



Manufacturing
Technology Centre

Support for Manufacturing in UK

- HVM Catapult
- MTC innovation ecosystem
- International activities
- Summary



Harald Egner
Porto, 20th October 2016



High Value Manufacturing Catapult (HVMC) history



Ingenious Britain
Making the UK the leading
high tech exporter in Europe
A report by James Dyson
March 2010

The Current and Future Role of Technology and Innovation Centres in the UK

A Report by Dr. Hermann Hauser

For Lord Mandelson
Secretary of State
Department for Business Innovation & Skills

Technology Strategy Board
Driving Innovation

High Value Manufacturing
Strategy

Technology Strategy Board
Driving Innovation

A landscape
for the future
of high value
manufacturing
in the UK

A study conducted for the
Technology Strategy Board

February 2012

HVM Catapult

- 7 World class centres of industrial innovation (£380m assets)
- Cutting-edge equipment for industrial scale up
- Lowering risk for business
- Platform for skills development at all levels
- Cross sector capability
- Supply chain partnership
- “Critical mass”

The Catapult network



CATAPULT

- Network of technology and innovation centres
- Focus on areas where UK has inherent strengths and where market potential is significant.
- Bringing the best of the UK's innovative businesses and researchers together to bring new products and services more quickly to commercialisation.

There are currently 11 Catapults:

Cell and Gene Therapy Catapult

Digital Catapult

Energy Systems Catapult

Future Cities Catapult

High Value Manufacturing Catapult

Medicines Discovery Catapult

Offshore Renewable Energy Catapult

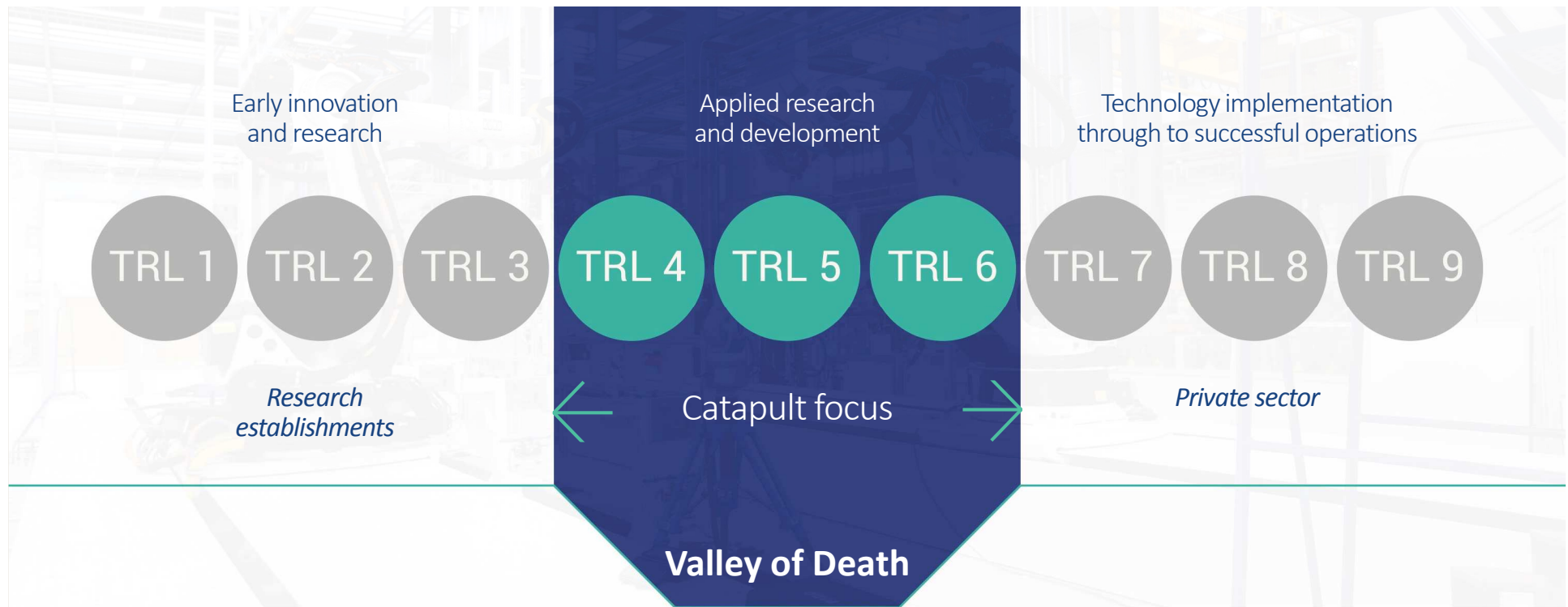
Precision Medicine Catapult

Satellite Applications Catapult

Semiconductors Applications Catapult

Transport Systems Catapult

Market failure: Bridging the Valley of Death



EPSRC

InnovateUK

Our mission

CATAPULT
High Value Manufacturing



The HVM Catapult is the catalyst for the future growth and success of manufacturing in the UK.

We help accelerate new concepts to commercial reality and thereby create a sustainable high value manufacturing future for the country.

27 technologies

CATAPULT
High Value Manufacturing



Advanced Assembly

Automation

Biologics

Biotechnology

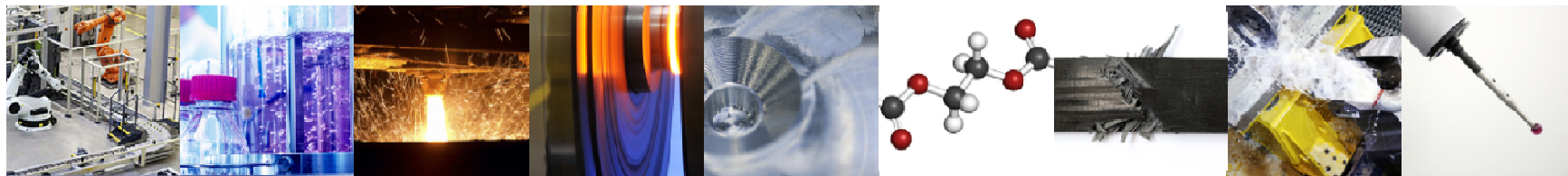
Casting

Composites

Design

Digital Manufacturing

Electronics



Flexible Manufacturing

Formulation

High Temperature Processing

Joining

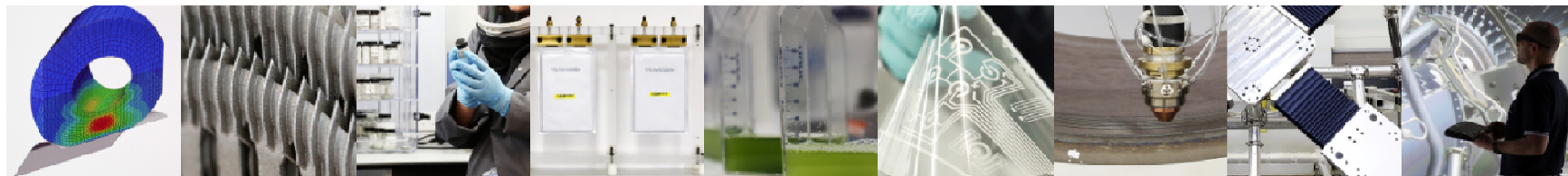
Machining

Polymers

Materials Characterisation

Metal Forming and Forging

Metrology



Modeling and Simulation

Netshape and Additive Manufacturing

Powder Technology

Power and Energy Storage

Resource Efficient and Sustainable Manufacturing

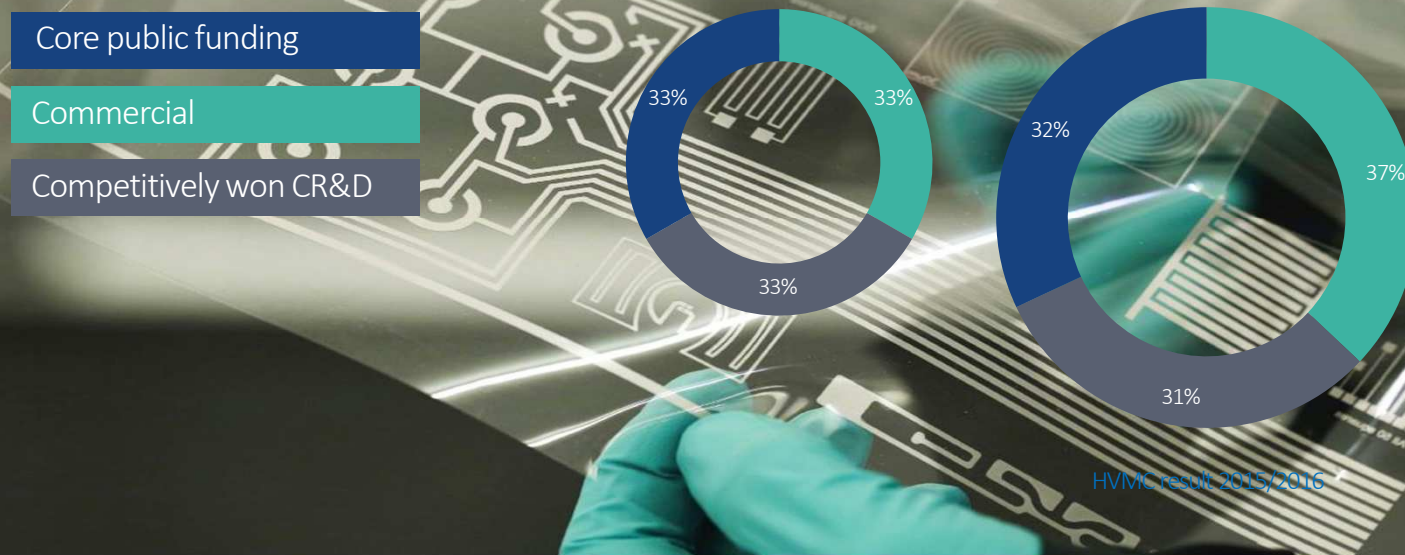
Printable Electronics

Surface Engineering

Toolings and Fixtures

VR and Virtualisation

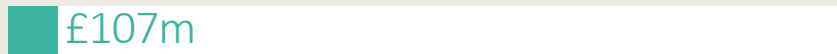
The funding model



Economic impact



Core funding received to date



Collaborative R&D Funding levered



Net benefits for the UK economy



Potential net benefits by 2020



£15

net benefits to the UK
economy from every

£1

core public
funding received

Source: WECD Economic Impact Evaluation study

HVM Catapult centres



Advanced Forming Research Centre AFRC

CPI Centre for Process Innovation

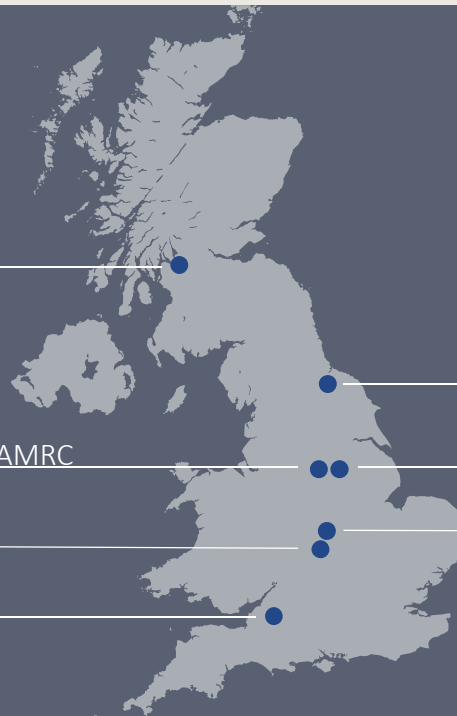
Nuclear AMRC

AMRC Advanced Manufacturing Research Centre

Warwick Manufacturing Group WMG

MTC Manufacturing Technology Centre

National Composites Centre NCC



Seven centres – different legal status

5 Centres with
university status

2 Centres with private
company status



AFRC



Nuclear AMRC



WMG

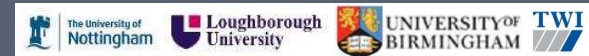


NCC

CPI

AMRC

MTC



Five centres with industrial membership model

CATAPULT
High Value Manufacturing



AFRC



Nuclear AMRC

WMG



NCC

CPI

AMRC

MTC



MANUFACTURING TECHNOLOGY CENTRE

▶ **FOUNDED IN 2010**

Independent RTO

Company limited by guarantee
(profit re-invested in MTC)

Purpose built facility (12,000m²) -
to allow industry & academia to perform
industrial scale projects



▶ **FOUNDED BY LEADING RESEARCH ORGANISATIONS:**

University of Birmingham

Loughborough University

University of Nottingham

TWI

With support of industry

❑ Rolls Royce

❑ Airbus

❑ Aero Engine Control

WORKING WITH MTC

- ▶ Open access centre
- ▶ Flexible approach to working with companies of all sizes from SMEs to Tier 1s and large OEMs
- ▶ A collaborative research programme driven by members

mtc
Manufacturing
Technology Centre

11
to
single client
project

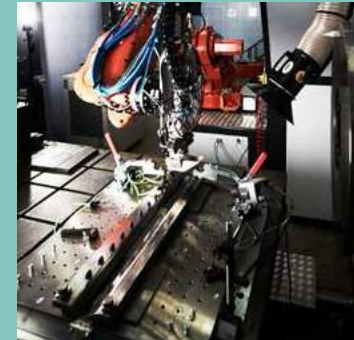


Government
backed
collaborative
R&D
projects



90+
member
companies

Collaborative
R&D project
portfolio funded
by members



MTC MEMBERS

TIER 1

Access to research outputs
across all themes
Programme board seat
(with voting rights)

TAB board seat
(with voting rights)

TIER 2

Access to research outputs
across all themes
Programme board seat
(with no voting rights)

TAB board seat
(with voting rights)



MTC MEMBERS

TIER 3

1 year commitment

No cash outlay required

Opportunity to engage with major OEMs and Tier 1's



GÜDEL



Prodtex

ABB



gem

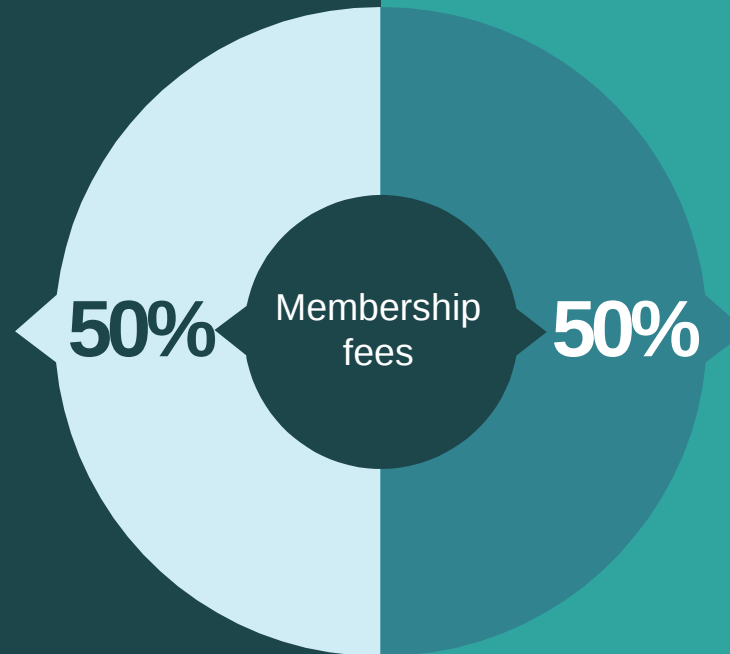


CORE RESEARCH PROGRAMME

Core Research Programme with shared results

Supported with additional Government contribution to generate collaborative R&D funding pot

Foreground IP owned by the MTC and licensed back to members royalty free



Directed research

Project commissioned by members either on a 1-to-1 basis with MTC or involving other members

MANUFACTURING SYSTEM SOLUTIONS

Advanced Production Systems

Special
Purpose
Machines &
Equipment

Electronics
Manufacturing

Assembly
systems

COMPONENT MANUFACTURING SYSTEMS

Net Shape

Additive
Manufacturing

Advanced
Material
Processing

Powder
Management

DIGITAL ENGINEERING

Design &
Simulation

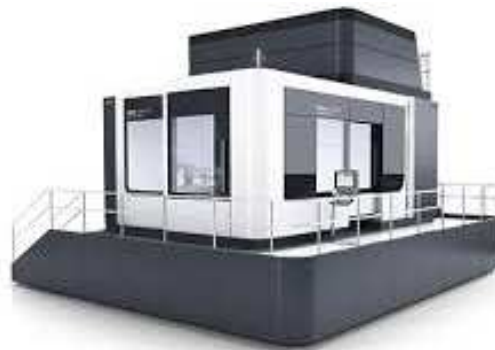
Metrology
& NDT

Intelligent
Automation &
Informatics

Operational
Efficiency

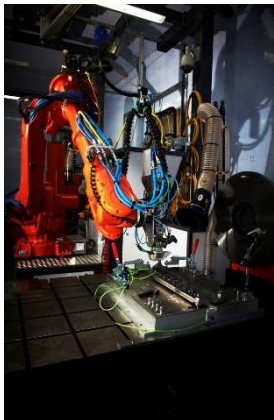
Industrial scale equipment for Industrial scale-up

DMU 340 FD



Large scale gantry system

- 18m x 7m working envelope



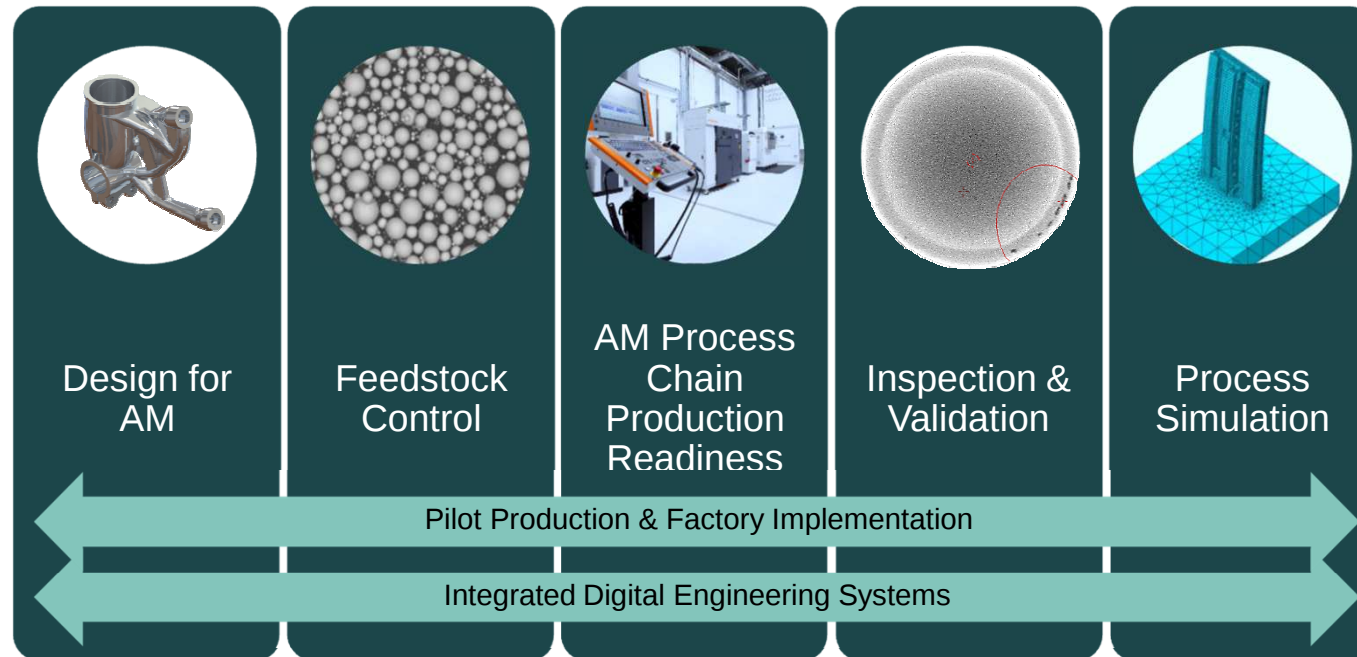
20KW Automated Laser Processing Cell



PKM - Parallel Kinematics Mechanism

- 11.5m x 4.5m working envelope
- Repeatability $\pm 0.01\text{mm}$
- Accuracy $\pm 0.02\text{mm}$

NATIONAL CENTRE FOR NET SHAPE AND AM



AM Process

Polymers

Material jetting
Material extrusion
Vat photopolymerisation



Metals

Powder bed fusion
(laser & electron beam
melting)
Directed energy
deposition
Hybrid (DED and PBF)



Ceramics

Vat photopolymerisation



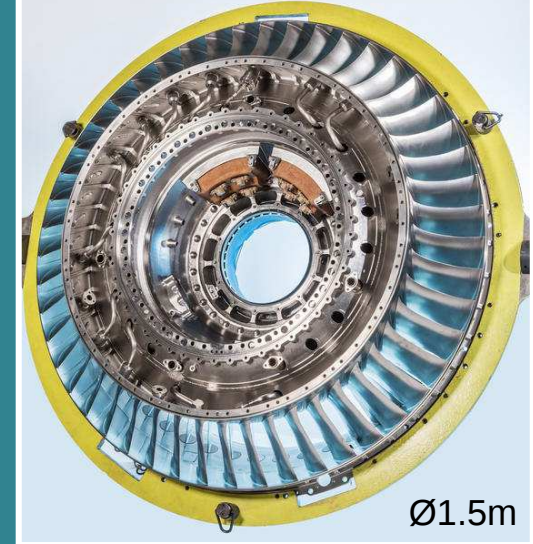
Pilot Production & Factory Implementation

“Demonstrate AM production capability in risk free environment”

We do:

- ▶ Design and build pilot production line for customer component requirements
- ▶ Develop baseline operating procedures / workflow / H&S documentation etc..
- ▶ Define & test KPV control plan to optimise and validate process chain
- ▶ Manufacture demonstrator components using fixed process to confirm process robustness
- ▶ Provide data from full process chain to demonstrate measures for rate/quality/ costs
- ▶ Train customer staff on whole process chain

A350 -1000 – FBH Courtesy of Rolls-Royce Plc



Demonstration factory taking raw material and part designs and producing fully finished parts where every stage of the process is carefully monitored and controlled



MTC approach to Digital Manufacturing

Technology Opportunities

Structural Challenges



End-Users

End-User Engagement

- Technology awareness
 - Lack of understanding of technologies
- Hidden business Benefits
 - Cost/benefit relation not clear or evident
- Risk and disruption
 - High levels of investment, legacy equipment and systems

Standards and Interoperability

- Definition and Adoption
 - Several established standards, professional organisations needed
- Systems Communication
 - Communication between third party systems, harmonise different solutions in the same platform

Skills

- Lack of manufacturing systems skills
 - In own teams, supply chain, technology providers and IT providers
- Skills on relevant technologies
- Use of relevant tools
 - Skills on usage of relevant tools and tool's usability

Better Decisions

Data Visibility

- Data capture, data selection, data preservation, big data, data life-cycle

Data Analysis

- Data visualisation, get information from data, diagnosis, use data for making decisions, prognosis

Connectivity

Data

- Data visibility, history of components, real-time capacity, synchronisation, coordination

Standards

- Consistency, interoperability, dialogue

Channels

- Wired, wireless, satellite, radio

Autonomous Decision Making

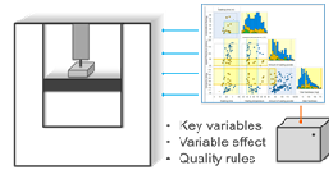
Predictive maintenance

- Data driven, real-time, preventative and scheduling

Self-adaptive processes

- Intelligent machines & processes, mass customisation, autonomy level, scheduling

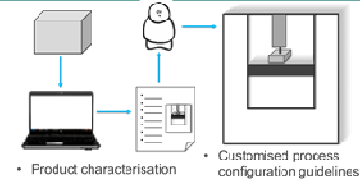
Decision Making



MACHINING PROCESS CHARACTERISATION
Support for process design and product quality



PREDICTIVE MAINTENANCE DASHBOARD
Support for maintenance decisions and activities

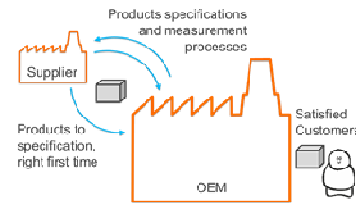


PROCESS CONFIGURATION GUIDELINES
Support for process configuration for new product variants

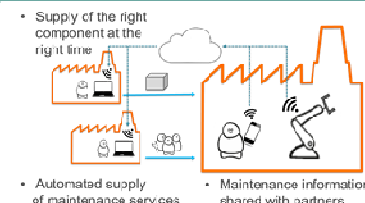
Interfaces



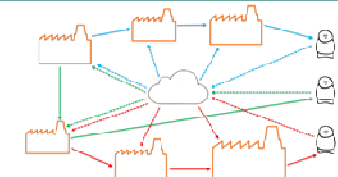
Connectivity



PLM INTEGRATED MEASUREMENT PLANNING
Supply chain quality assurance / management



COLLABORATIVE MAINTENANCE AND REPAIR
Automated workflows for maintenance and repair

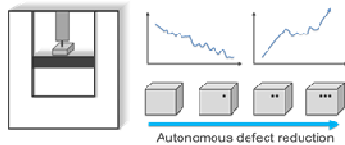


RECONFIGURABLE SUPPLY NETWORKS
Supports different supply network configurations for different demand signals and requirements

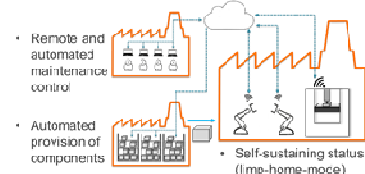
Security



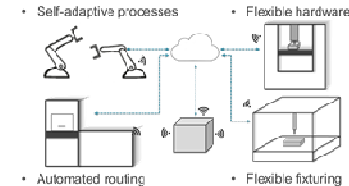
Autonomous Systems



SELF ADAPTIVE QUALITY IMPROVEMENT
Processes that are quality aware and can adapt accordingly to improve product quality



SELF-SUSTAINING MANUFACTURING SYSTEM
Autonomous provision of maintenance parts and services, and self-sustaining equipment



FLEXIBLE MANUFACTURING SYSTEMS
A system that can self configure to produce different product variants in the same shop floor

Safety



Product Quality

Equipment Health

Flexible Systems

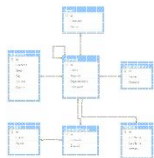
Value extracted from data



Innovation



Intelligence



Structure

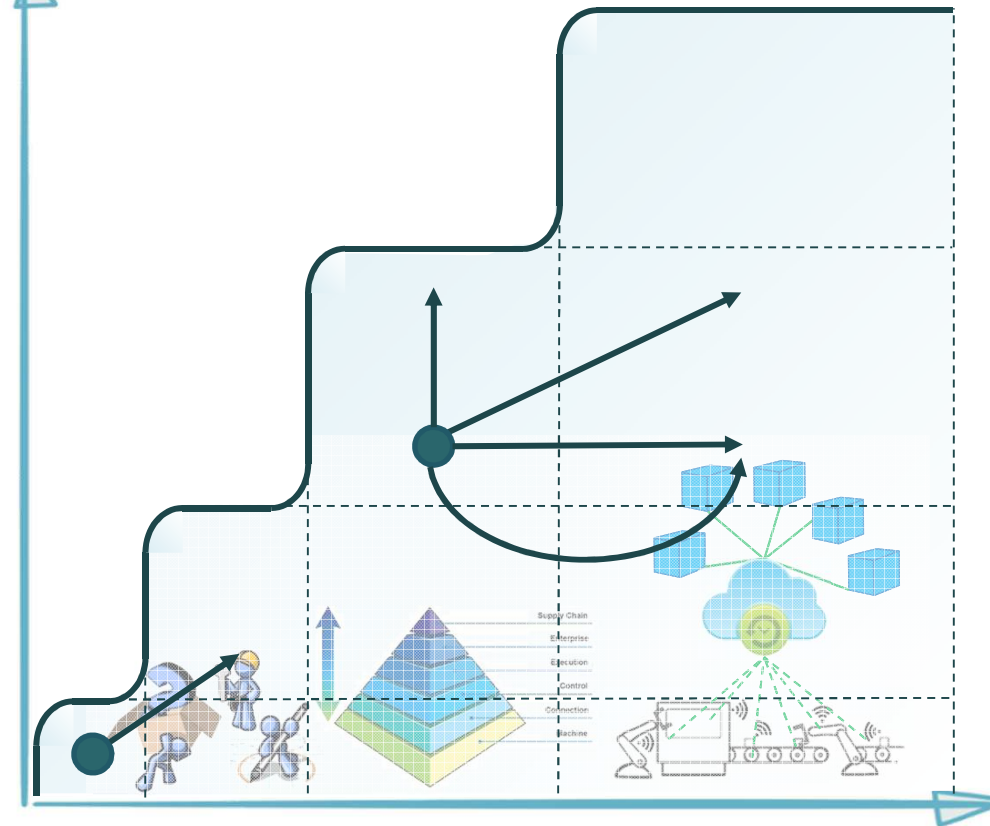
A	B	C
Name	Number	Number
John	10023	10023
John	10024	10024
John	10025	10025
John	10026	10026
John	10027	10027
John	10028	10028
John	10029	10029
John	10030	10030
Mike	10031	10031

Data

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“Self-check”



Isolated
Solutions

Hierarchical
Integration

Industry 4.0
Architectures

ICT Technology
Strategy

LLOYDS Advanced Manufacturing Training Centre

MTC have been awarded £18.19m capital funding to establish the MTC Advanced Manufacturing Training Centre

Financial sponsorship from LLOYDS Bank for next 10 years

The Centre will deliver a range of innovation training elements

- Manufacturing Engineering Apprenticeships (SME access opportunity in year 3 and 4)
- Up-skilling of Manufacturing Engineers (internal, external)
- Graduate development



Supported by

- Training equipment via Industrial members (technology providers)
- MTC technical infrastructure (equipment, trainer)
- Expertise via Industrial members

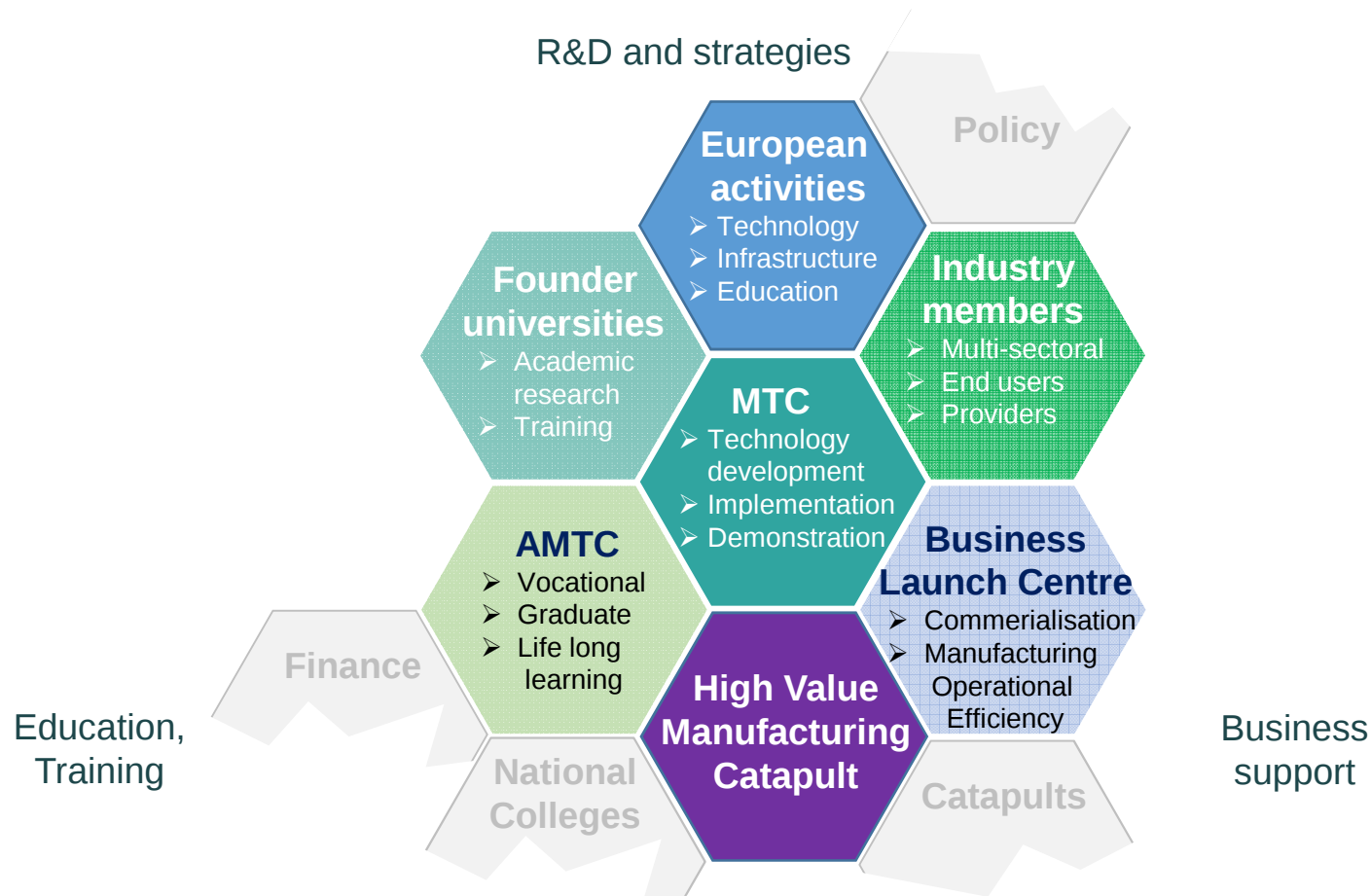
MTC campus

High Temperature
Research Centre

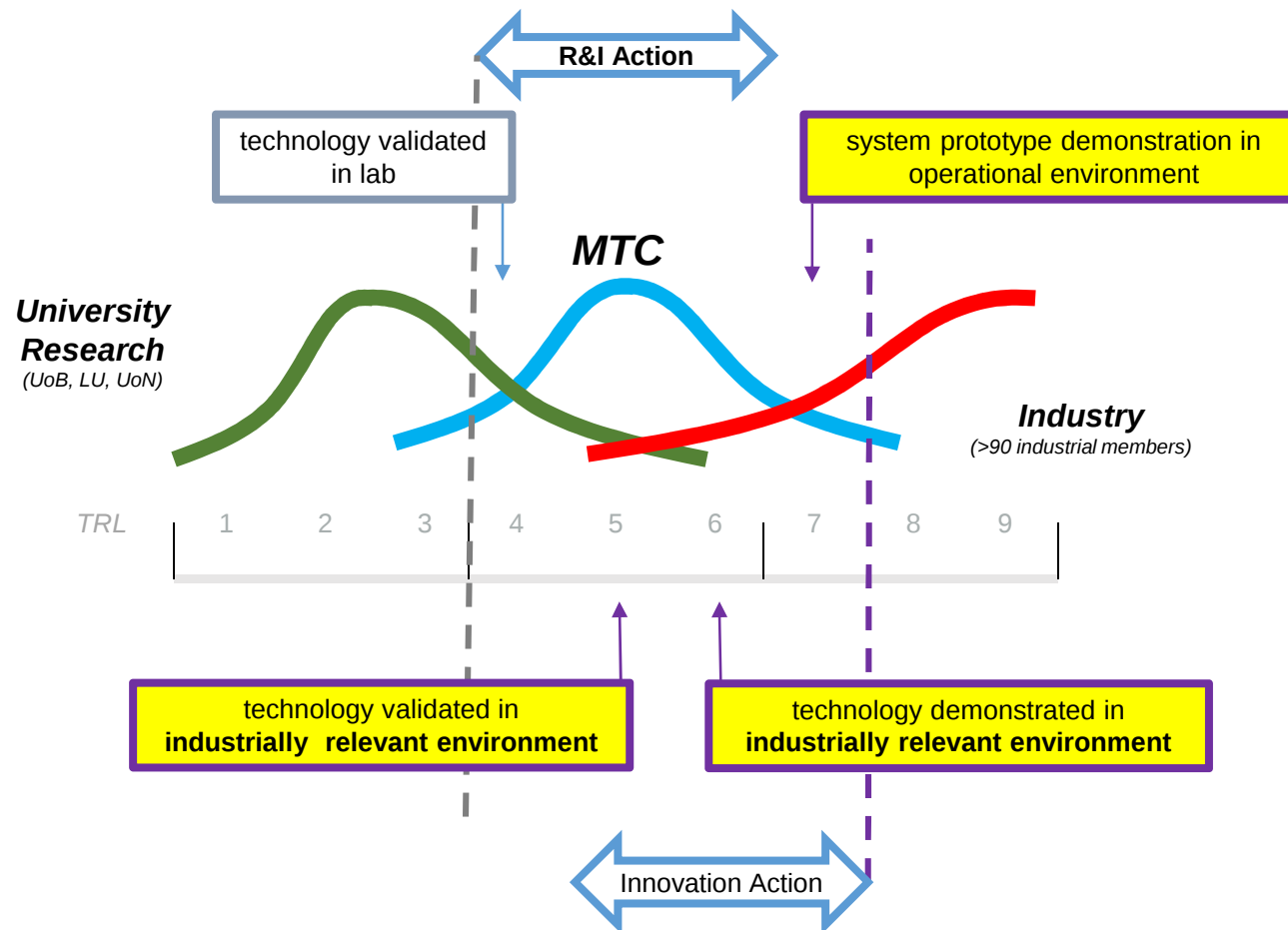
Aerospace
Research Centre



MTC Innovation Ecosystem



MTC position in H2020



MTC H2020 EU approach

Key features for H2020 participation

- Applied research and implementation (RIA TRL 4-6, IA TRL 5-7)
- Key focus on “Industrial Leadership”
- Impact is a key criteria for success demonstrated through realistic “use cases”
- Demonstrators in an “industrial relevant environment”
- Only 25% recovery of overheads
- Being serious about what we want to do – not doing it for the (H2020) money



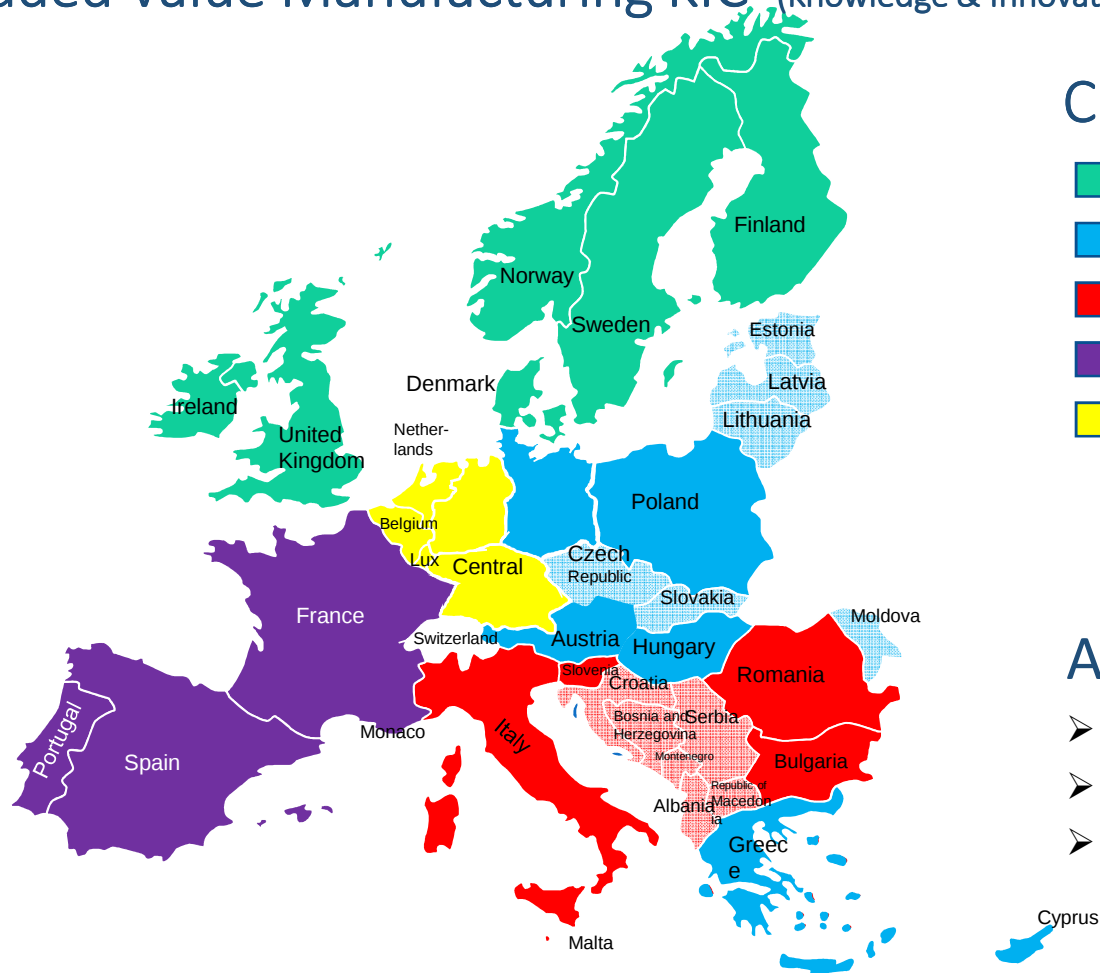
Strategic approach MTC

- Added value through knowledge generation aligned with roadmaps
- Proposals based on use cases from industrial members
- Strategic partnership with a founder partner in consortium (where applicable)
- Professional approach to proposal writing (methodology, process)

H2020 projects to date

FoF-01-2014:	RADICLE	Real Time Dynamic Control System for Laser Welding (MTC coordinator, RIA)
FoF-11-2015:	PERFoRM	Production harmonizEd Reconfiguration of Flexible Robots and Machinery (IA)
FoF-09-2015:	X2I4MS	ICT Innovation for Manufacturing SMEs (I4MS CSA; setting up 30 new Digital Innovation Hubs)
ICT-24b-2015:	TT-Net	A shared infrastructure to sustainably optimise technology transfer throughout Europe (DTI/DK, Fraunhofer/DE, Tecalia/ES, MTC)
CS2-CPW02-2015:	EWIRA	External WIng for Regional Aircraft demonstrator ("Novel design capabilities" and "additive manufacturing applications", IA)
FoF-01-2016:	OpenHybrid	Developing a novel hybrid AM approach which will offer unrivalled flexibility, part quality and productivity (MTC coordinator, RIA)
FoF-13-2016:	ENCOMPASS	Integrated Component and Process Design tool (SLM) (MTC coordinator, IA)
FoF-11-2016:	Connected Factories	Industrial Scenarios for Connected Factories (I4MS, CSA; Coordinator EFFRA)

Added Value Manufacturing KIC (Knowledge & Innovation Community)



CLC groups

- North (UK, Birmingham)
- East (AT, Vienna)
- South (IT, Milano)
- West (FR, Paris)
- Central (DE, Aachen)

Head Quarter: Brussels

AVM KIC status

- Proposal submitted 14th July 2016
- Evaluation result expected Nov 2016
- Start 2017 if selected

MTC Summary

- ❑ Technology competence, industrial scale and critical mass
- ❑ Financial mix (basic, public, industry)
- ❑ Core funding to invest in new emerging topics
- ❑ Own legal entity, all services in house, high agility
- ❑ Private company with no public restrictions
- ❑ Personnel mix between academic and industrial background
- ❑ No fixed-term contracts
- ❑ Industrial membership
 - financial commitment
 - strategic partnership, CRP
- ❑ Research partnership with 3 whole universities and TWI

Dimensions of a Manufacturing Ecosystem

Technologies

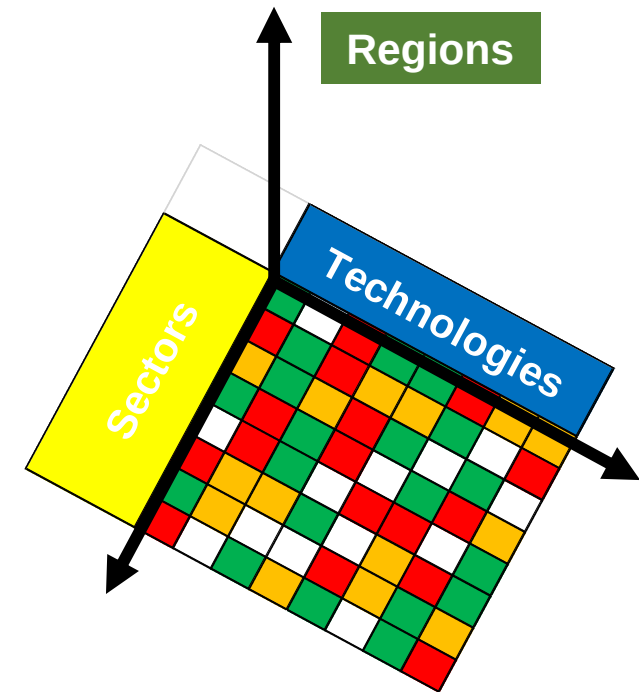
- Technology Innovation Centres
- 27 technologies (*Started with 22 identified by IfM report*)
- Industrial scale equipment

Sectors

- Aerospace
- Automotive
- Food & drink
- Rail
-

Geography, Regions

- Some initial investment by RDAs
- 7 Centres in HVMC spread across UK



THANK YOU

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