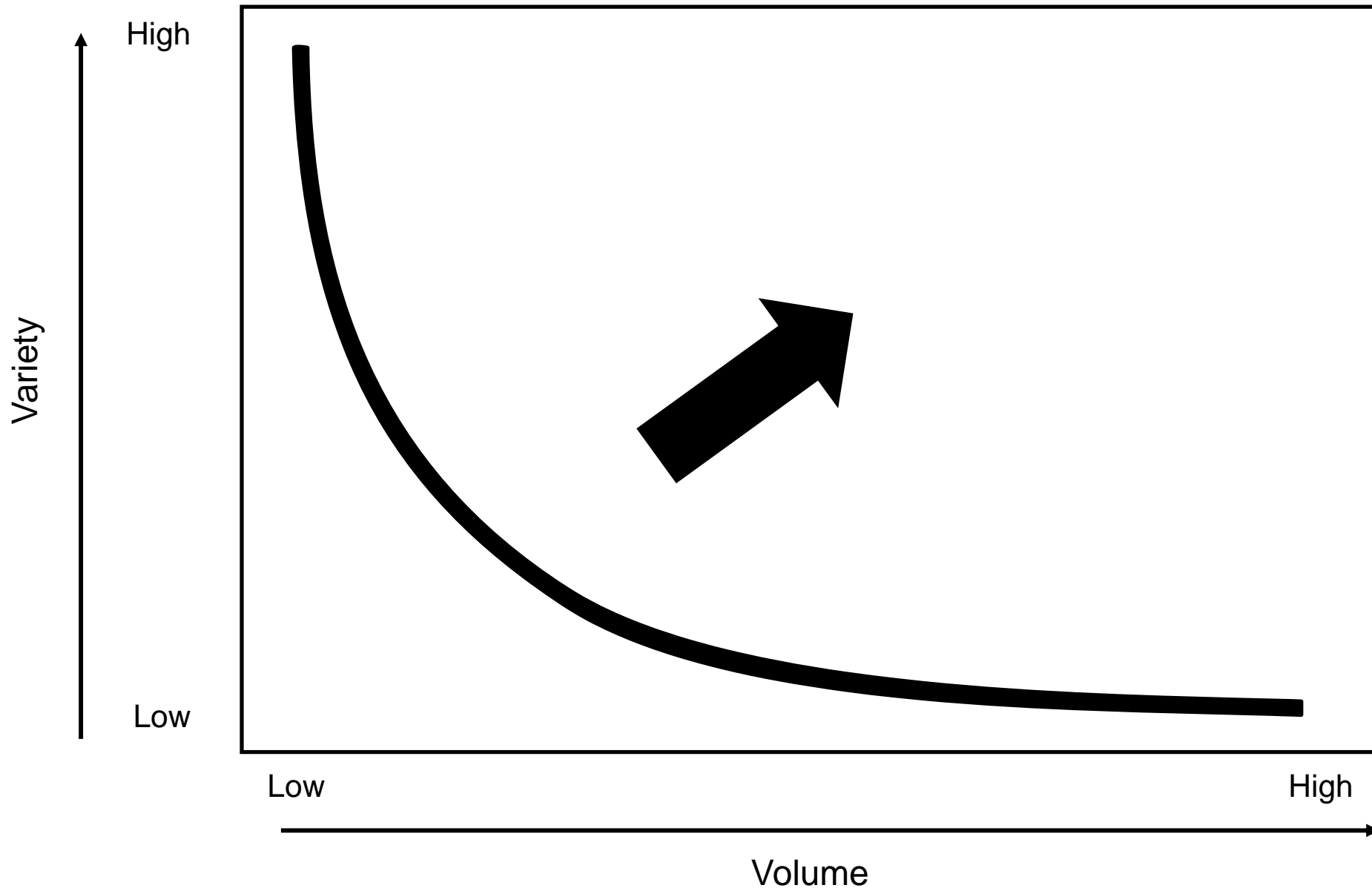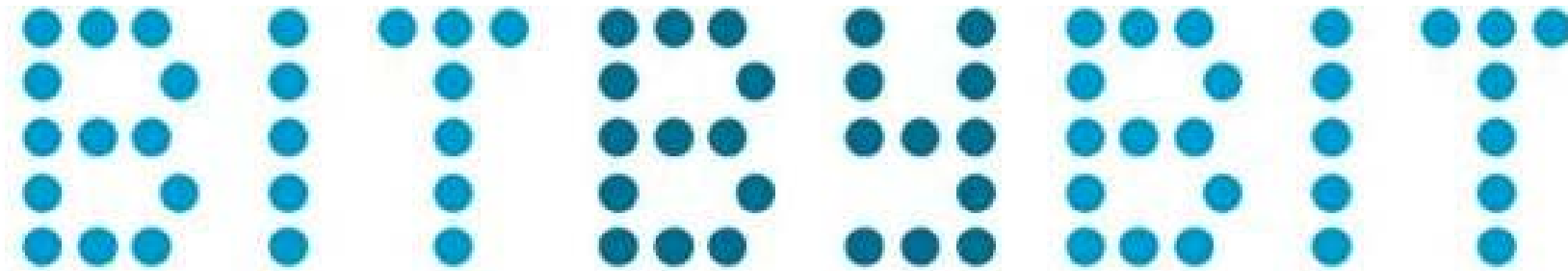
Capturing the value from the digital fabrication revolution
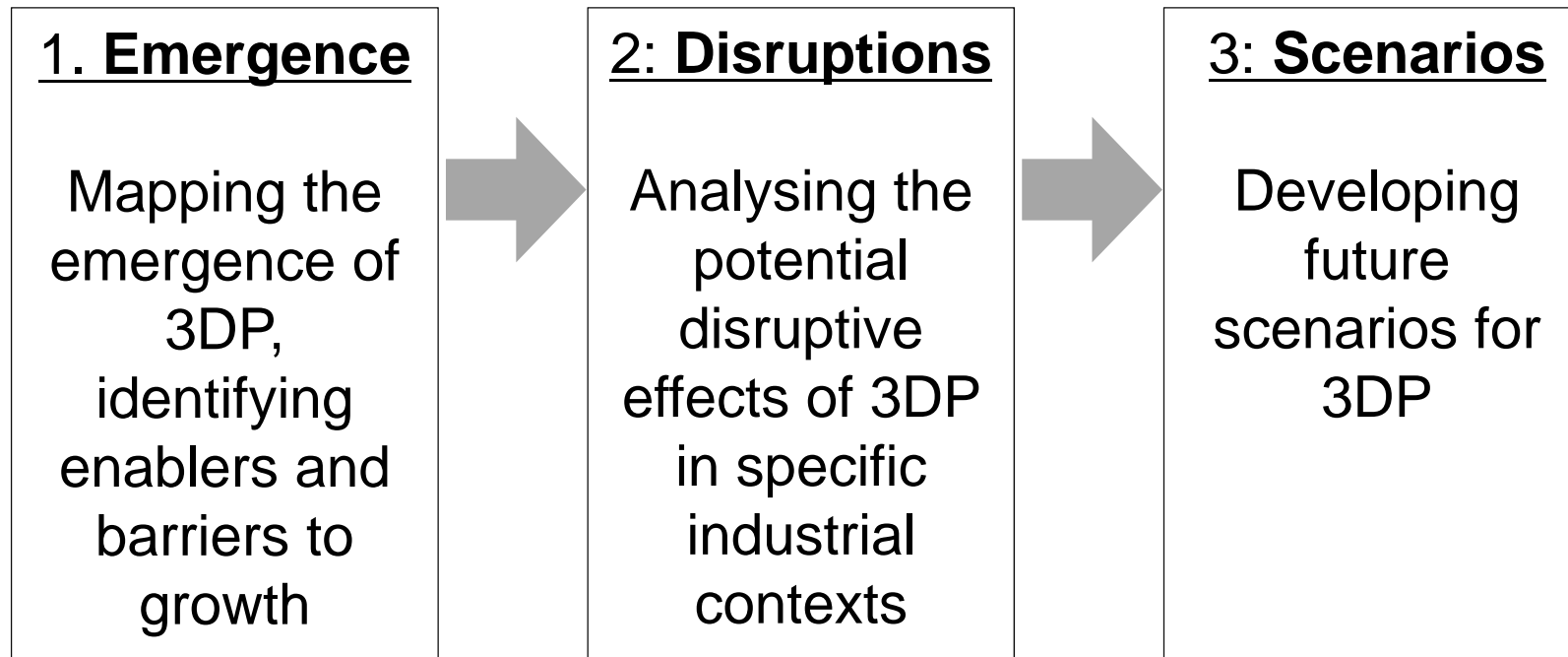
3D Printing technologies: an opportunity for innovating with others?

Source: 3dprint.com

Rosa Pasta from Loris Tupin, a 3D model that 'blooms' and turns into a rose when placed in boiling water

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With thanks to Dr Letizia Mortara

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3D Printing technologies: an opportunity for new products and platforms?

Source: www.naturalmachines.com

ChefJet Source: www.3dsystems.com

DOVETAILED

Source: www.dovetailed.co

Souce: www.tno.nl

With thanks to Dr Letizia Mortara

3D Printing technologies: a potential 'game-changer'?

Source: 3dprintingindustry.com

① Take a small biopsy

② Extract myosatellite cells

③ Add animal-free growth serum to multiply cells

④ Print sheets from cell paste using a bioprinter

⑤ Assemble sheets into meat cube culture and condition cubes to improve texture

⑥ Grind up thousands of muscle strips

⑦ Add flavour, iron and vitamins

⑧ Cook. EAT!
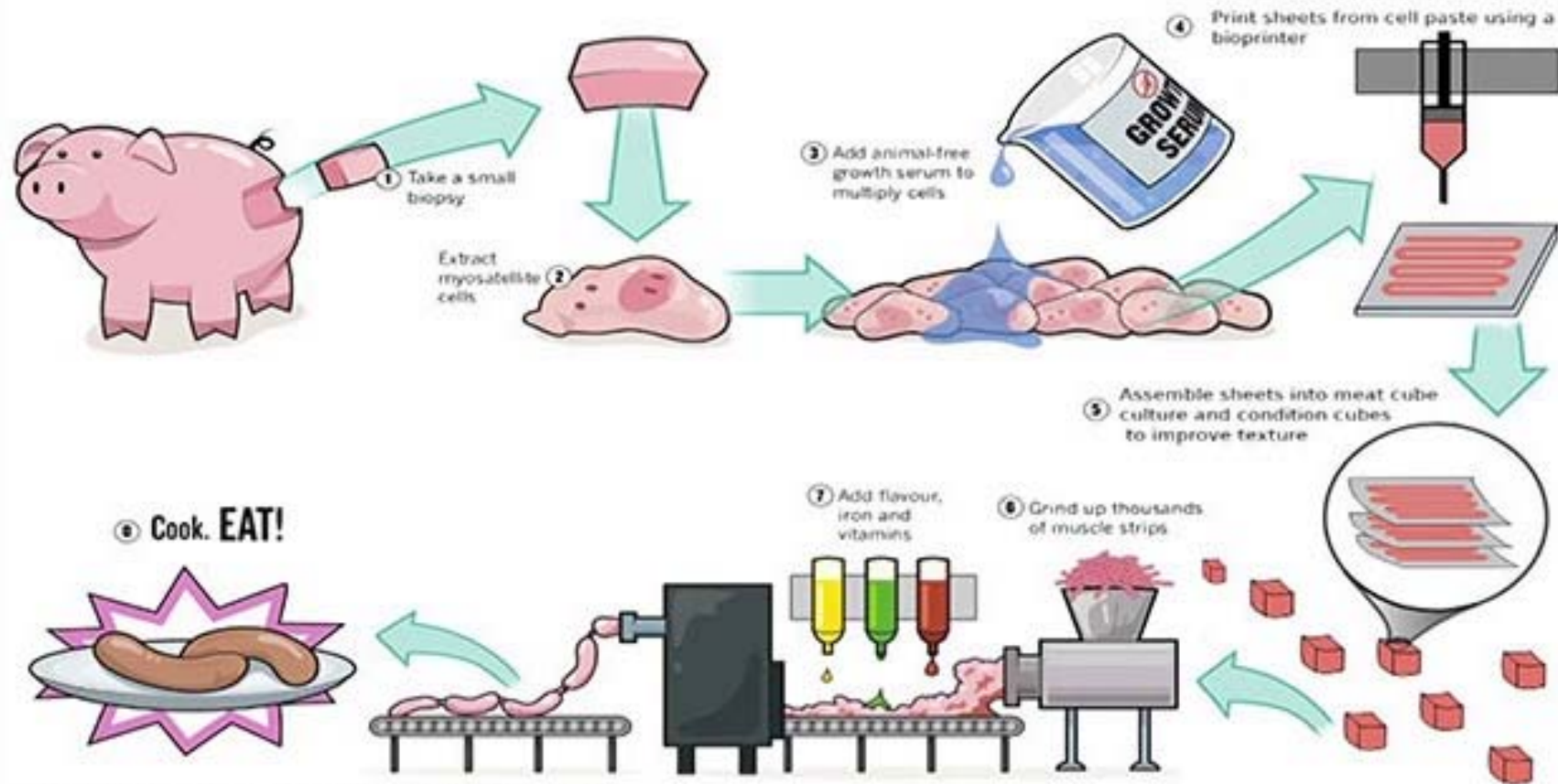
Sources: A taste of things to come, Nature, Dec 9, 2010 [Volume 468]

Source: Modern Meadow

With thanks to Dr Letizia Mortara

Summary of sustainability impacts
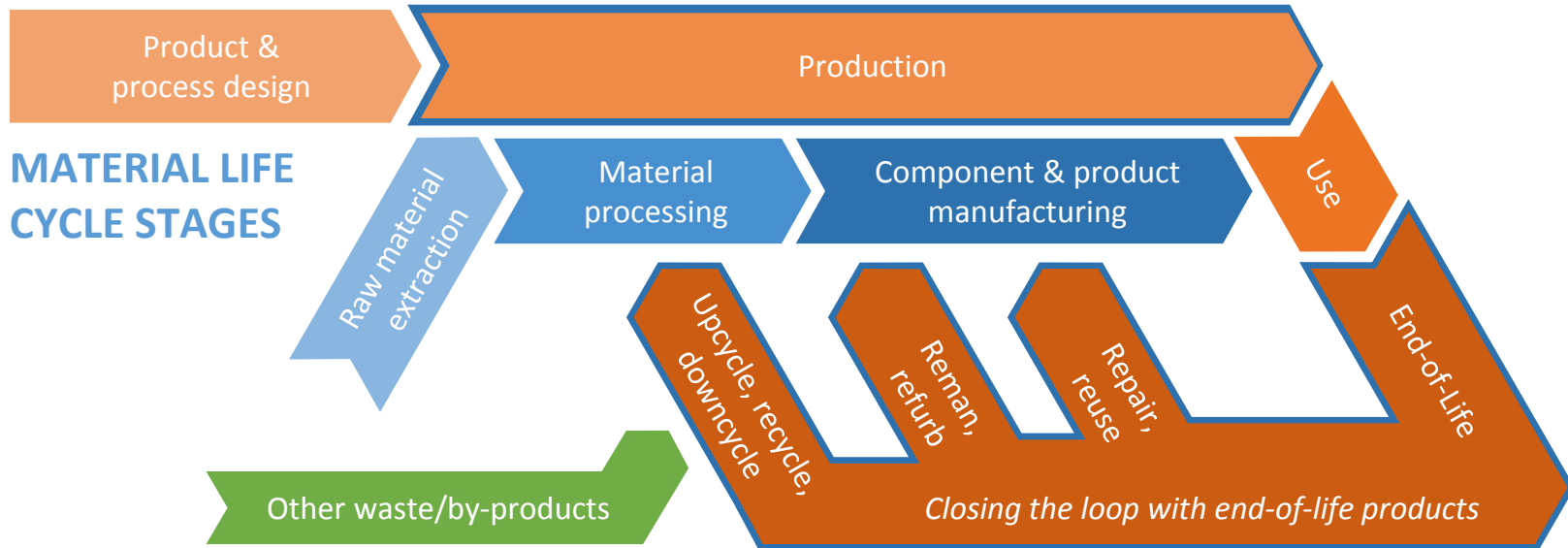
Source: Mélanie Despeisse and Simon Ford

3D printing-enabled re-distributed manufacturing

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50 YEARS OF MANUFACTURING AT CAMBRIDGE
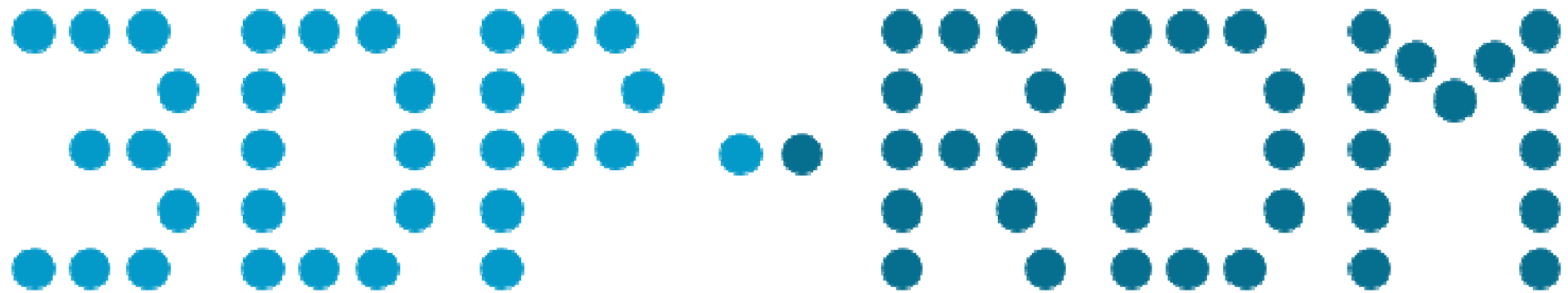
3DP-RDM: Defining the Research Agenda for 3D printing-enabled re-distributed manufacturing
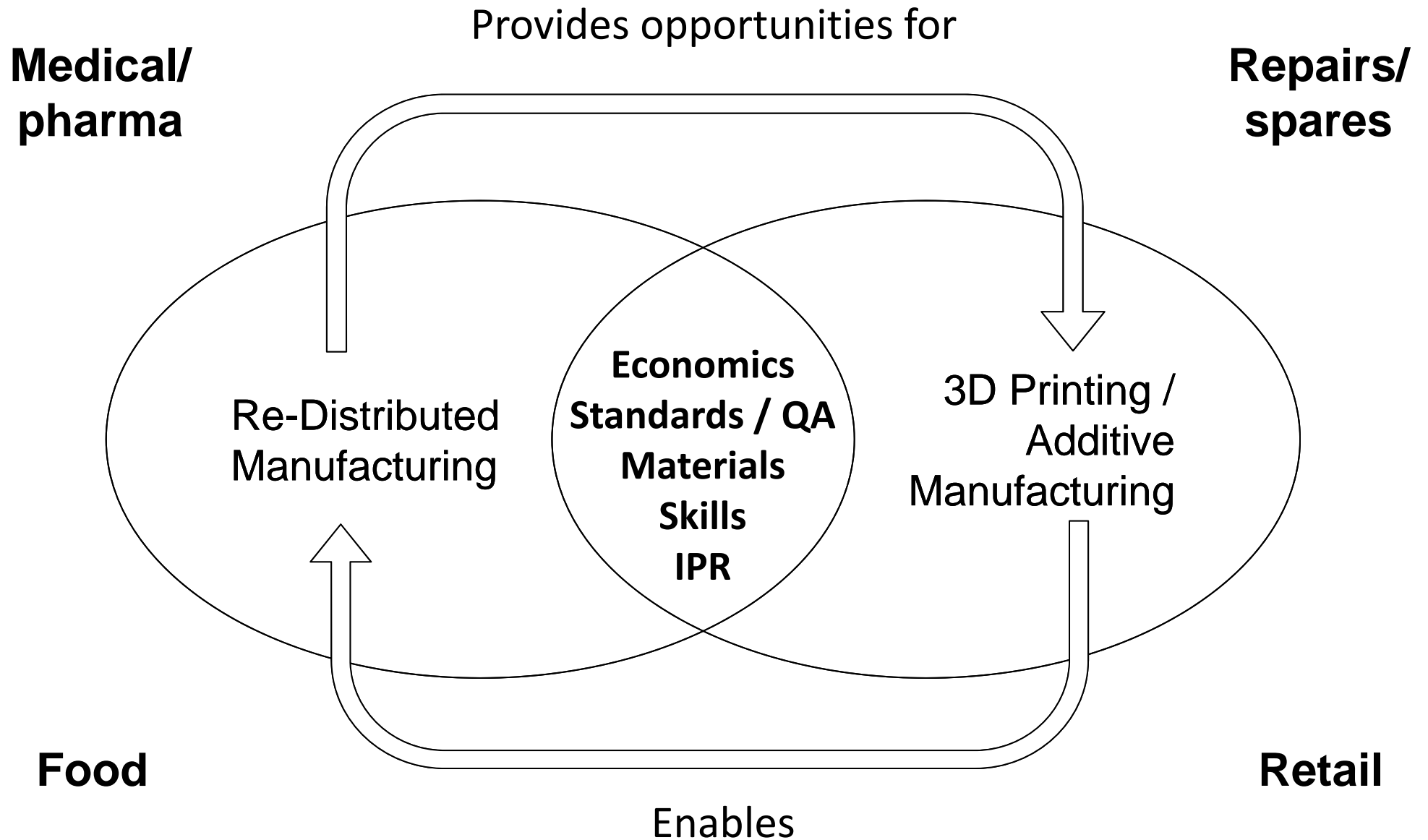
Provides opportunities for

Medical/ pharma

Repairs/ spares

Re-Distributed Manufacturing

Economics Standards / QA Materials Skills IPR

3D Printing / Additive Manufacturing

Food

Retail

Enables

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Image: NASA

http://kazzata.com/

Design
Architecture and design blog

The first 3D-printed pill opens up a world of downloadable medicine

Now that the US has approved a 3D-printed drug, pharmaceuticals companies in the UK are hoping their patents will be next – from the pyramid-shaped pill-makers to the man who has done for drugs what Apple did for music

Oliver Wainwright

🐦 @ollywainwright

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http://www.theguardian.com/artanddesign/architecture-design-blog/2015/aug/05/the-first-3d-printed-pill-opens-up-a-world-of-downloadable-medicine

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4 exploratory projects

Investigating the Impact of CAD Data Transfer Standards for 3DP-RDM – Dr Eujin Pei, Brunel University

OPTIMOS PRIME: Organising Production Technology Into MOst Responsive States – 3D PRInt Machine Enabled Networks – Prof. Duncan McFarlane, University of Cambridge, and Edinburgh University

The enabling role of 3DP in redistributed manufacturing: A total cost model – Dr Martin Baumers, University of Nottingham, and University of Oxford

Redistributing Material Supply Chains for 3D printing – Dr Matthias Holweg, University of Oxford

Issue	Summary of common perceived barriers
Materials	Understanding properties in different processes / machines / applications, QA, costs, availability (IP constraints, independent suppliers), use of mixed materials, recyclability, biocompatibility.
Design	Need for guides and education programmes on design for AM – better understanding of design for AM constraints, availability of AM-skilled designers, security of design data.
Skills / Education	Lack of appropriate skills (design, production, materials, testing) preventing adoption, up-skilling current workforce vs. training of next generation, education of consumers, awareness in schools.
Cost / Investment / Financing	Funding to increase awareness and reduce risk of adoption (testing, scale-up, machine purchase) – especially for SMEs, understanding of full costs (including post-processing, testing), cost of materials.
Standards / Regulation	Perceived or actual lack of standards – all sectors / sector specific (especially aero / health / motorsport), for processes / materials / software / products / applications.
Measurement / Inspection / Testing	Need data libraries, standards for tests (general and sector specific), materials/ in-process / final part, tests for higher volumes, non-destructive testing, QA through lock-in *c.f.* open access to data.
IP / Protection / Secrecy	Balancing need for openness to share knowledge with need for commercial protection to capture value from investments, enforcement of IP rights.

Delivering and sustaining growth through innovation and technology management

How we can help

- Flexible innovation and technology management approaches
- Developed by University of Cambridge researchers (& extensively tested through practical application)
- Configured to your organisation's needs
- Delivered to you by our team of experienced consultants

Our focus:

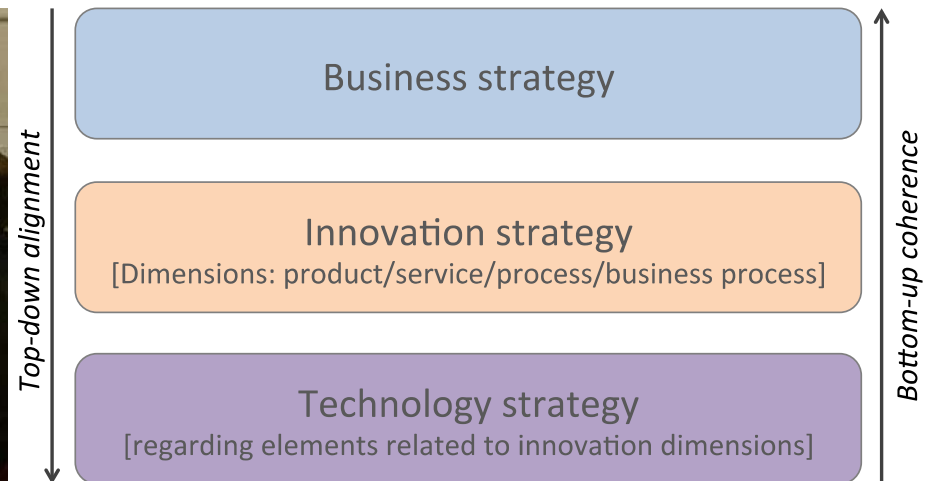Three core elements of innovation and technology management

- *Strategy*
- *System*
- *People and Organisation*

Define a coherent strategy

Your ITM strategy should support your business objectives, and help you concentrate on most suitable products/services and technologies for the market.

How we can help

- Aligning your business objectives and technology/R&D plans and policies
- Focused product-technology planning aligned to market requirements
- Helping key stakeholders (internal and external) engage in structured discussions to reach crucial decisions through workshop-styled processes
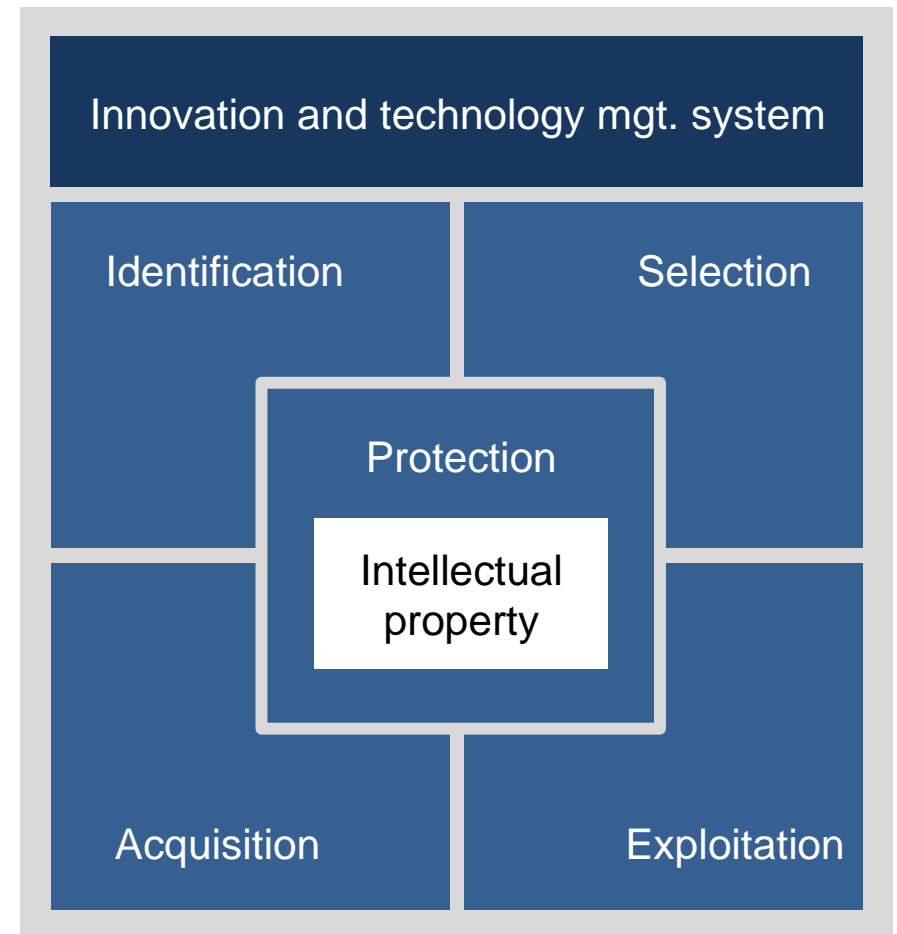

Top-down alignment

Business strategy

Innovation strategy
[Dimensions: product/service/process/business process]

Technology strategy
[regarding elements related to innovation dimensions]

Bottom-up coherence

Develop the system

Your ITM system should support strategy execution and help you deliver new and improved products and services, with more efficient use of your resources.

How we can help

-Assessing your company's maturity level across key areas of innovation and technology management

-Stimulate debate to help everyone understand their role in achieving set objectives

-Identify priority areas for development in the ITM system and create an action plan

Innovation and technology mgt. system	
Identification	Selection
Protection — Intellectual property	
Acquisition	Exploitation

Develop the system: ITM Maturity Assessment

	Category : Business Strategy	Relevant approaches and people	
		Approaches	**People**
1	*We have a clear understanding of how best we can compete in our chosen markets*	*Organisational scan, ECS Strategy process, Market intelligence, Marketing planning toolkit*	*Michèle, Letizia, Clive, Imoh*

Equip your people; establish a sound culture

You need the right people, equipped with the right expertise and operating within a culture conducive for good innovation and technology decisions.

How we can help

- Organising and developing a culture for innovation
- Customised and open education programmes
- Developing new leaders through executive and professional education

People and organisation	Business strategy	
	Innovation and technology mgt. system	
	Identification	Selection
	Protection — Intellectual property	
	Acquisition	Exploitation
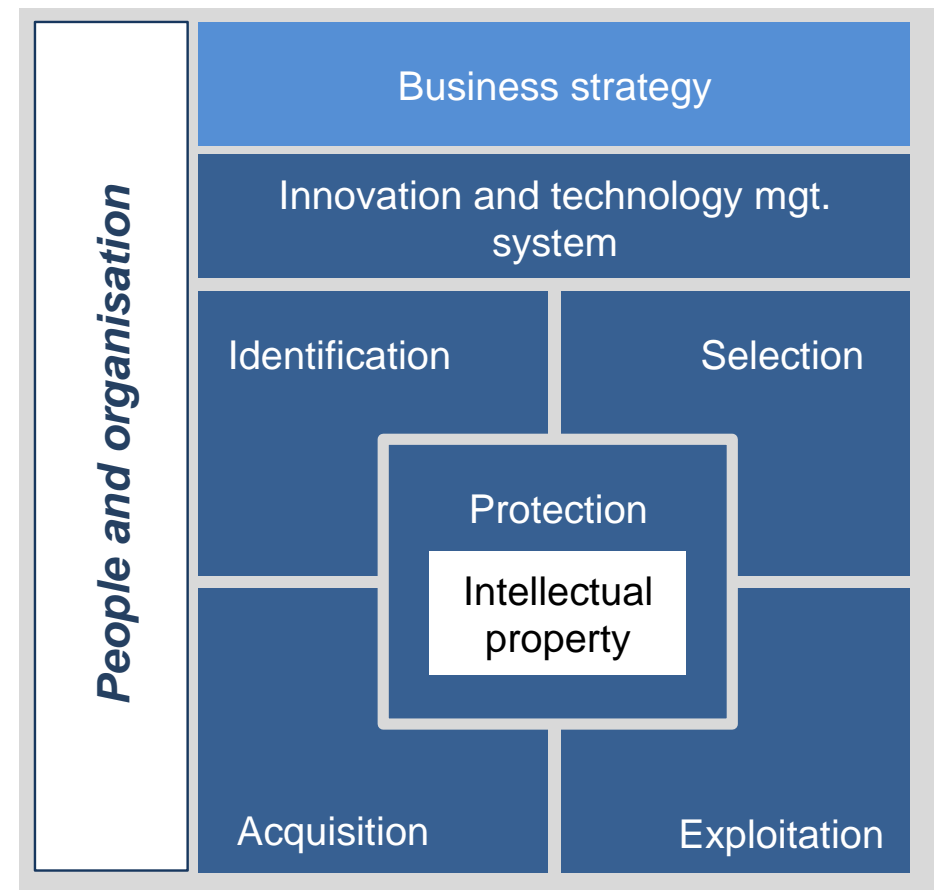
Questions and discussion

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