IfM Briefing Day
11 May 2017

What do we mean by the **Next Production Revolution?**

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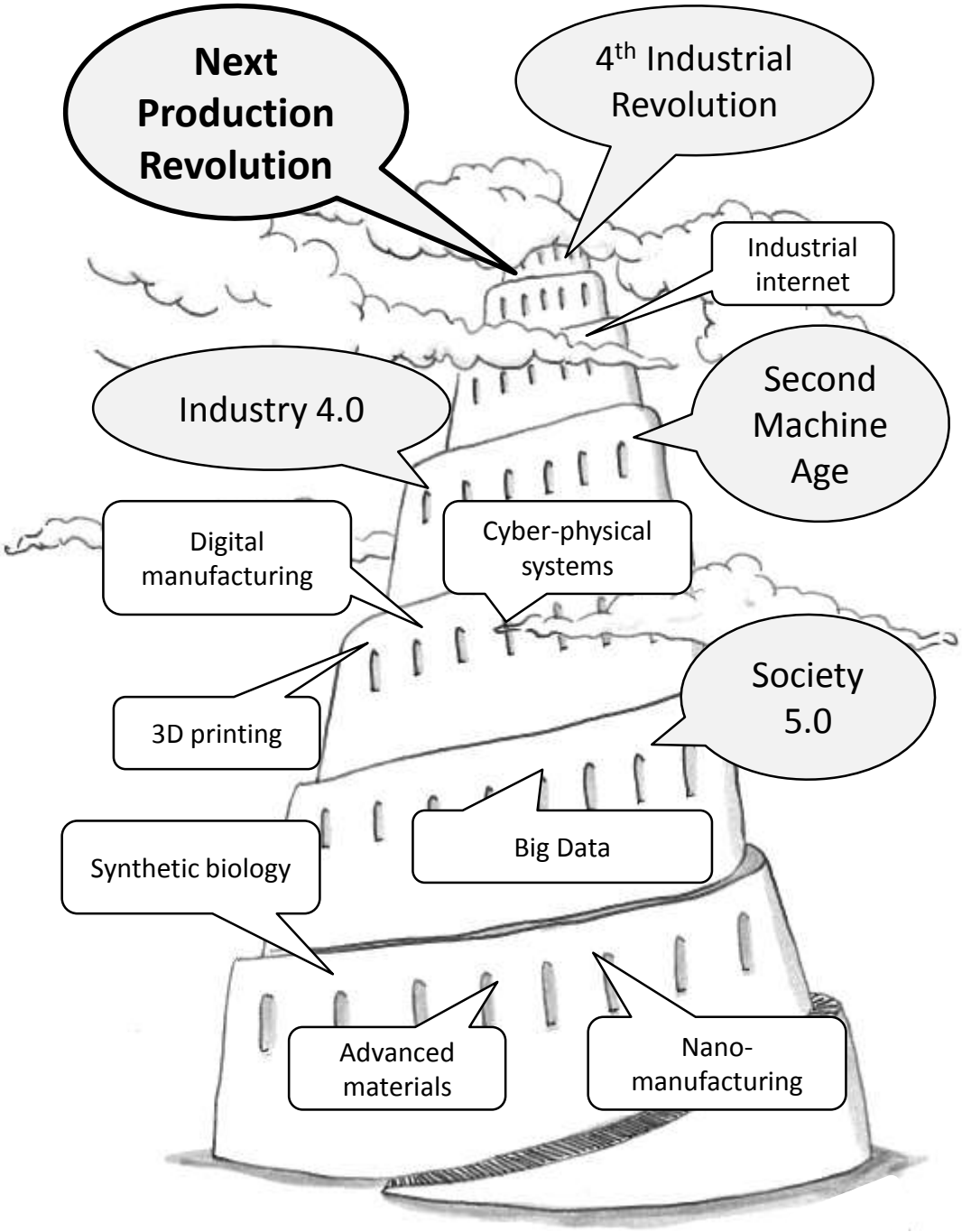
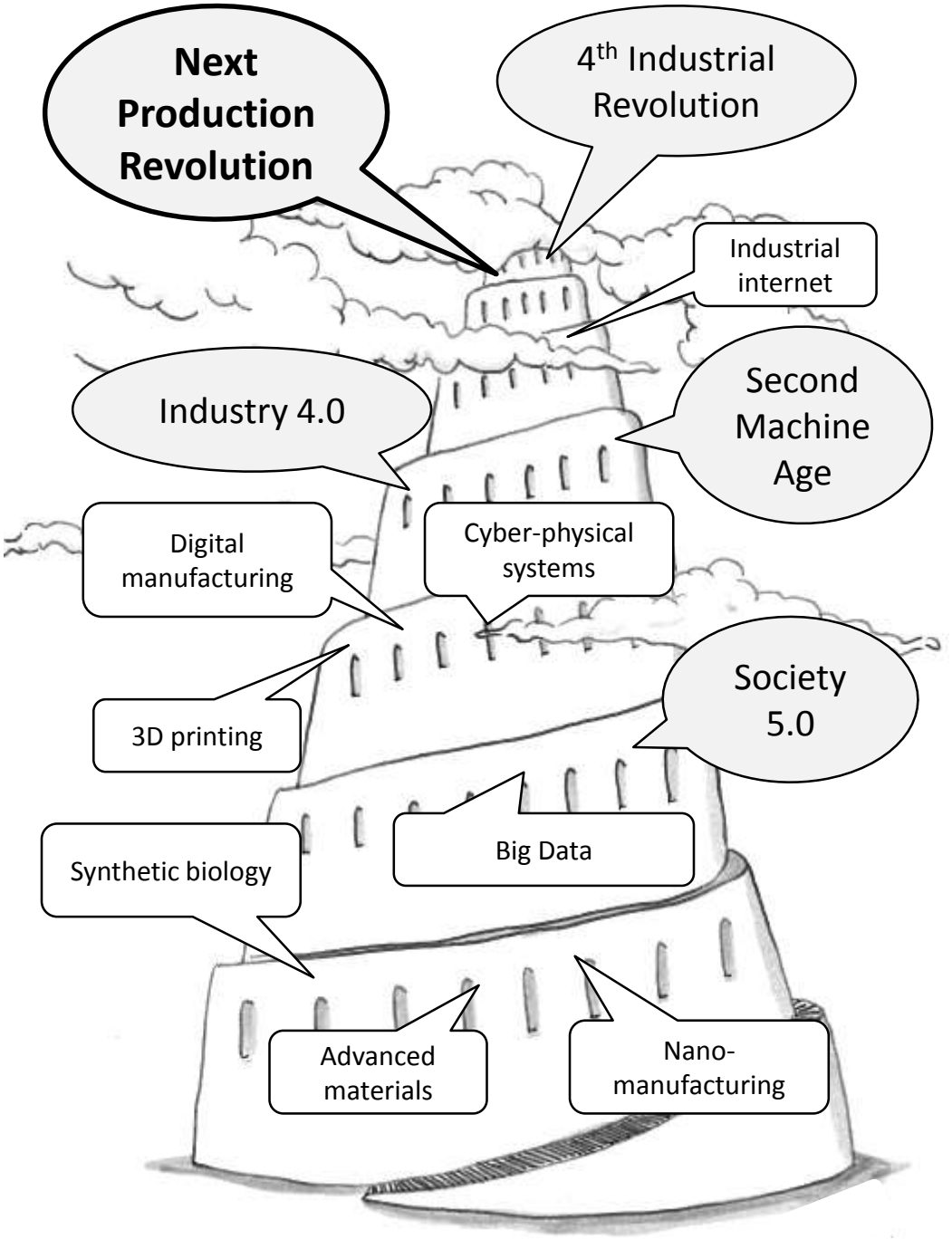
CSTI Science Technology Innovation Policy

What do we mean by **“The Next Production Revolution”?**



The Next Production Revolution: Outline

- Definition & drivers
  - Technological
  - Non-tech factors
- A converging systems revolution:
  - Technologies
  - Manufacturing value chains
  - Manufacturing & innovation
- Manufacturing research - emerging themes:
  - Scale-up
  - Digitalisation
  - Future supply chains
  - Business models



What do we mean by **The Next Production Revolution?**

OECD

Emergence / convergence of technologies:

- digital (IoT, robotics, big data…)
- biotech (industrial biotech, synthetic biology…)
- 3D printing / additive manufacturing
- advanced functional materials
- nanomanufacturing
- …

Non-tech factors / context

- Global value chains
- Digitalisation of society / economy
- Internet-based business platforms
- Knowledge-based capital
- Industrial / socio-economic ‘grand challenges’

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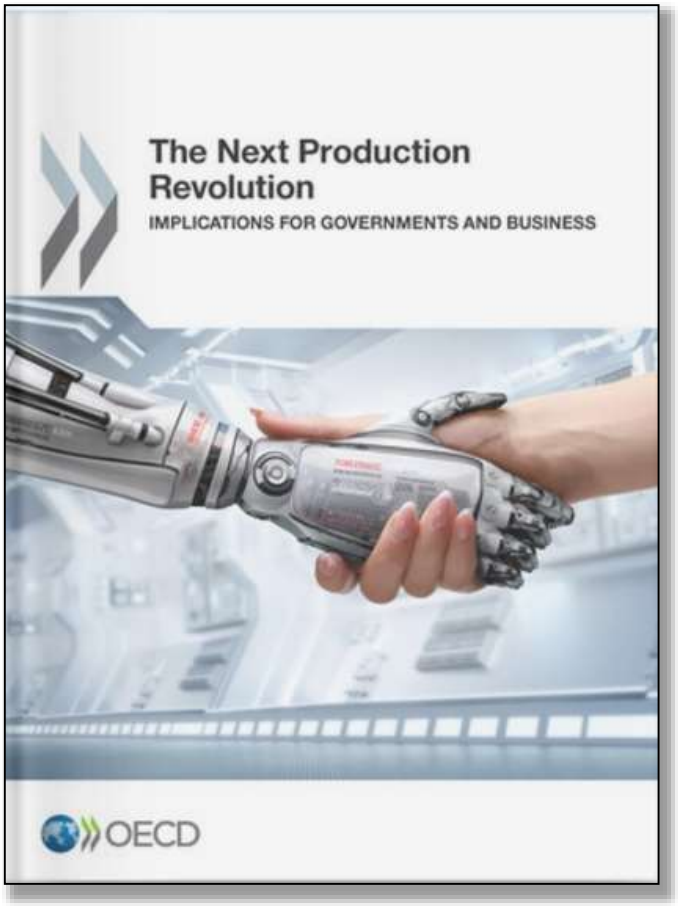


Emergence / convergence of new technologies

↓

Transformation of production
(and distribution/supply of products and services)

↓

Productivity / competitiveness

↓

New policy challenges

- **New manufacturing R&D priorities**
- Diffusion of new technologies / knowledge
- New institutions and infrastructure
- New skills
- Organisational change
- New business models
- Cyber-security, privacy, customer protection

CSTI Contribution to OECD *Next Production Revolution*

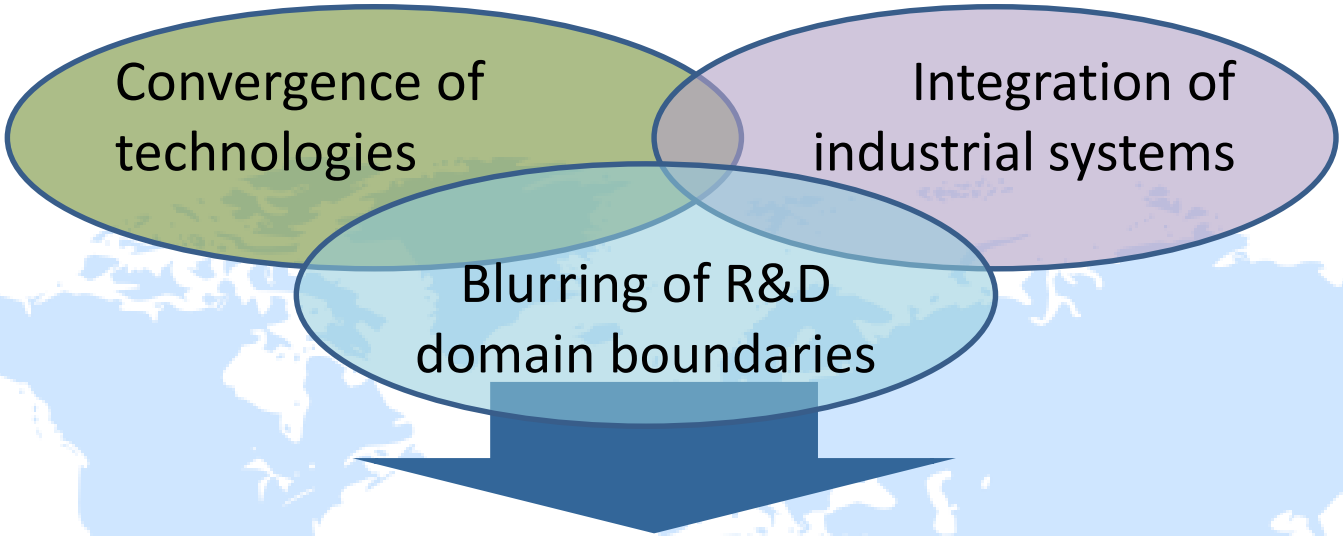
Review of International Advanced Manufacturing Innovation Policies, Policy Studies, Initiatives

Systematic review of:

- International advanced manufacturing R&D strategies
- Manufacturing foresight reports / manufacturing-related roadmaps
- Manufacturing research priorities / agency portfolios
- Flagship R&D programmes
- Strategies of new manufacturing R&D institutes / public private partnerships

International Manufacturing R&D Trends

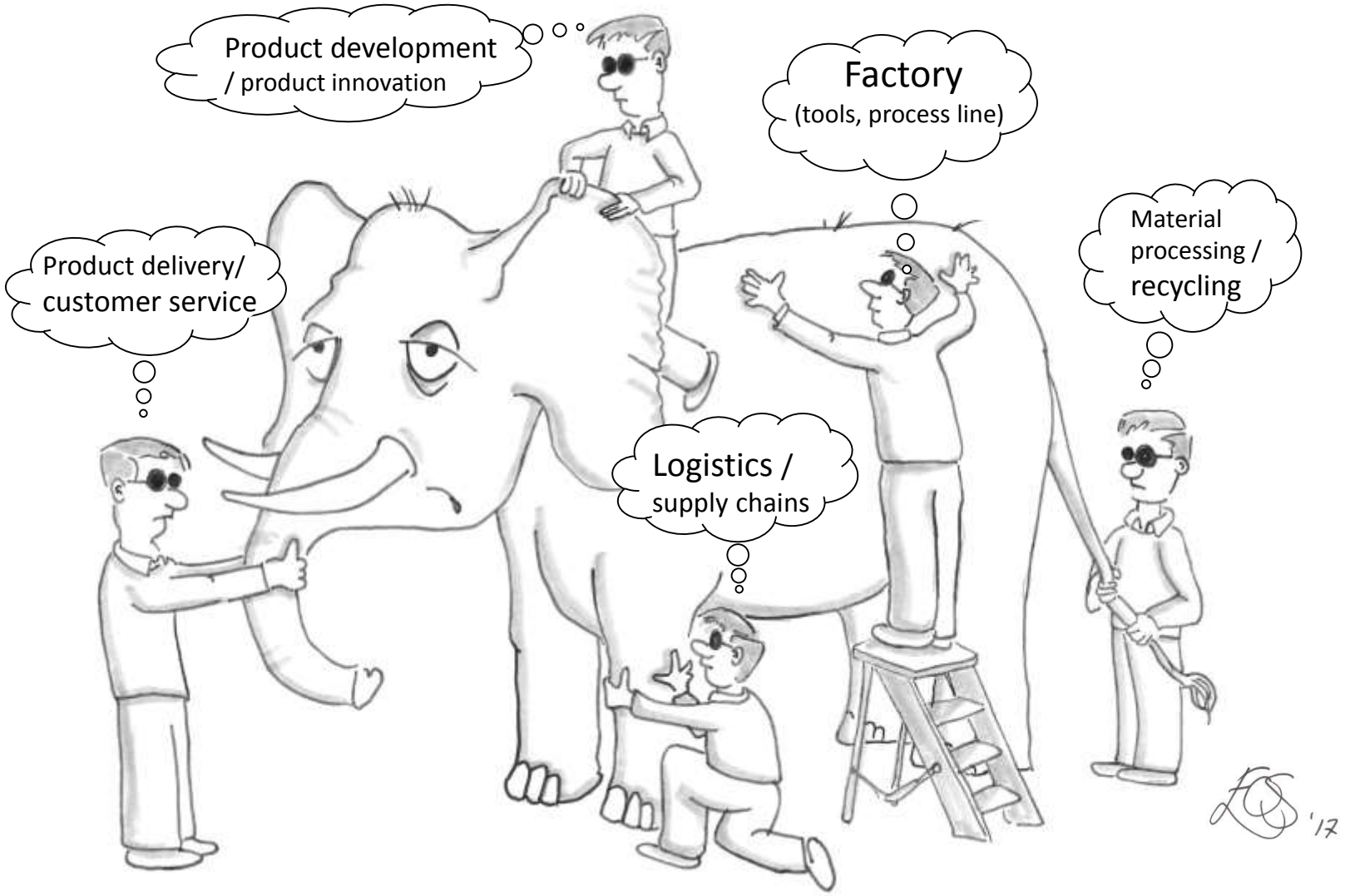
The Next Production Revolution: *A Systems Revolution*



- **Convergence** of key technologies: ICT… nano-, bio-… [but also…]
- Interdependence of manufacturing systems and research systems
- Urgency for (speed-to-manufacturing) **'scale-up'** of emerging tech
- **Digitalisation:** Accelerating trends / offering new opportunities
- **New business models:** Not least internet-based platform businesses

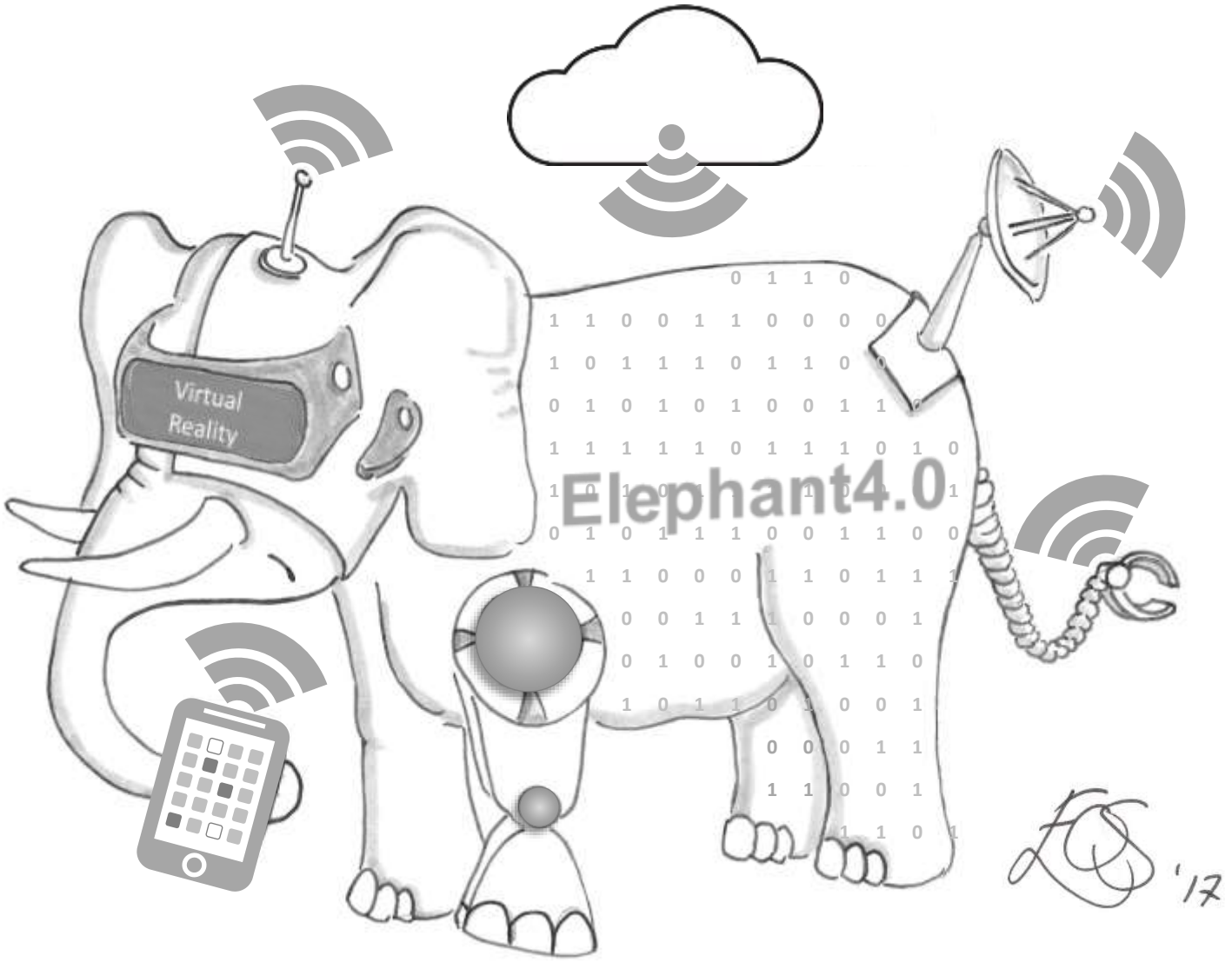
Framing the discussion:

Perspectives on ‘Manufacturing’



Digitalisation of Manufacturing

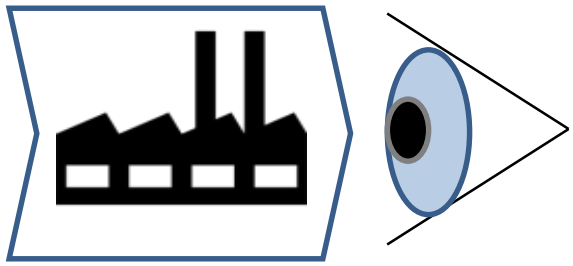
What will the Fourth Industrial Revolution look like?



Framing the discussion:

Perspectives on ‘Manufacturing’

(value chain systems)



Innovation
new manufactured products

Research → Development → Design → Supply management → Production → Distribution → After-sales Services

Assembly /
fabrication of manufactured products

Processed materials → Parts → Components → Sub-assemblies → Production → Distribution

Production
capability-building
for manufactured products

Engineering tools → Mecha-tronics → Adaptive machines → Factory equipment → Process line → Production

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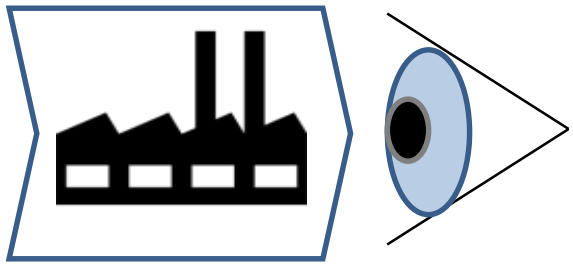

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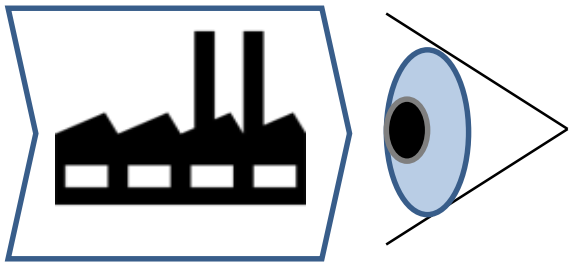

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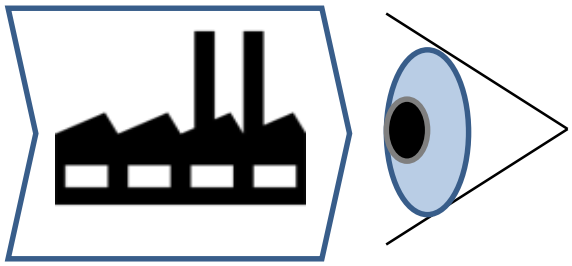

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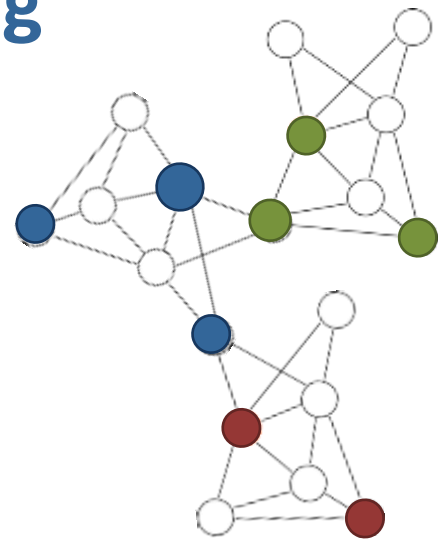
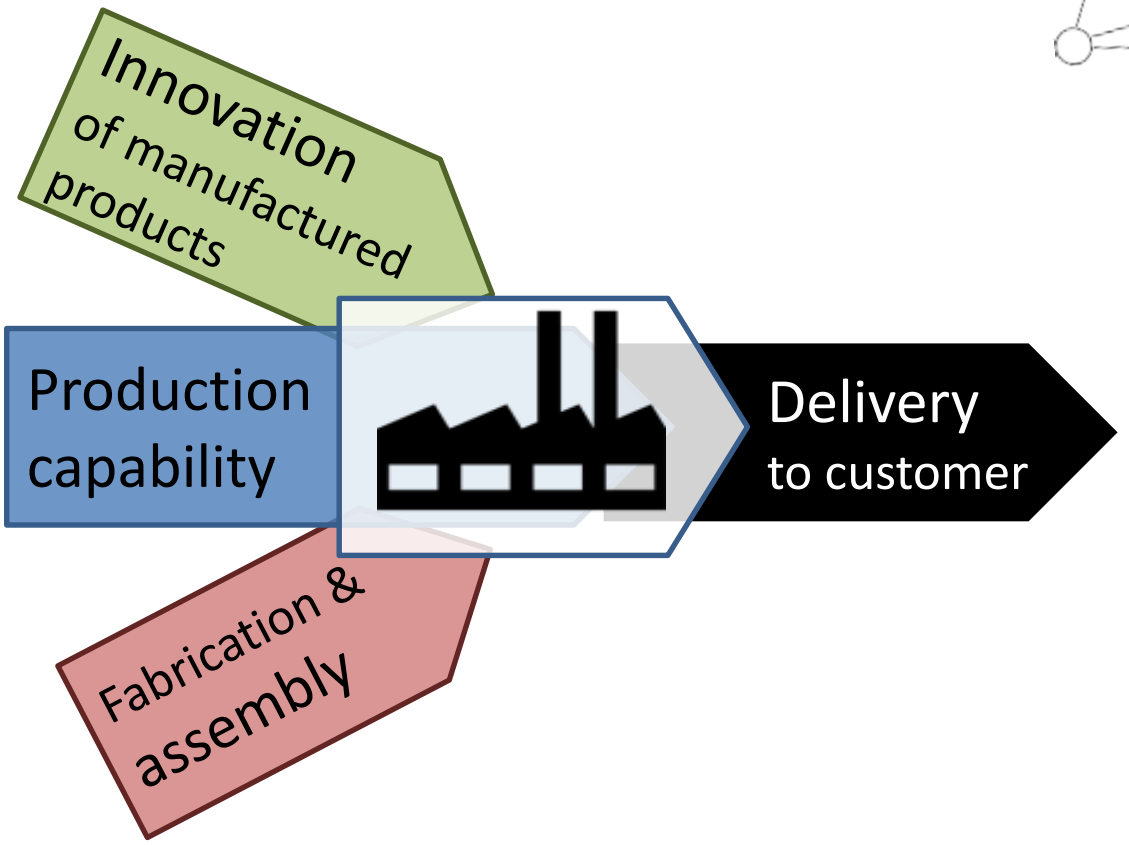
Different Perspectives on Manufacturing

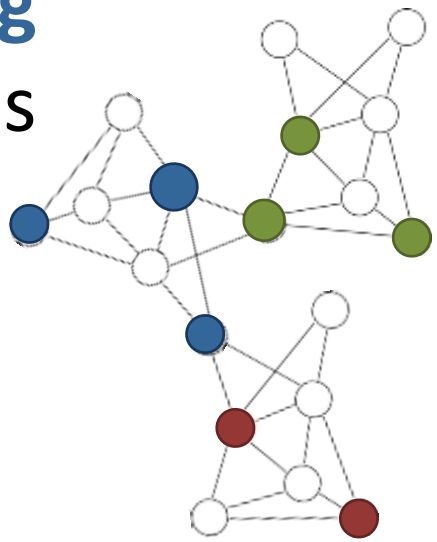
Increasingly integrated systems

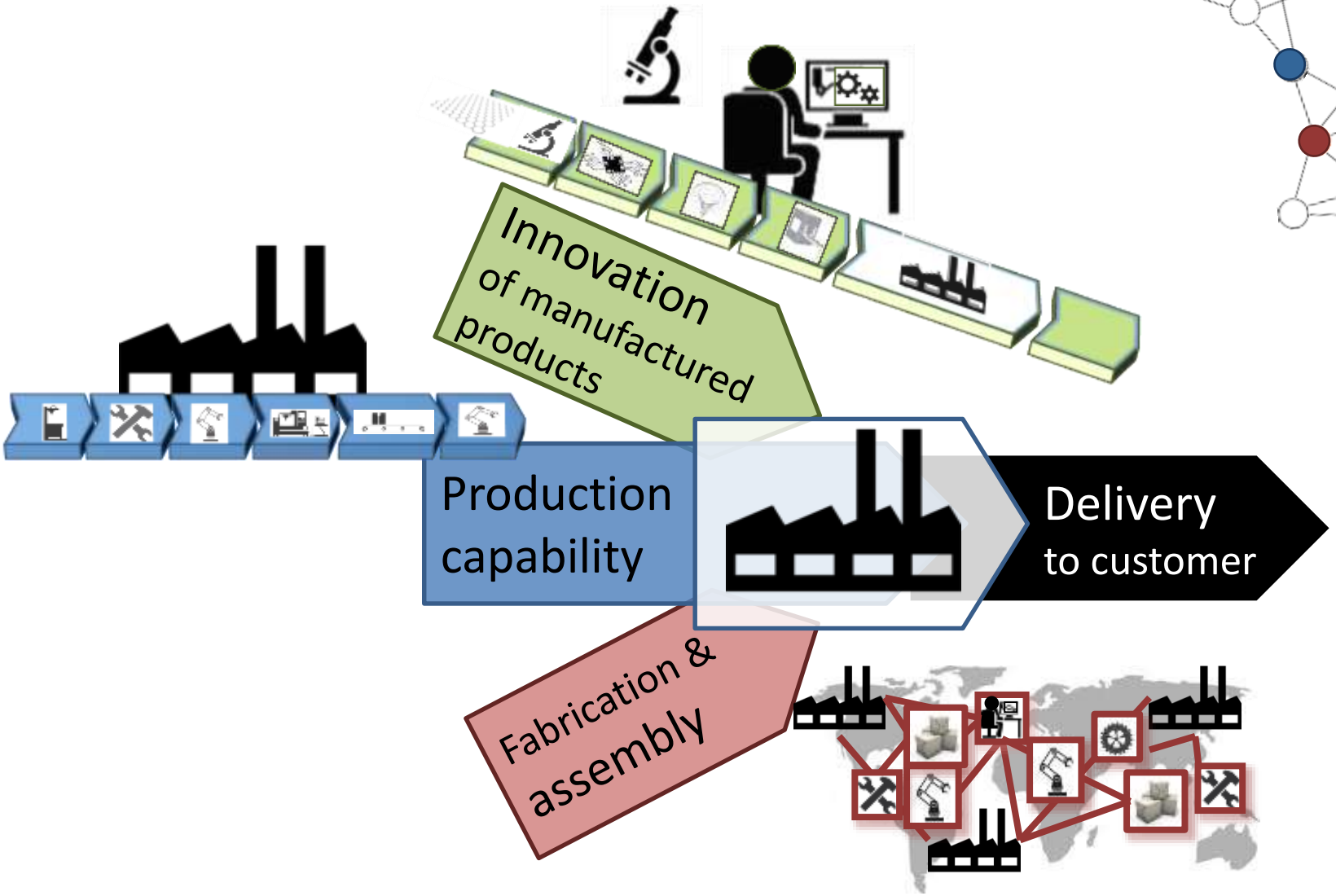




Different Perspectives on Manufacturing

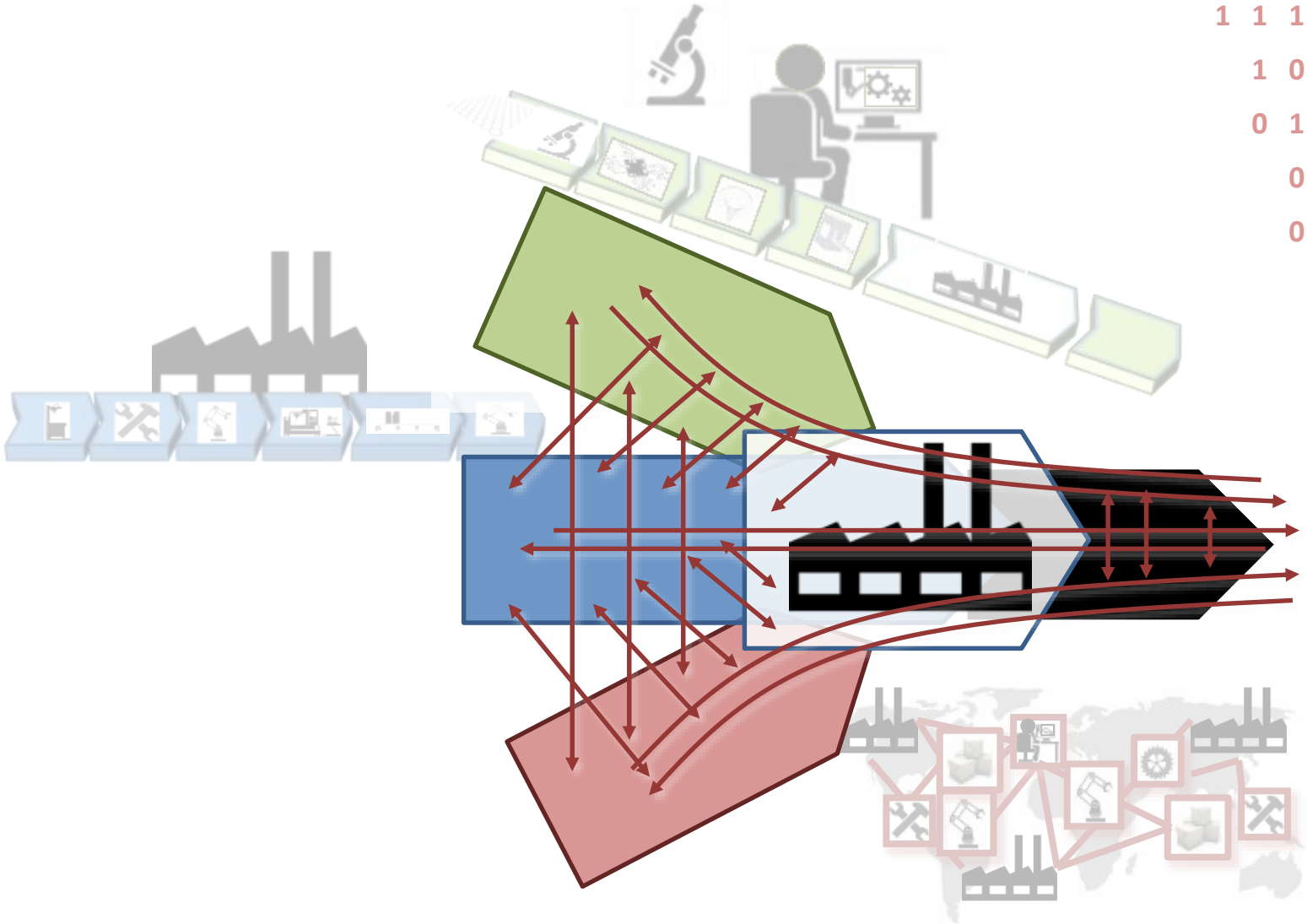
Many links between value chain activities





Different Perspectives on Manufacturing: Digitalisation

Web of 'digital threads' connecting different activities along value chains



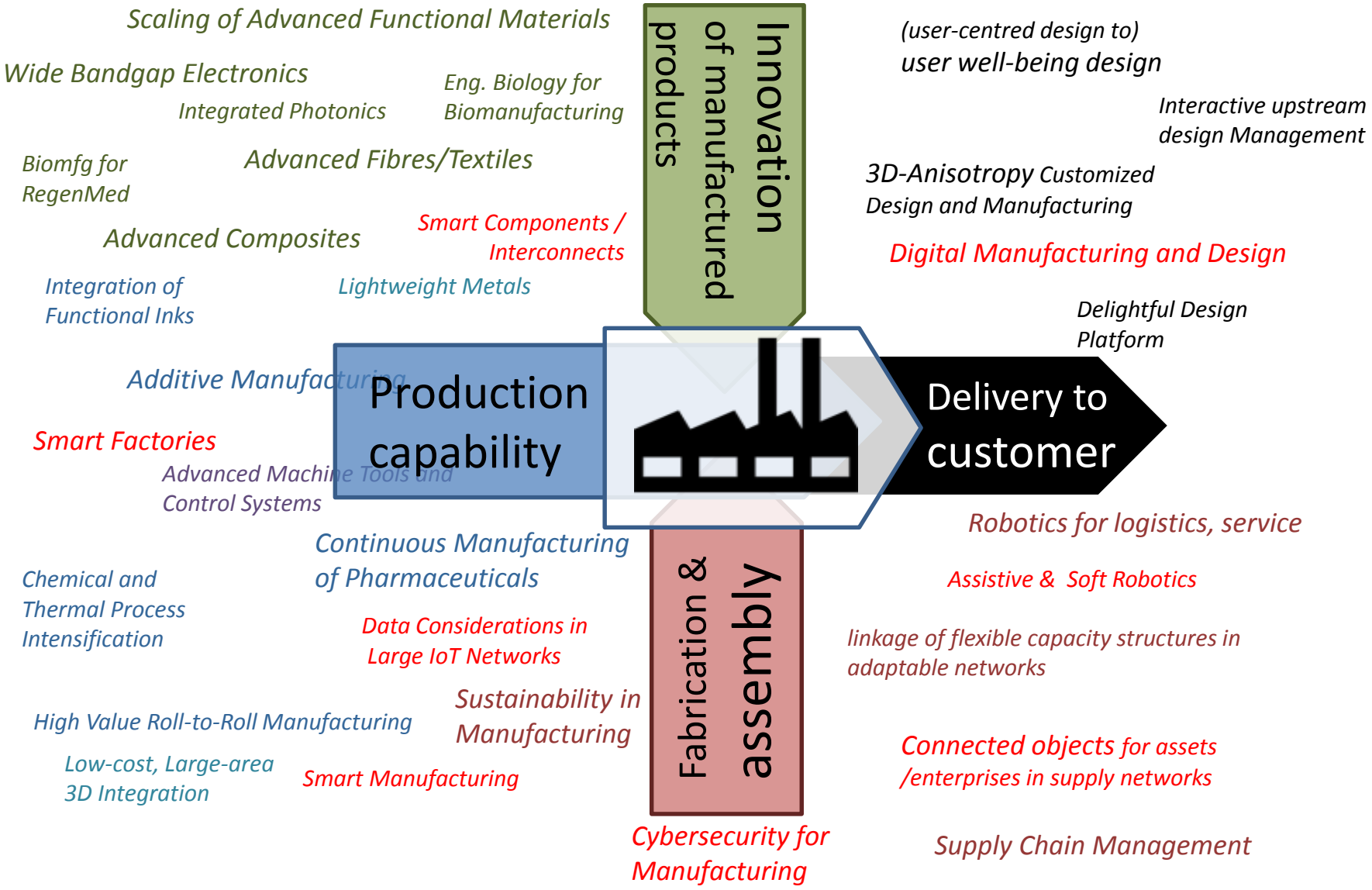
Capturing Value from Advanced Manufacturing

Different sources of competitiveness

Manufacturing perspective	How do firms capture value in modern manufacturing?	Advanced manufacturing challenges (and opportunities)
Product innovation	Competing on speed of new technology development	Development of products with improved functionalities, performance and reliability through application of advances in physical/biological sciences (e.g. nanotech, chemistry, biotech)
Process innovation	Competing on product mix flexibility and factory productivity	Process optimisation (speed, cost, resources); production technologies capable of more complex shapes and tighter process tolerances; hybrid production technologies/systems able to deliver individualised products at mass production prices
Supply chain	Competing on reconfigurable supply capabilities	Supplying materials and components faster/more efficiently; establishing adaptable and agile (global) supply chains in emerging and established industries (to deliver current and next-generation products)
Customer demand	Competing on superior customer satisfaction	Getting products and services to customers faster/more demand-led; creating stronger (digital) links between design, production and delivery; foreseeing changing patterns of demand and customer wants and needs

Manufacturing R&D targeting innovation throughout

Product Development, Production, Supply Systems



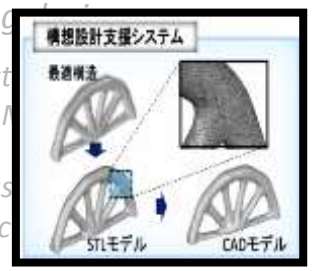
Key manufacturing research themes / challenges

requiring **more/stronger linkages** (industrial & interdisciplinary)

Scaling-up of emerging technologies

Innovation of manufactured products

Digital **manufacturing & design;** and business platforms



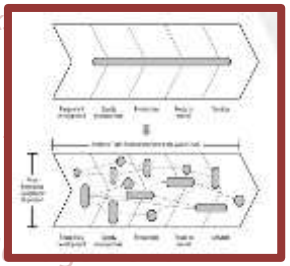
Production capability

Delivery to customer

Fabrication & assembly

Hybrid production technology systems

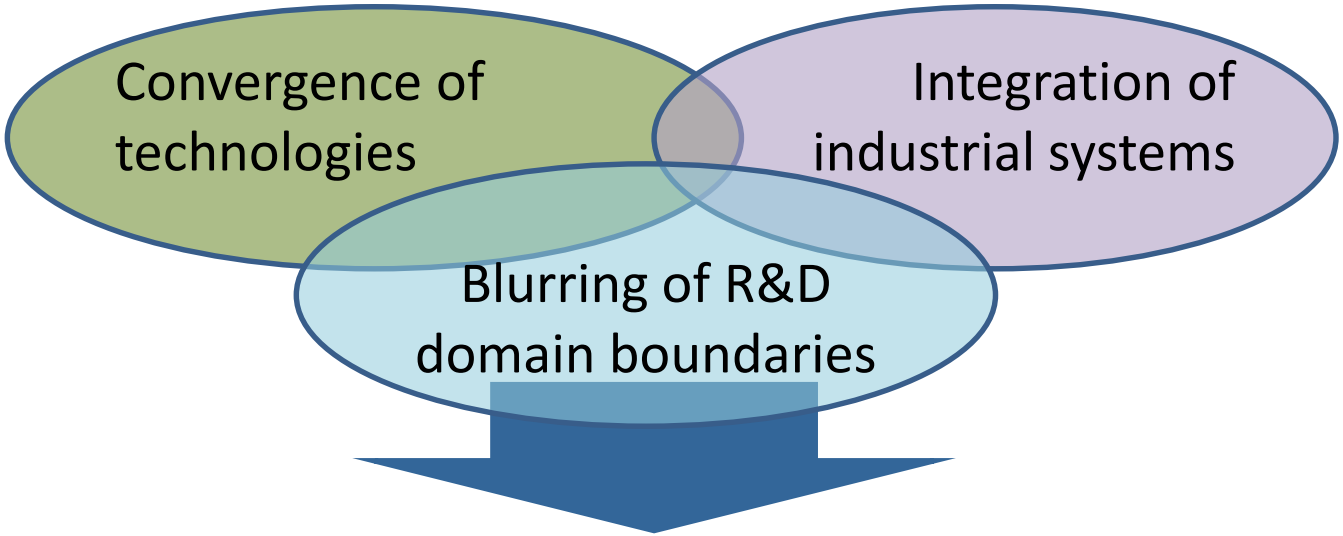
‘Smart’ **adaptive supply chains**



Scaling of Advanced Functional Materials
Electronics
Eng. Biology for
Advanced
Smart Components / Interconnects
Advanced Co
Integration of Functional Inks
Lightweight Metals
Additive Manufacturing
Smart Factories
Advanced Machine Tools and Control Systems
Chemical and Thermal Process Intensification
Continuous Manufacturing of Pharmaceuticals
Data Considerations in Large IoT Networ
Roll Manufacturing
Sustainabi
Manufactu
Smart Manufacturing
Cybersecurity for Manufacturing
(user-centred design to)
user well-being
Interact
design
3D-Anisotropy Cus
Digital Factory Planning and Design
Delightful Design Platform
Robotics for logistics, service
Assistive & Soft Robotics
linkage of flexible capacity structures in adaptable network
Connected objects
Supply Chain M

Implications of Next Production Revolution Trends

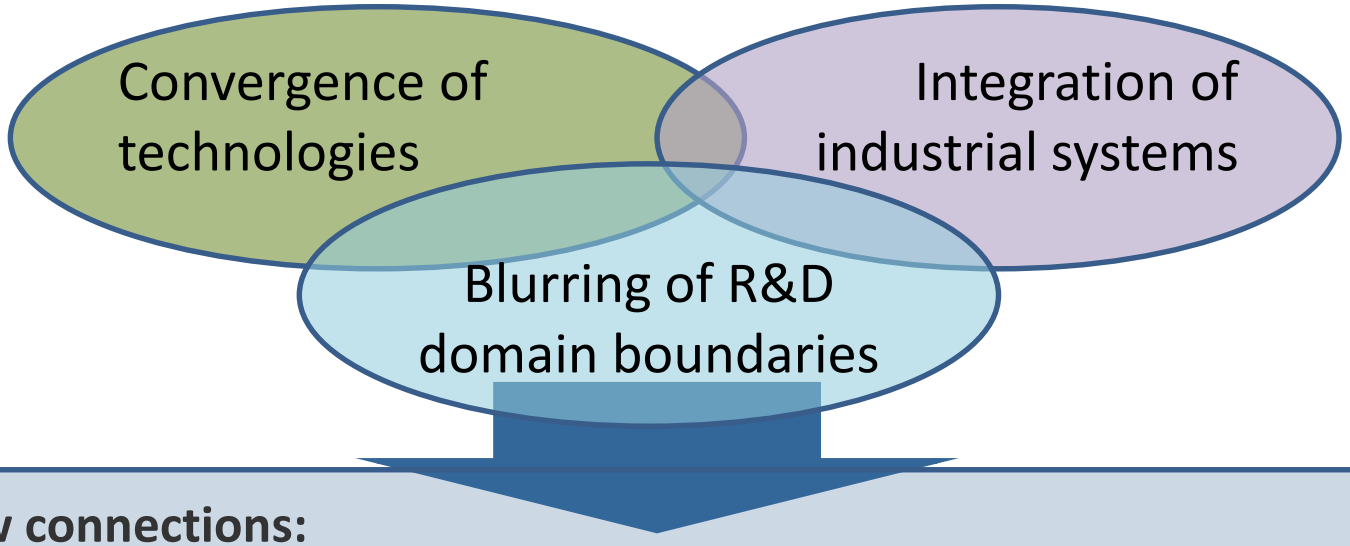
Manufacturing Research Priorities



- R&D addressing manufacturing **systems challenges**
- **New inter-disciplinarity** between emerging technology domains (e.g. adv materials, biotech), production technologies/tools, operations management, business management, ICT…
- **'Translational research'** for manufacturing scale-up
- R&D for 'sticky' **manufacturing for high wage economies**
- R&D informed by (big) **data from whole manufacturing system**

Implications of Next Production Revolution Trends

Manufacturing Research Priorities



- **New connections:**
  - **Industry**: shop floor, design, supply chains, vendors…
  - **Research base**: Uni centres, RTOs, natl labs, metrology labs, business schools…
- **Shared space:** Demonstration / scale-up facilities; user engagement, 'living labs'
- **Shared visions:** Foresight/roadmaps… Awareness / linkage-building exercises…
- **Key themes:**
  - **scale-up** (especially advanced materials)
  - **business models** (including internet-based platforms)
  - **digitalisation** (of factories, value chains, product innovation, service delivery)
  - **advanced supply chains**

Thank You

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