



# IfM Briefing Day

**High Value Manufacturing Landscape Update**

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# Agenda

## HVM study

- Background and Objectives
- Definitions
- HVM Challenges
- International comparison
- General observations

## Related studies:

- Machinery and Components Sector
- Application of digital technologies to innovation in manufacturing

## Next steps

# UK Future Manufacturing Landscape 2011

## To map the for the 15 – 25 year horizon

The most important trends influencing the changing nature of manufacturing

The greatest challenges and opportunities

The capabilities needed in the UK to capture these opportunities

## To help develop the medium to long term strategy of the High Value Manufacturing Catapult

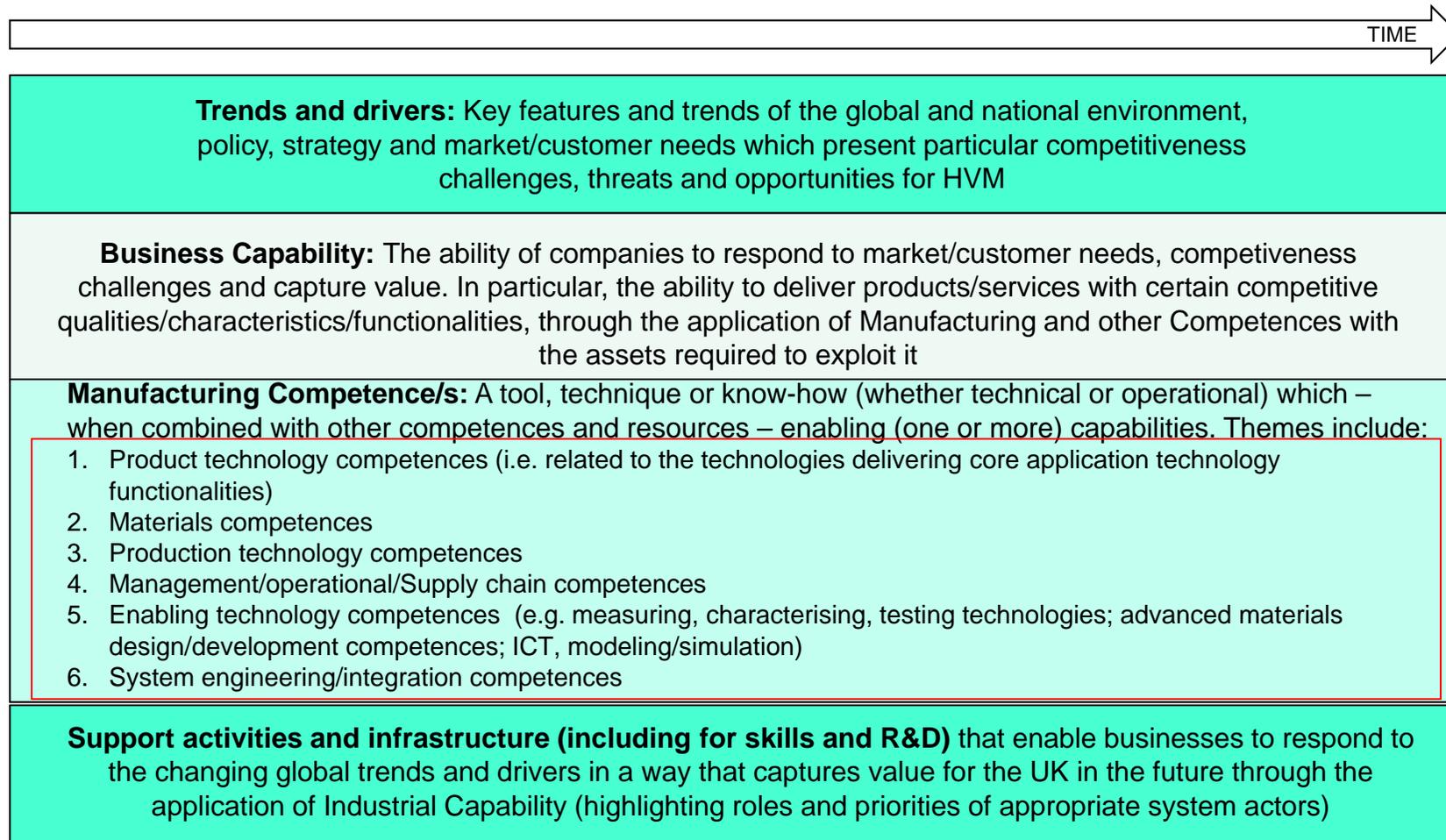


# UK Future Manufacturing Landscape Update 2014-5

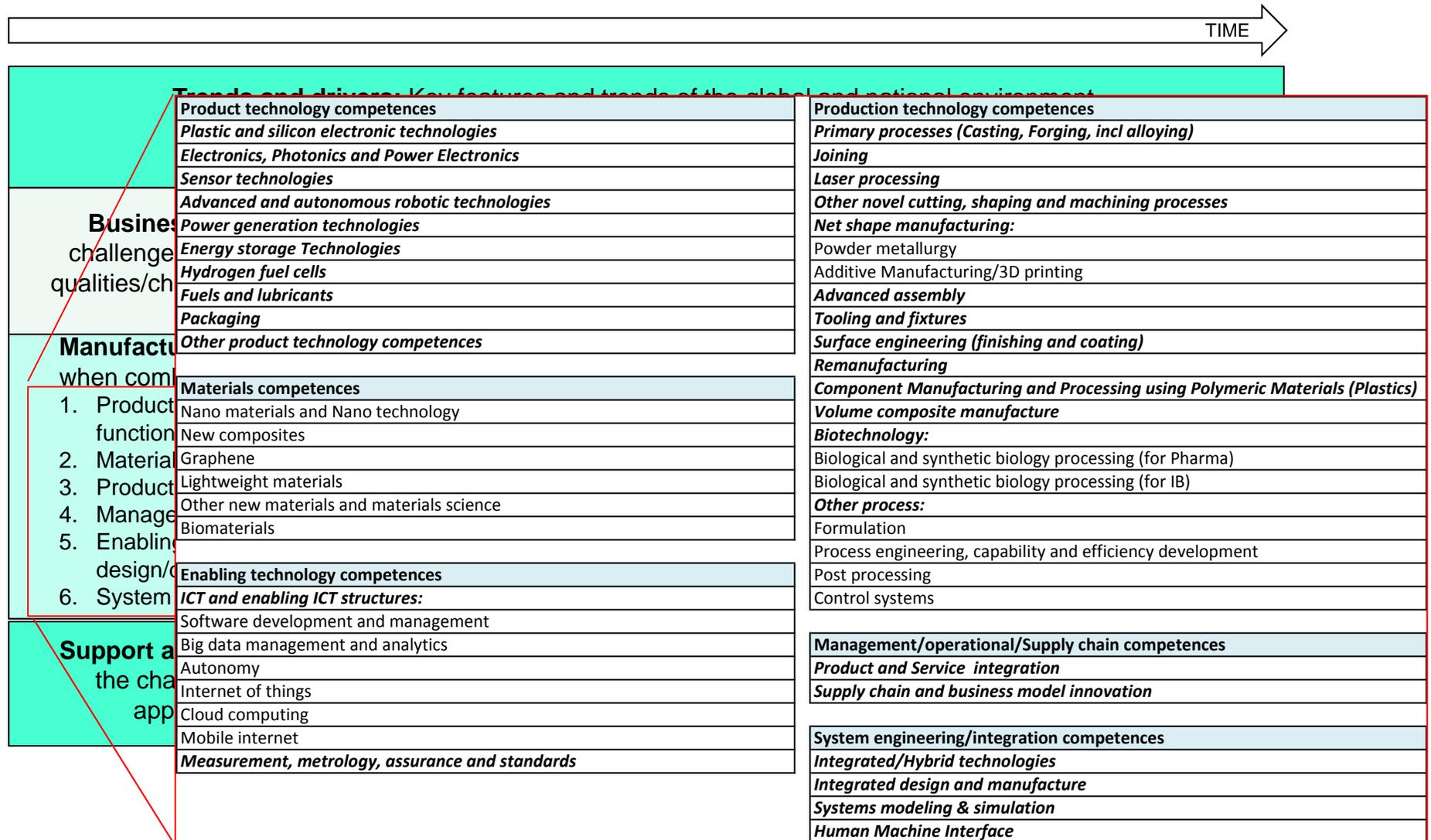
## Objectives:

- Produce an updated and solid set of themes on which to build further and is agreed by stakeholders across industry, government and research, ***informing Innovate UK HVM strategy***
- Provide an indication of possible areas worthy of investigation for the development of Manufacturing Competences across appropriate Sectors and Government (e.g.: Innovate UK/HVM Catapult/Research Councils/BIS/MoD and DSTL), ***integrating with the high level priorities of the HVM Catapult operational strategy***

# HVM Landscape definitions



# HVM Landscape definitions



# HVM Challenge definition

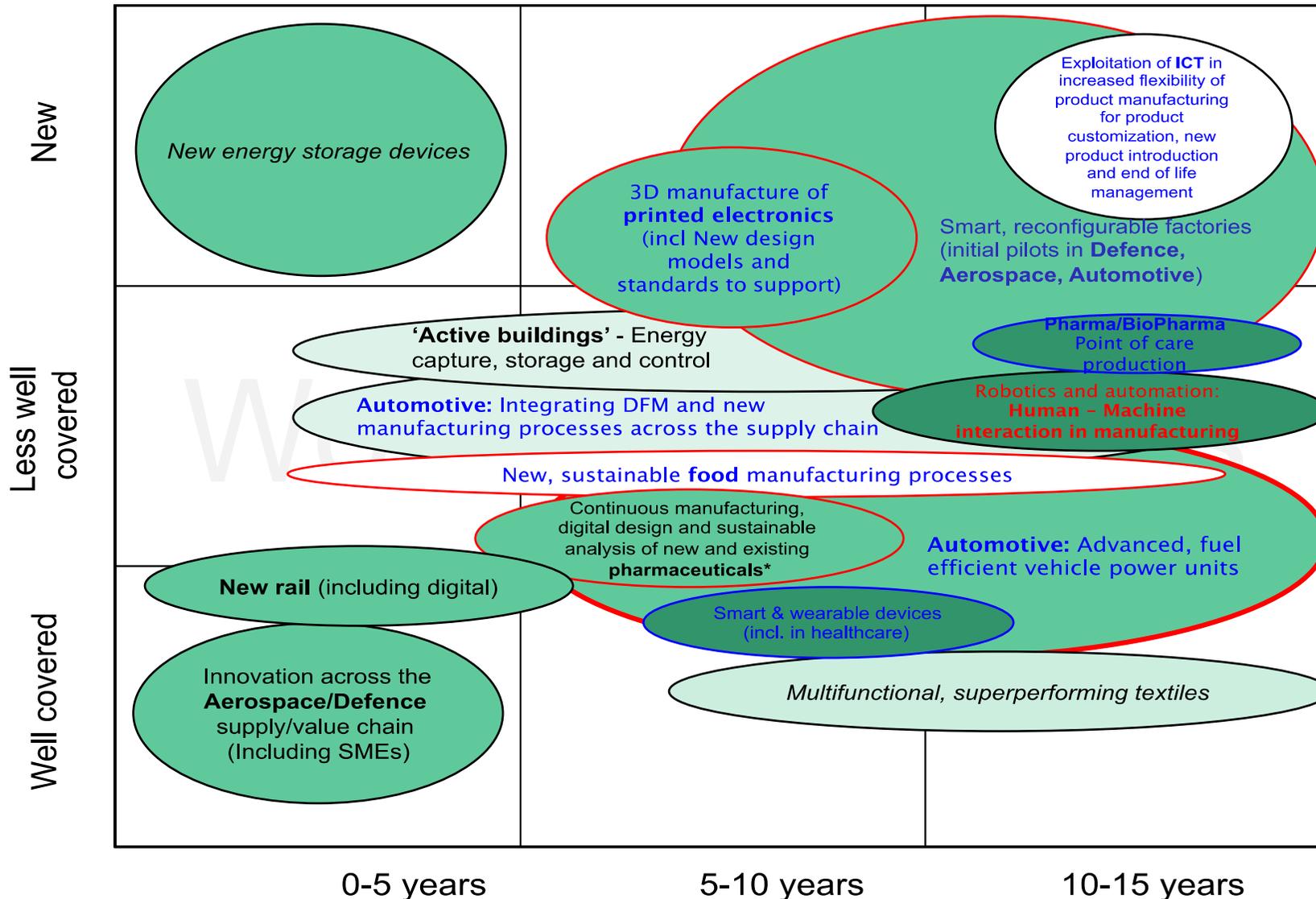
## An HVM challenge is:

A significant **opportunity or threat** to UK industries' and firms' ability to create value in the global market place in 2030, which requires:

- New/enhanced **business capabilities** (to meet the above opportunities/threats)
- New/enhanced **manufacturing competences** (to create the above capabilities)
- New/enhanced **action(s)** by one or more institutional actor(s) to deliver on UK value potential

# Top challenges

Blue = Identified in Landscape workshop, Sector documentation and Industrial consultation  
 Black = Identified in Landscape workshop and Sector documentation  
*Black italic = Identified in Landscape workshop and Industrial consultation*  
 RED = Identified only in Landscaping workshops



Autonomous **Automotive** vehicles cannot be placed on chart due to lack of data

# Challenge Themes

Pervasive challenges, which will have impact across the whole manufacturing economy, particularly as regards the **digitisation of the manufacturing supply chain, smart and reconfigurable manufacture, automation and product/electronics integration**

Challenges associated with **national infrastructure investment** priorities in areas such as rail, energy and building and construction

Challenges identified in **sectors such as aerospace, automotive and defence** and textiles particularly around **strengthening the supply chain as well as new product and process innovation** that may have potential for **spin out benefits in other sectors**

Sector-specific challenges, particularly as regards **healthcare and nutrition/food**, reflecting continued and/or growing importance of manufacturing in those sectors within the wider economy

# International comparison

**The digitalisation of manufacturing:** ICT-enabled manufacturing technologies and systems. Particular effort is being put into 'cyber physical systems' (embedded software and sensors, and advanced measurement and control systems) and applications of the 'internet of things' to manufacturing, whereby 'intelligent' systems can be coordinated via the internet throughout entire value chains, allowing rapid development of new products, more efficient logistics, and more customised products and services

**Manufacturing and advanced materials:** The scale-up, integration and deployment of advanced materials are critical manufacturing research domains in all countries. This includes research into simulation technologies and expertise to enhance predictive (multi-scale) modelling

**Advanced manufacturing enabling key emerging technologies:** such as the translation of emerging technologies into high-value products and novel effective production technologies, in particular: advanced functional materials (as discussed briefly above), as well as novel biotechnology domains (e.g. synthetic biology and regenerative medicine), photonics, and nanoelectronics

**Manufacturing 'infrastructural' technologies:** such as advanced metrology, real-time monitoring technologies, characterisation, analysis and testing technologies, shared databases, modelling and simulation tools. There appears to be increased funding of test beds, pilot lines and related facilities

**Customer-focused manufacturing:** Increasing attention to more 'customer-focused' research endeavours, including tools for personalised and innovative product design, upstream design management, and on-demand manufacturing of customised products, product-service systems, etc.

## General observations

More opportunities have been identified than previously in a number of sectors such as **food, pharmaceuticals, textiles, medtech, rail, built environment and electronics**

**Application of ICT and data management to manufacturing and the supply chain**, the integration of technology and IT to create **highly flexible, 'mass customised' and in some cases localised manufacturing**, has grown greatly in significance

**Specific manufacturing competency themes** which appear more prominently in this study include: *electronics, photonics and power electronics; sensors; materials, particularly nanomaterials, new composites, and biomaterials; measurement, metrology and assurance; advanced assembly; tooling and fixtures; volume manufacture of composites, and remanufacturing*

**Sustainability** is seen as a key driver for many challenges, but has not emerged to date as a specific theme

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# Machinery and Components Strategy

Manufacturing sector strategies developed in recent years identify **significant growth opportunities and challenges** for their associated supply chains.

Government policy, previously developed through '**vertical**' sector strategies, now focusses on cross-sector developments to support **exports, re-shoring, productivity and technology and innovation**.

A requirement has been identified for the machinery and components producers to develop a new strategic approach which looks at the **issues and opportunities across sectors**, to develop and grow businesses in line with emerging Government strategies

2014 – 2016 programme of engagements and workshops:

- OEMs
- SMEs
- Government and Government Agencies
- Trade associations

# Manufacturing competencies with identified capacity and capability gaps and opportunities

Supply chain and business model innovation	
Product and service integration	
Interconnected topics relating to the overarching themes of digitally enhanced manufacturing	Advanced and autonomous robotic technologies
	Advanced assembly
	Additive manufacturing
	Big data management and analytics
	Internet of things
Measurement, metrology, assurance and standards	
<i>Automation</i>	
<i>Productivity benchmarking</i>	

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# Observations

There are numerous examples of **first rate innovators in the machinery and components area**. However, there are presently a number of **significant barriers** to this happening more broadly:

- **A segmented approach** is required in supporting in many cases small and medium sized companies who vary greatly in their level of **maturity as regards innovation**, and there is a general **lack of understanding within the sector as to the opportunities and support available**.
- **Supply chain and business model innovation, automation and productivity benchmarking** are very important competencies for the future competitiveness of the sector. These **do not feature as national innovation priorities**, however, so that institutional support is less well focussed
- There is a **gap in information and visibility between OEMs and potential machinery and component sector suppliers** which hinders exploitation of the available capability
- Many **Local Enterprise Partnerships** are key in directing funding and support to SMEs but this study has of necessity engaged only two LEPs, both in the Midlands.

# Recommendations

The strengthened co-ordination is required for the sector including:

- **Input to the shaping of future government agency initiatives and promoting existing and new initiatives to their members**, for example presently:
  - Link with RAS SIG and National Digital Strategy and with HVMC and BSI 'Digital Strategy' programme
  - Together with MTC and other providers offer support to SMEs in building automation competency
- **Proactive engagement with relevant LEPs to:**
  - Promote the local development and application of skills and education support and channel available support to the benefit of the sector
  - **Ensure the former MAS networks and suppliers are linked in to the new LEP 'Growth Hubs'**
  - **Ensure expertise is available to support SMEs in supply chain and business model innovation, automation, and productivity benchmarking**
- Ensuring companies in the sector are aware of, and can link to the new regional centres established under the **National Product Verification Programme**
- Take a role in **excellence transfer across the sector**, potentially by sponsoring cross-sector capability promotion events

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# Proposed scope

Support BSI in understanding how standards can underpin innovation efforts and accelerate productivity growth in relation to the application of digital and automation technologies to innovation in manufacturing processes and systems:

## End Use Sectors

- Food
- Agritech
- Pharma/BioPharma
- Medtech
- Aerospace
- Automotive
- Built environment

## Cross cutting sectors

- Electronics and ICT

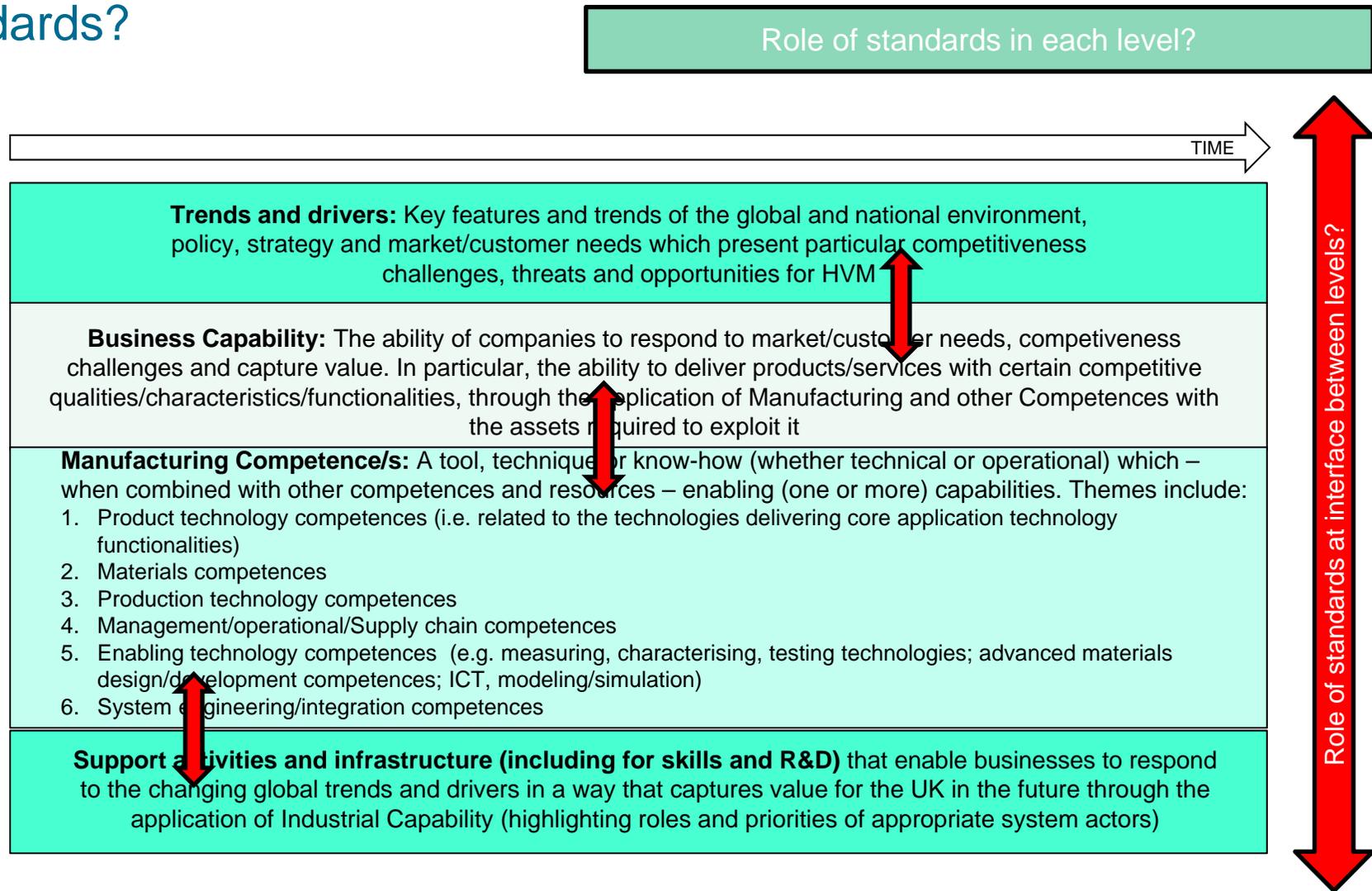
<b>Product technology competences</b>
<i>Plastic and silicon electronic technologies</i>
<i>Electronics, Photonics and Power Electronics</i>
<i>Sensor technologies</i>
<i>Advanced and autonomous robotic technologies</i>
<i>Other product technology competences</i>
<b>Materials competences</b>
Nano materials and Nano technology
New materials and materials science
<b>Management/operational/Supply chain</b>
<i>Product and Service integration</i>
<i>Supply chain and business model innovation</i>
<b>Enabling technology competences</b>
<b>ICT and enabling ICT structures:</b>
Software development and management
Big data management and analytics
Autonomy
Internet of things
Cloud computing
Mobile internet
<b>Measurement, metrology, assurance and</b>
<b>Communications technologies</b>

<b>Production technology competences</b>
<i>Primary processes (Casting, Forging, incl alloying)</i>
<i>Novel cutting, shaping and machining processes</i>
<b>Net shape manufacturing:</b>
Additive Manufacturing/3D printing
<b>Advanced assembly</b>
<b>Tooling and fixtures</b>
<b>Remanufacturing</b>
<b>Biotechnology:</b>
Biological and synthetic biology processing (for
<b>Other process:</b>
Process engineering, capability and efficiency
Control systems
<b>System engineering/integration competences</b>
<b>Integrated design and manufacture</b>
<b>Systems modeling &amp; simulation</b>
<b>Human Machine Interface</b>

Source: HVM Challenge workshops Feb/Mar 15

Note: Scope includes the full value chain: R&D; Design; Production; Supply; Sales & Marketing; Services; Reuse/Disposal

# HVM Landscape – role of standards?



# BSI digital manufacturing

Support BSI in understanding how standards can underpin innovation efforts and accelerate productivity growth in relation to the application of digital to innovation in manufacturing processes and systems:

## End Use Sectors

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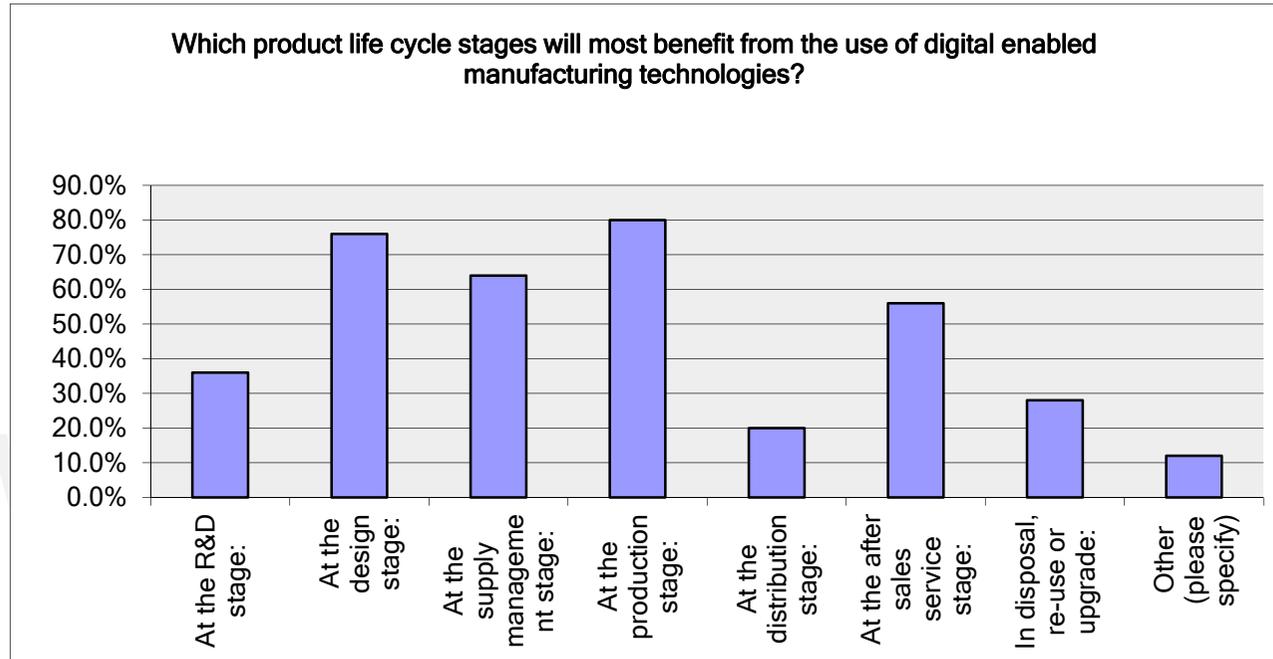
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## Q3: Lifecycle stages to benefit most



**Production:** Precision, efficiency, integration; making information from vast amounts of data

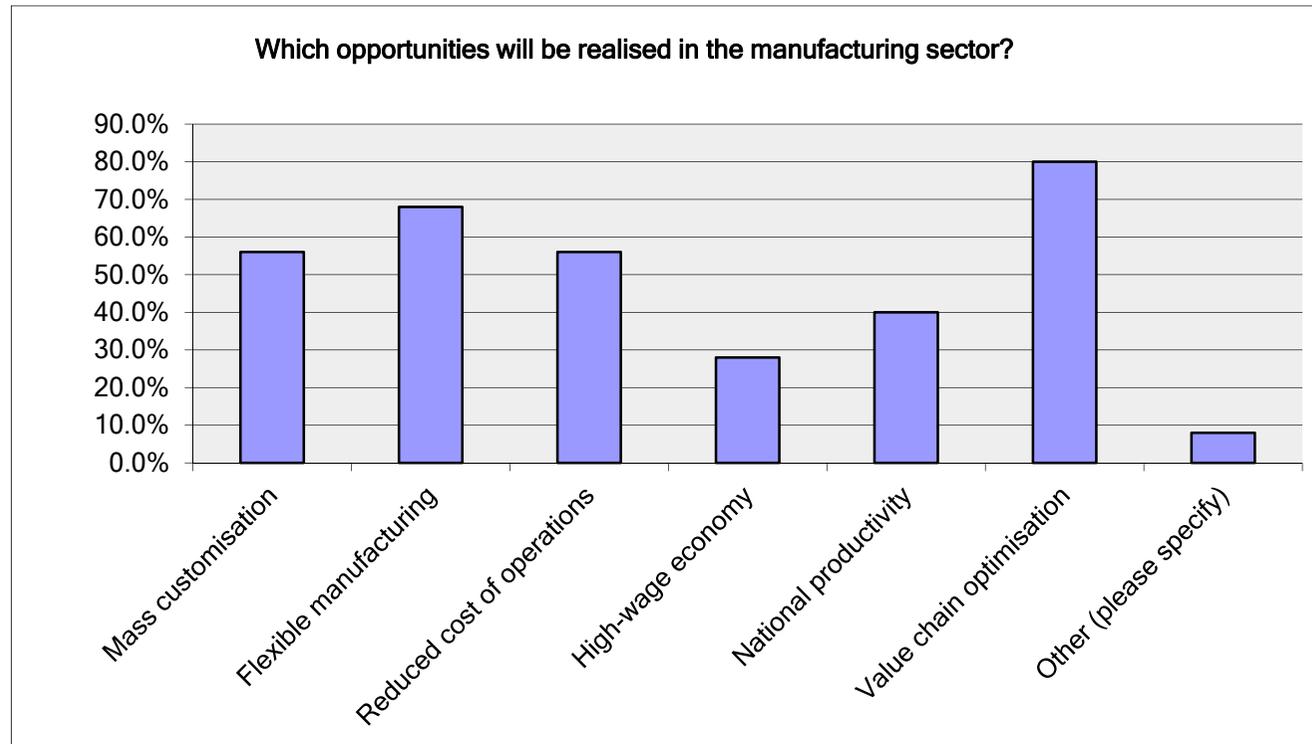
**Design:** Quick and low cost design and redesign; using real manufacturing data at the design stage

**Supply management:** Visibility, traceability, synchronisation and collaboration; effective connection to production stage

**Service:** Full, real time service condition monitoring and maintenance, with feedback to design and production

**R&D:** Rapid prototyping and development; digitalisation of early discoveries

## Q5: Which opportunities will be realised?

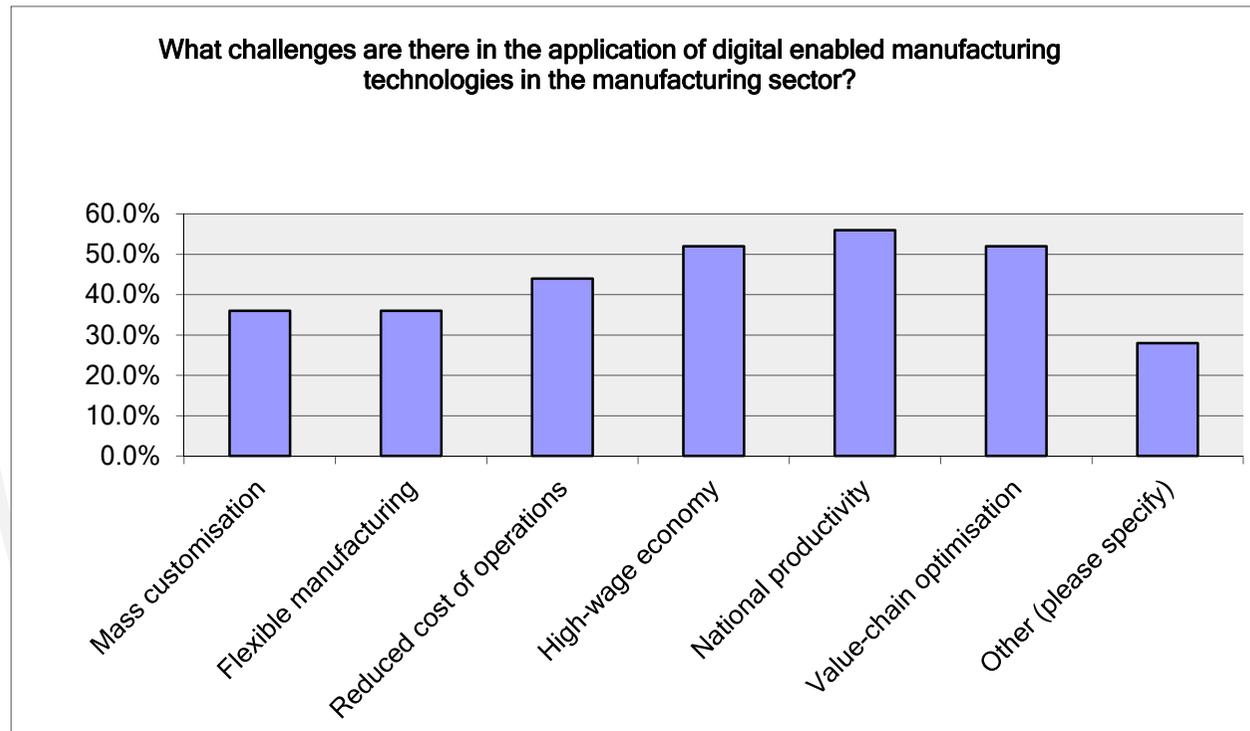


**National Productivity** was not as widely selected as other options, but scored very highly when chosen.

The benefits of **Value chain optimisation** and **Flexible manufacturing** were linked, both relating largely to better control and management through greater visibility and access to information.

An interesting submission under **Other** was 'the ability to participate in higher-level complex systems where the barriers to entry are currently too high'.

## Q6: What challenges are there?



Many of the challenges, especially in **National Productivity**, revolved around speed and cost of adoption of digital technologies, with the need for demand and a change of mindset viewed as the central enablers. A skills shortage was seen as the central challenge in the **High-wage economy**, with high initial costs providing the greatest source of difficulty in **Reduced cost of operations**.

The challenges in **Other** were concerned a lack of vision or acceptance and a reliance on old knowledge sitting alongside significant security implications and the need for standardised, resilient systems.

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## **Next steps**

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<b>Report publication</b>	<b>June 2016</b>
<b>'Technology Pull Through' priorities</b>	<b>July 2016</b>
<b>M&amp;CS strategy consultation and validation</b>	<b>May – June 2016</b>
<b>BSI Digital strategy development</b>	<b>July 2016</b>
<b>International workshop</b>	<b>TBC</b>
<b>HVMC Collaboration</b>	<b>TBC</b>