Wrocław University of Technology

CAMT

Fraunhofer IWS

Inicjatywa FoF – cele, strategia, działania

KIC AVM

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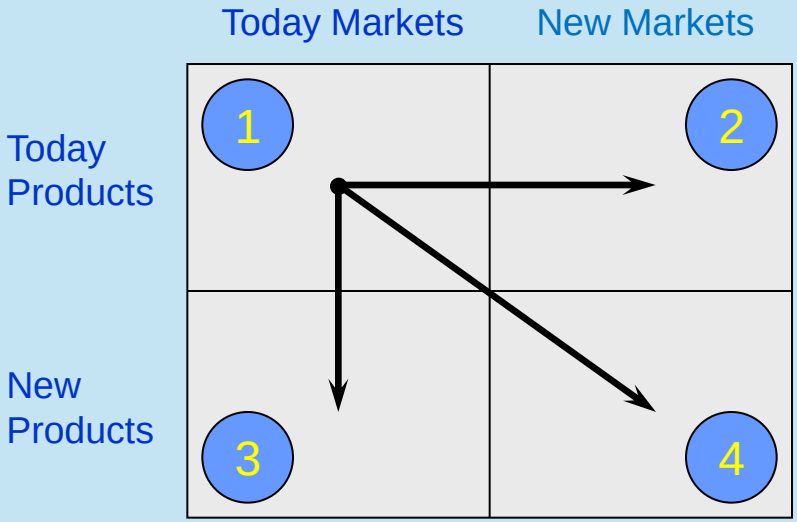
Director of Centre for Advanced Manufacturing Technologies / Fraunhofer Project Center – FhG- IWS Dresden

Topics:

- European strategy of manufacturing
- new technologies in product development
- new technologies in process development
- EIT KIC AVM

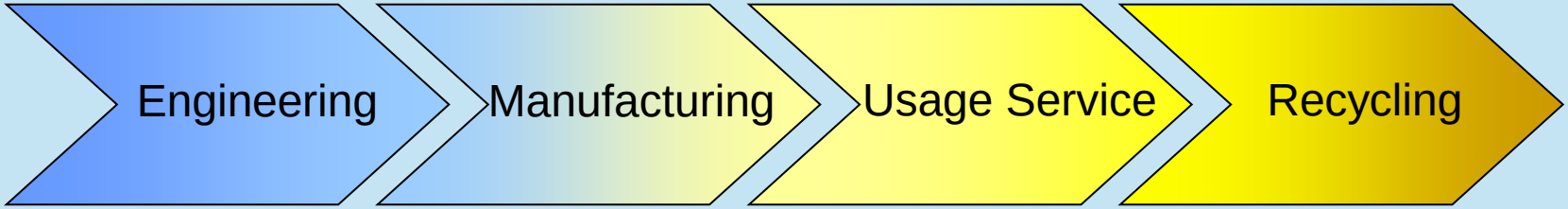
Strategy for Manufuture

1. Customization
   Quality, Cost, Time
2. Global Production
3. Leadership in Technology
4. New Technologies for
   Strategic Technology-
   Platforms



R&D Key Challenges

Paradigm: Life Cycle Orientation



Paradigm: Product Integrated Knowledge (Inteligent Products)

- Adaptive … Processes, Systems, Structures
- Digital and Virtual … Engineering Methods and Tools
- Integrated Networks … Supply Chain and E-Manufacturing
- Knowledge based … Process Control and Engineering
- High Performance … Quality, Time, Cost
- New Taylorism … „Scientific Management by Workers”

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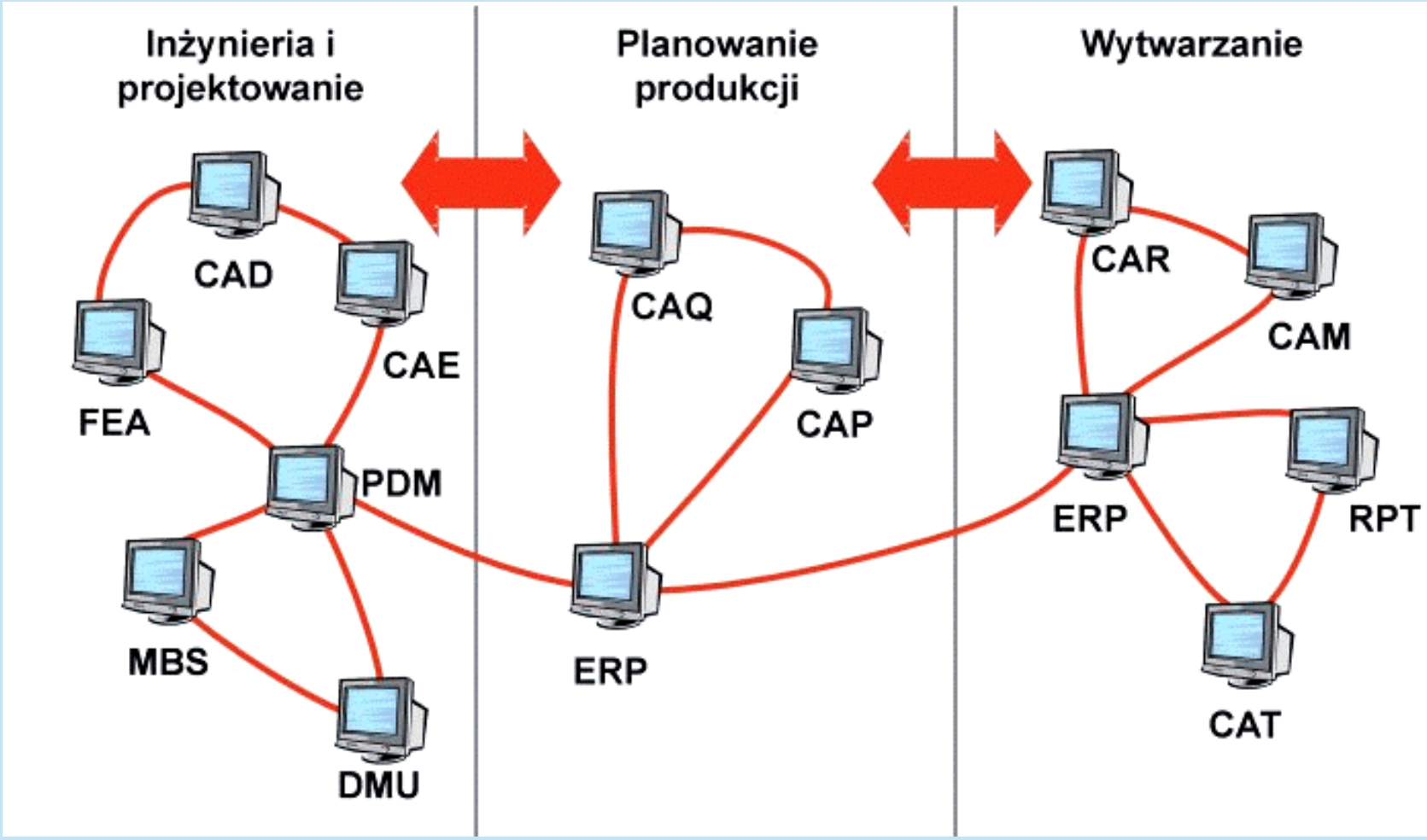
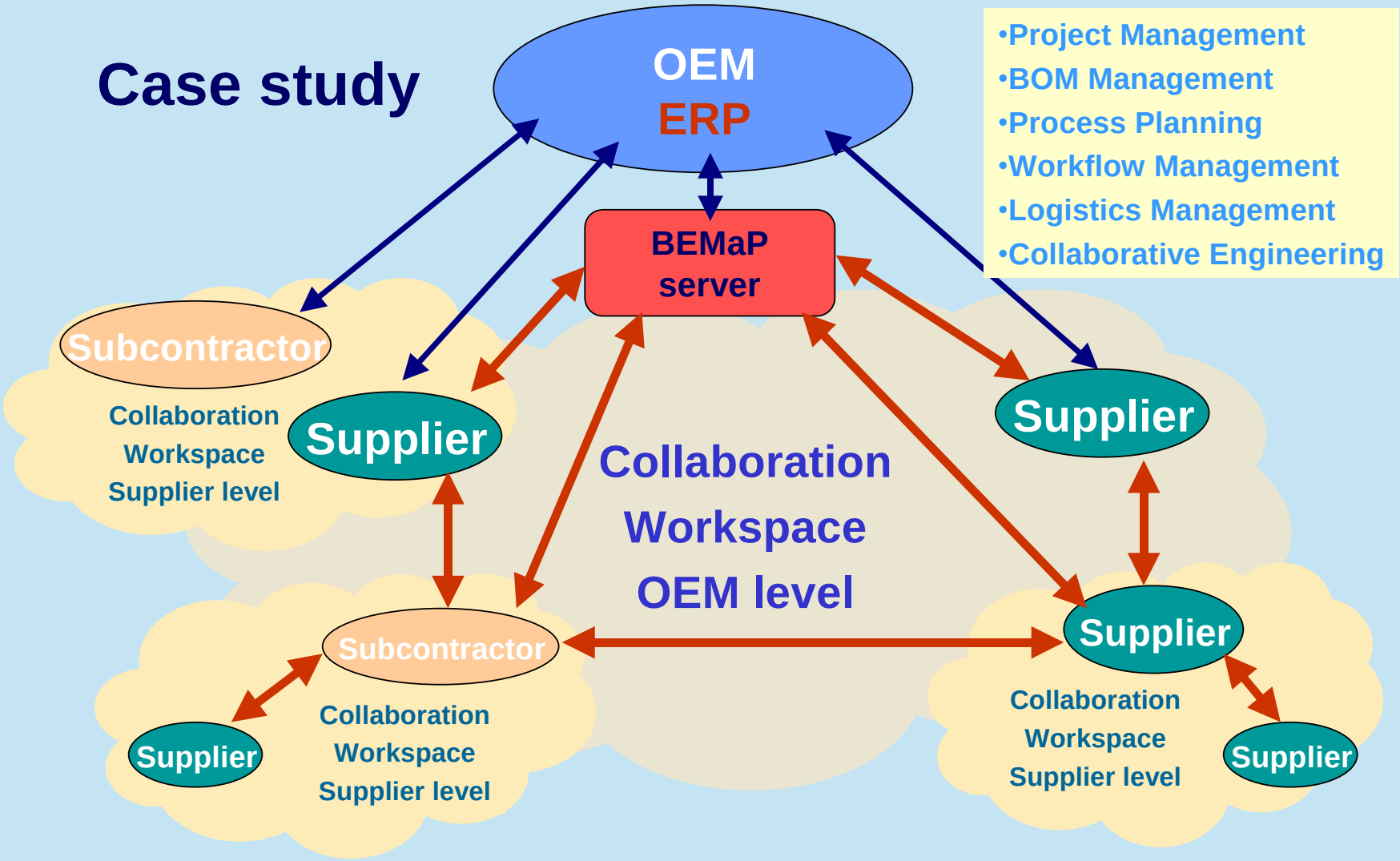
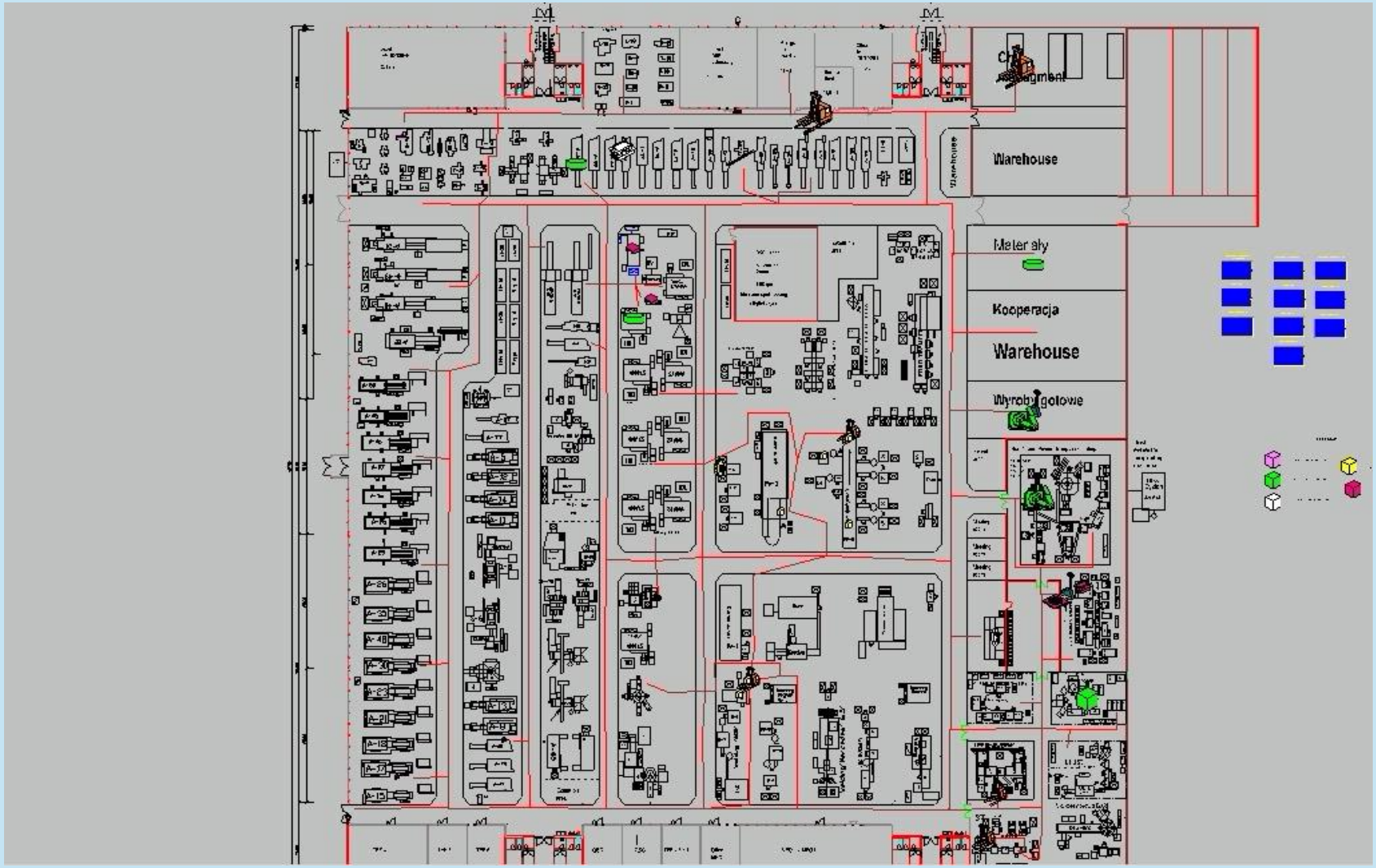

Inżynieria i projektowanie
Planowanie produkcji
Wytwarzanie
CAD
CAE
FEA
PDM
MBS
DMU
CAQ
CAP
ERP
CAR
CAM
ERP
RPT
CAT

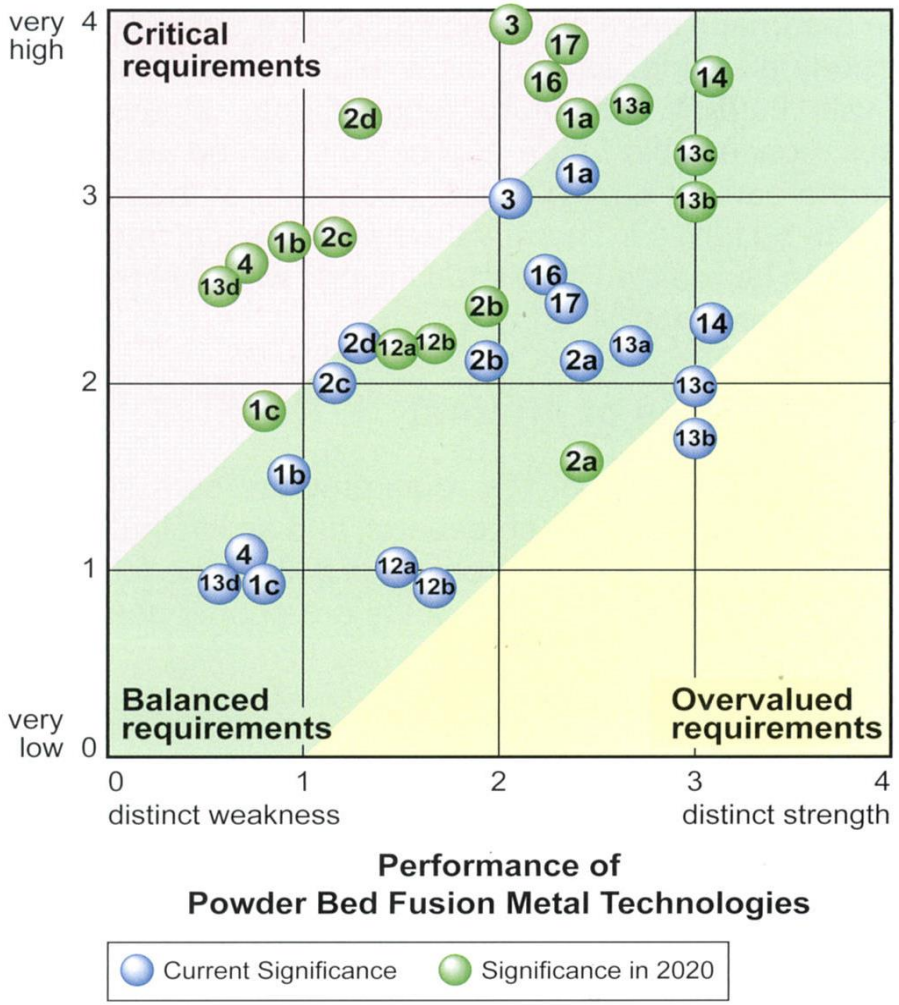
Case study



- Project Management
- BOM Management
- Process Planning
- Workflow Management
- Logistics Management
- Collaborative Engineering

Animation of simulation model





1. **Build chamber volume (V in m³)**
   - 1a) $V < 1\ m^3$
   - 1b) $1\ m^3 \leq V \leq 8\ m^3$
   - 1c) $V > 8\ m^3$
2. **Build-up rates (production speed at highest quality in cm³/h)**
   - 2a) 1 - 10 cm³/h
   - 2b) 11 - 40 cm³/h
   - 2c) 41 - 100 cm³/h
   - 2d) > 100 cm³/h
3. **High process stability**
4. **Integration of electronic circuits into additively manufactured parts**

   ⋮

12. **Processability of materials with AM-machines**
    - 12a) Magnesium
    - 12b) Shape memory alloys (SMA)
13. **Availability of new material properties**
    - 13a) Fire resistance
    - 13b) Thermal conductivity
    - 13c) Electrical conductivity
    - 13d) Self-healing properties
14. **Recyclability of materials**

    ⋮

16. **Provision of design rules**
17. **Availability of a database containing properties of Additive Manufacturing materials** (e.g. thermal characteristics, tensile strength etc.)

Source: Thinking ahead the Future of Additive Manufacturing – Exploring the Research Landscape – Project DMRC and HN Institute at Paderborn University

- **FoF 01-2016: Novel hybrid approaches for additive and subtractive manufacturing machines**
- **FoF 02-2016: Machinery and robot systems in dynamic shop floor environments using novel embedded cognitive functions**
- **FoF 03-2016: Zero-defect strategies at system level for multi-stage manufacturing in production lines**
- **FOF 04-2016: Continuous adaptation of work environments with changing levels of automation in evolving production systems**
- **FoF 05-2016: Support for the further development of Additive Manufacturing technologies in Europe**
- **FoF 06-2017: New product functionalities through advanced surface manufacturing processes for mass production**

- **FOF 07-2017: Integration of unconventional technologies for multi-material processing into manufacturing systems**
- **FOF 08-2017: In-line measurement and control for micro-/nano-enabled high-volume manufacturing for enhanced reliability**
- **FoF 09-2017: Novel design and predictive maintenance technologies for increased operating life of production systems**
- **FoF 10-2017: New technologies and life cycle management for reconfigurable and reusable customised products**
- **FOF-11-2016: Digital automation**
- **FOF-12-2017: ICT Innovation for Manufacturing SMEs (I4MS)**
- **FOF-13-2017: Photonics Laser-based production**

Conditions for the Call for Factories of the Future call

Opening date(s), deadline(s), indicative budget(s):1 Topics

(Type of Action)	Budgets (EUR million)	Deadlines
2016/2017		
Opening: 01 Oct 2015		
FOF-01-2016 (RIA)		
FOF-02-2016 (IA)		
FOF-03-2016 (IA)		
FOF-04-2016 (RIA)	65.00	21 Jan 2016
FOF-11-2016 (RIA)	51.00	
FOF-06-2017 (RIA)		
FOF-07-2017 (RIA)		
FOF-08-2017 (IA)	80.00	19 Jan 2017

Proposal

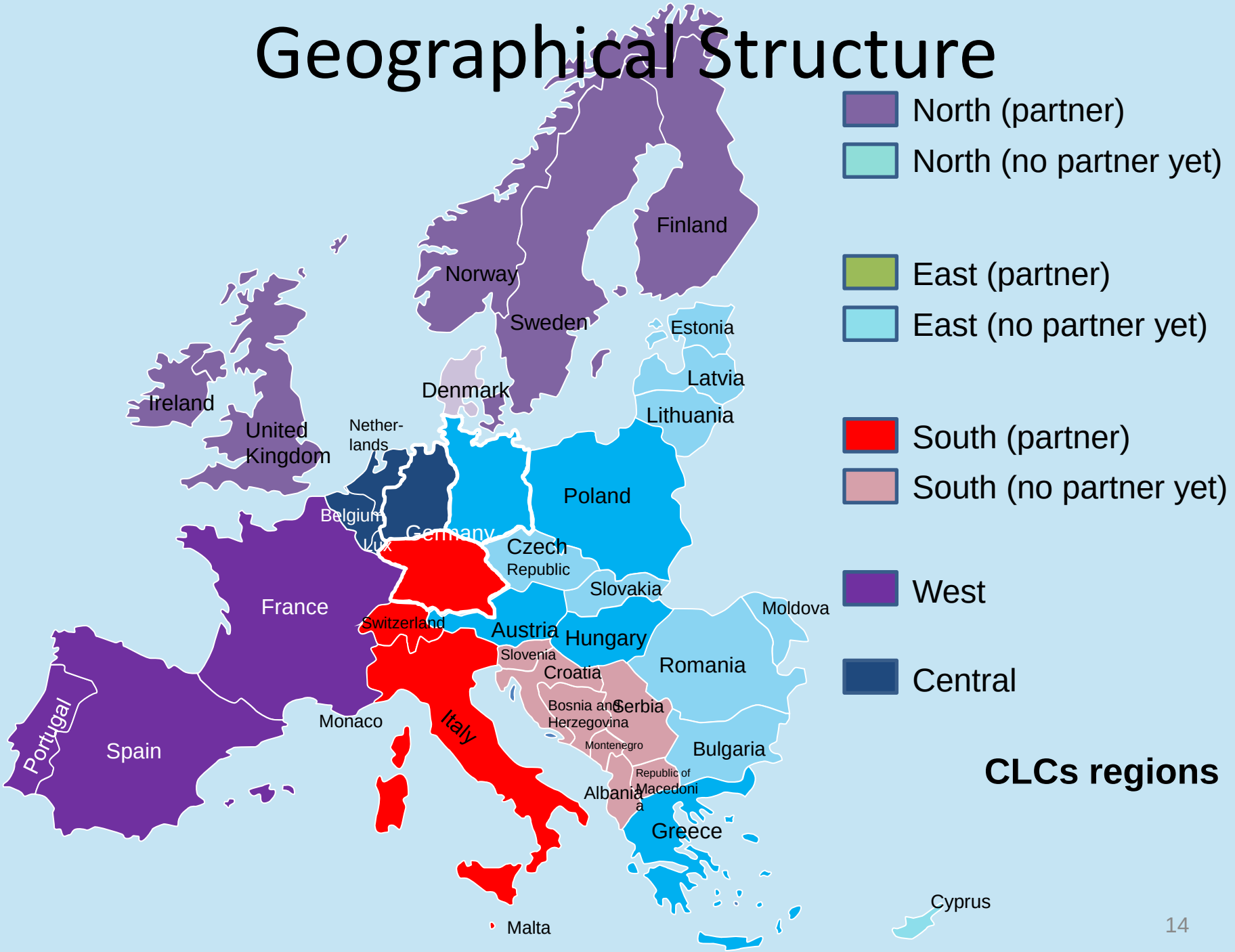
Towards a CLCs approach for the AVM KIC

Different approaches for CLC structure

Approaches delivered by different partners

- Geographical structure
- Thematic structure
- Operational structure
- Sectorial perspective

Geographical Structure



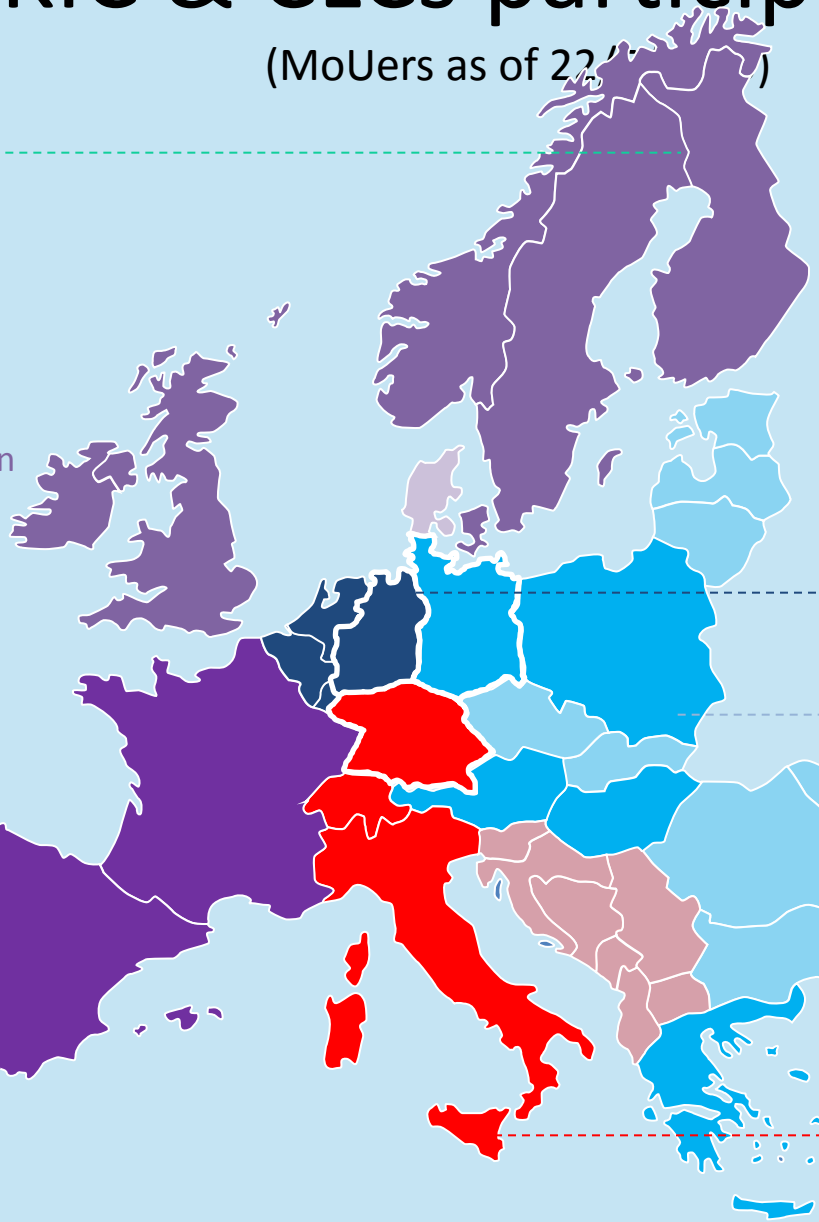
KIC & CLCs participation

Criteria (indicative)

- Strong participation and/or coordination in European research & innovation activities / projects
- Excellence / technical expertise related to a number of manufacturing related topics
- Industrial collaboration at a national and international level with manufacturing companies
- Wide range of manufacturing research and innovation activities
- Scientific publications in the field of manufacturing
- Compliance with the Knowledge Triangle
- Regional and national commitment to support the KIC

KIC & CLCs participation

(MoUers as of 22/[illegible])



NORTH

Catapult
Chalmers
ICMR
FIMECC
NTNU
SINTEF
Teknikforetagen
TUT
TWI
UCD
VTT
....

WEST

CEA
CETIM
EC Nantes
IK4
INESC Tech
Mondragon
TECNALIA
....

CENTRAL

EffizienzCluster
FhG ILT
FhG IML
FhG IPT
it's OWL
KU Leuven
PTW Darmstadt
RWTH Aachen
TNO
....

EAST

FhG IWU
LMS
SZTAKI
TU Wien
Wroclaw University
....

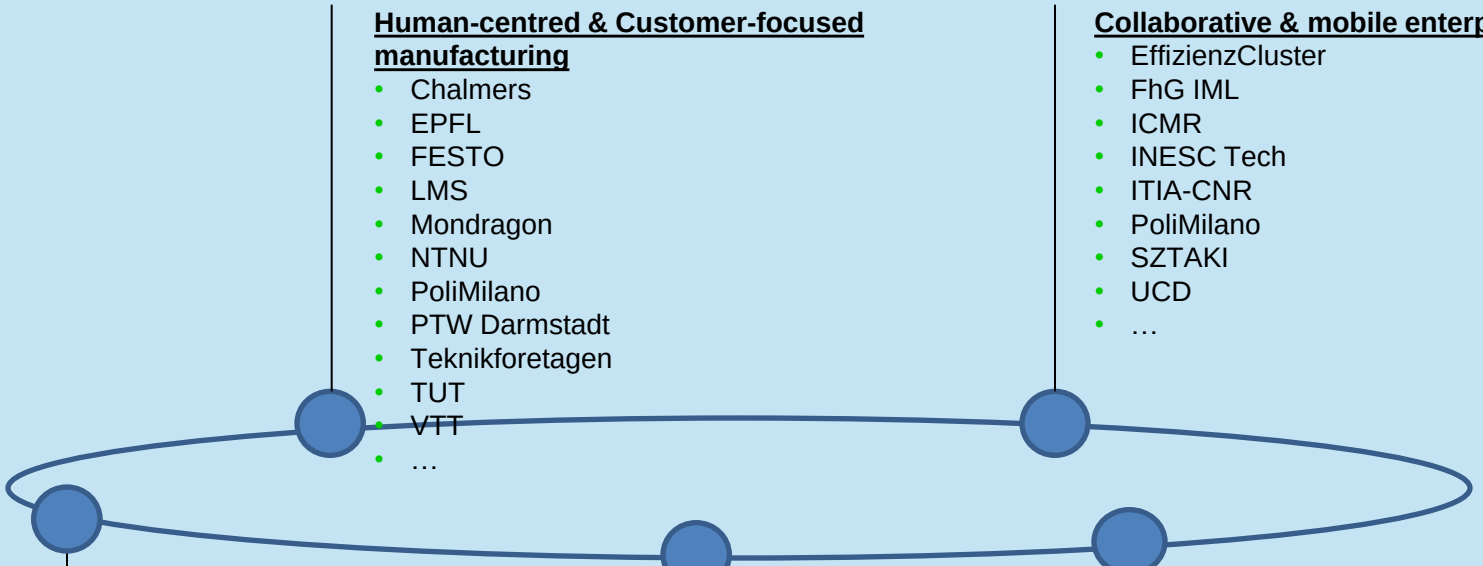
SOUTH

COMAU
EPFL
FESTO
FhG IPA
ITIA-CNR
PoliMilano
PRIMA
....

Thematic structure

A number of five (5) key areas taken from the research and innovation priorities of the FoF2020 roadmap were identified as priority themes for the technical competences of the CLCs

- **Human-centred & Customer-focused manufacturing**
- **Advanced manufacturing processes**
- **Digital, virtual & resource efficient factories**
- **Adaptive & smart manufacturing systems**
- **Collaborative & mobile enterprises**



Human-centred & Customer-focused manufacturing

- Chalmers
- EPFL
- FESTO
- LMS
- Mondragon
- NTNU
- PoliMilano
- PTW Darmstadt
- Teknikforetagen
- TUT
- VTT
- …

Collaborative & mobile enterprises

- EffizienzCluster
- FhG IML
- ICMR
- INESC Tech
- ITIA-CNR
- PoliMilano
- SZTAKI
- UCD
- …

Adaptive & smart manufacturing systems

- Catapult
- CEA
- Chalmers
- COMAU
- FESTO
- FhG IPT / RWTH
- FIMECC
- it's OWL
- KU Leuven
- LMS
- NTNU
- PRIMA
- SINTEF
- SZTAKI
- TECNALIA
- TNO
- TU Wien
- Wroclaw University
- …

Advanced manufacturing processes

- Catapult
- CETIM
- COMAU
- EC Nantes
- FhG ILT
- FhG IPA
- FhG IPT / RWTH
- FhG IWU
- KU Leuven
- PRIMA
- SINTEF
- TECNALIA
- TNO
- TWI
- UCD
- …

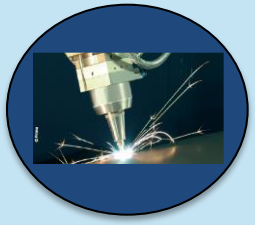
Digital, virtual & resource efficient factories

- CEA
- CETIM
- EC Nantes
- EffizienzCluster
- EPFL
- FhG IML
- FhG IPA
- FhG IWU
- FIMECC
- ICMR
- IK4
- INESC Tech
- it's OWL
- ITIA-CNR
- Mondragon
- PTW Darmstadt
- Teknikforetagen
- TU Wien
- TUT
- VTT
- Wroclaw University
- …

Thematic structure

(CLCs core themes mapping)

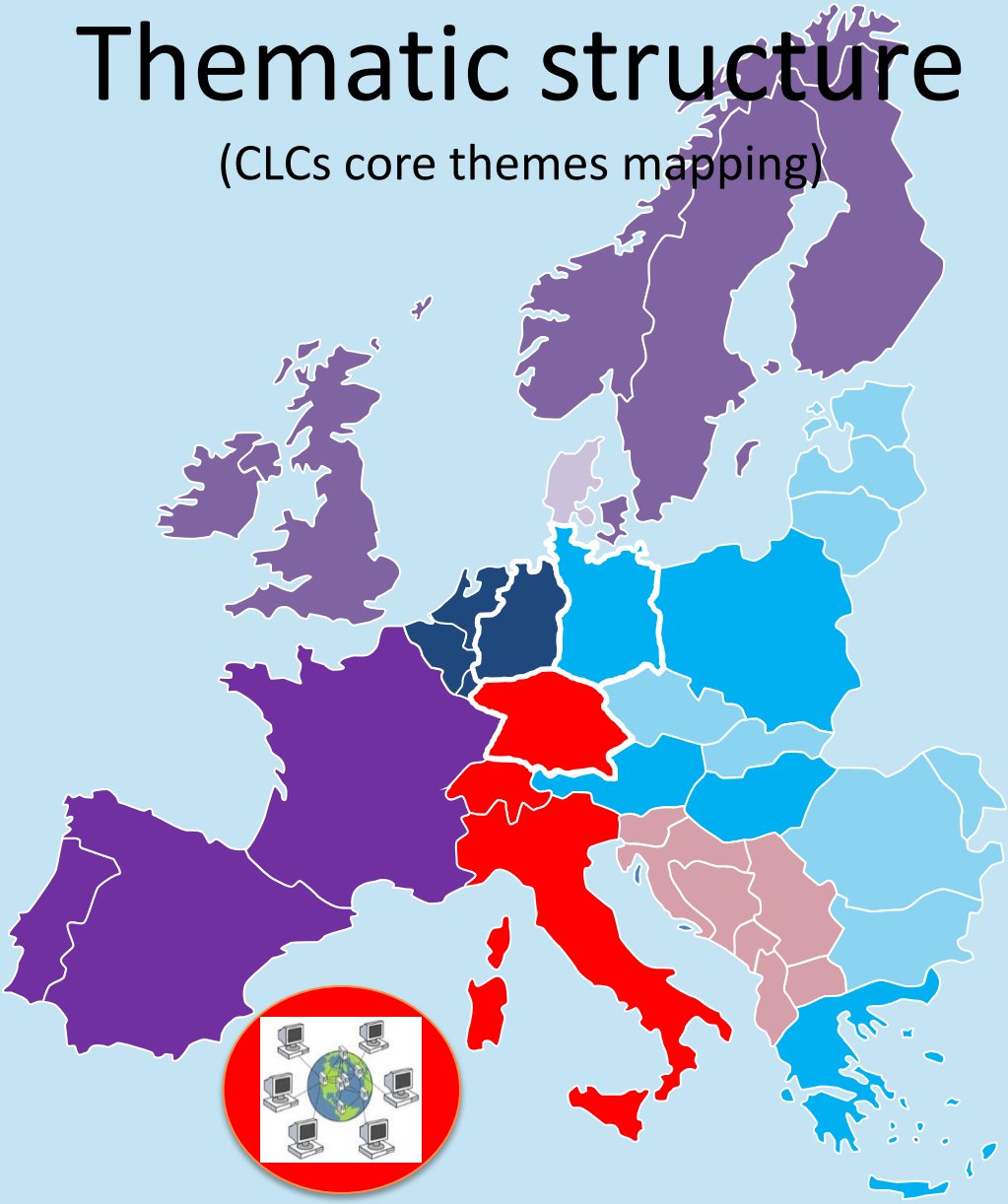
Human-centred & Customer-focused manufacturing



Advanced manufacturing processes

Digital, virtual & resource efficient factories

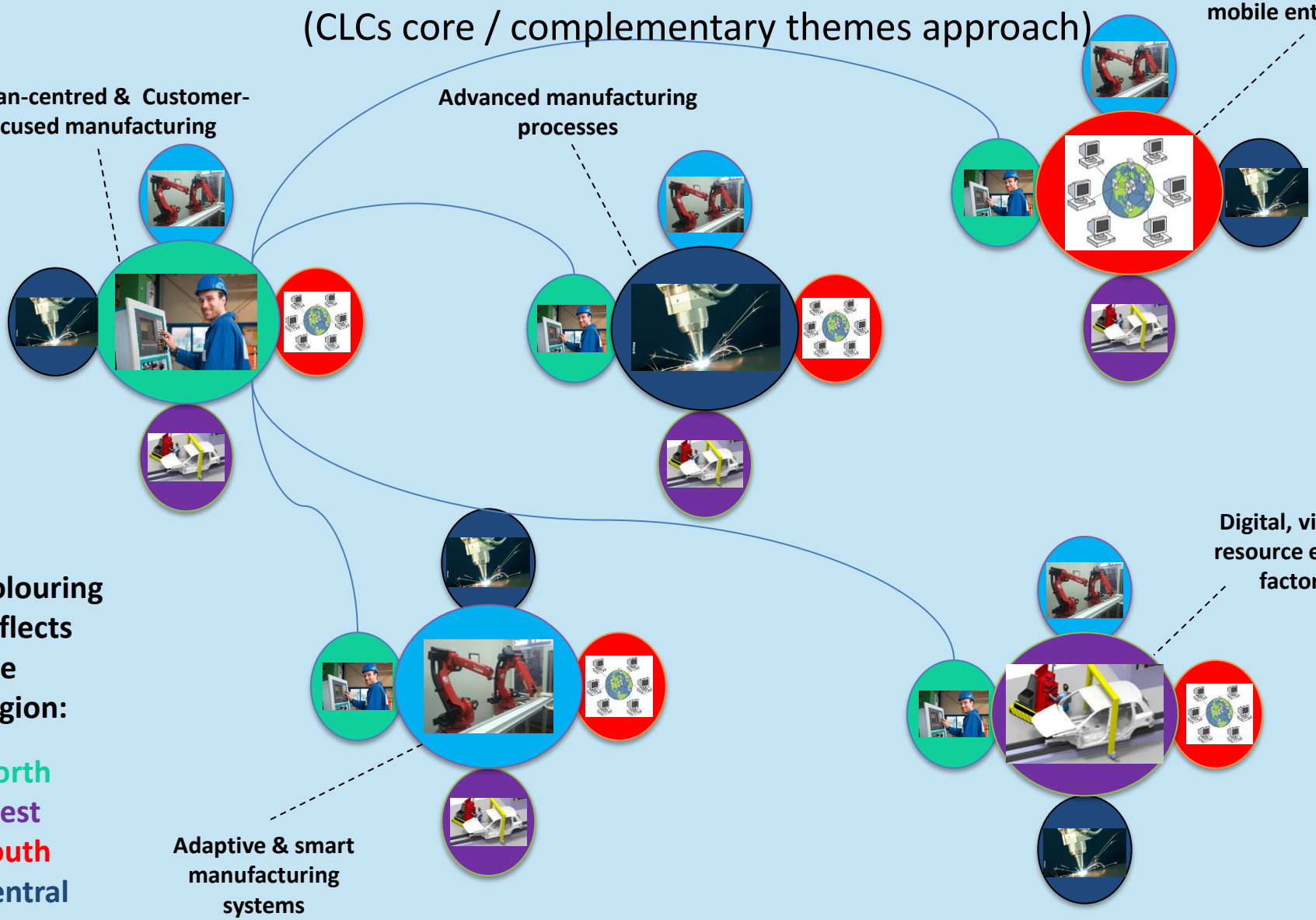
Adaptive & smart manufacturing systems



Collaborative & mobile enterprises

Operational structure

(CLCs core / complementary themes approach)



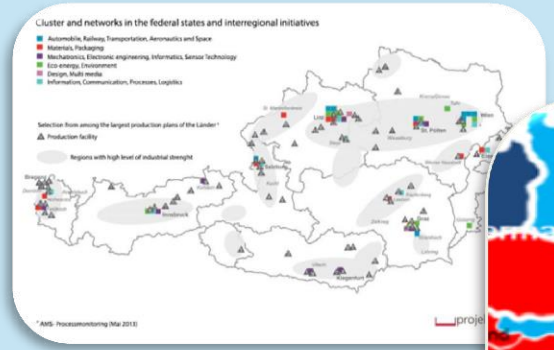
KIC Added Value Manufacturing Regional Approach for CEE

Results of preparatory workshops of the stakeholders of the Central East Europe (CEE) Region

Version 05, 18.09.15

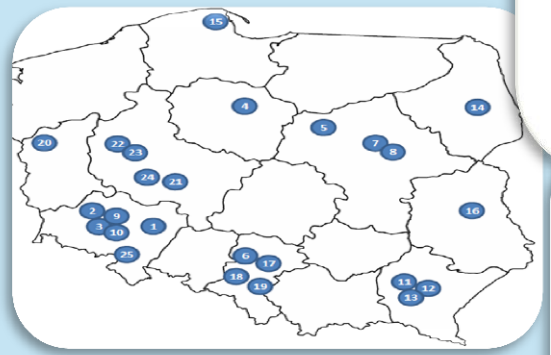
Who we are

5 core partners and their network to drive the innovation capability of the CEE Supply Chains

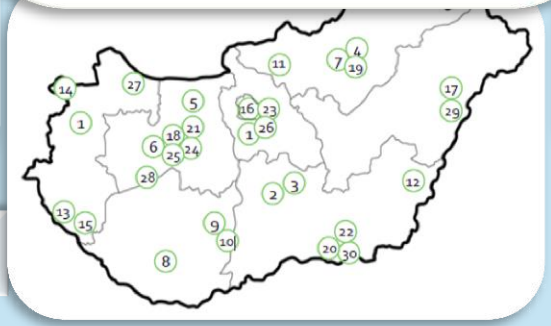


Austria

Saxony (Germany East)



Poland



Hungary

Greece

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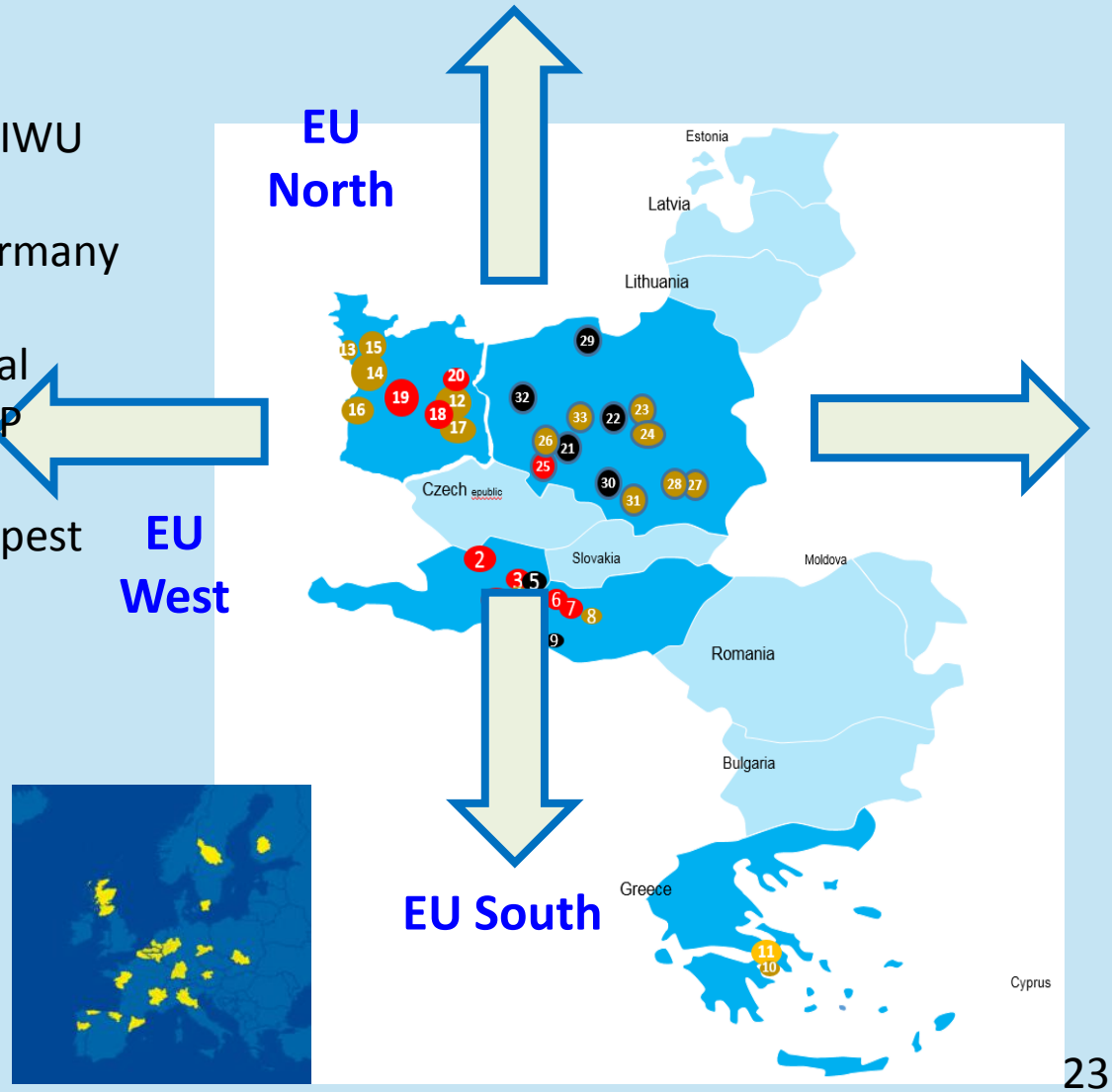
Who we are

5 core partners and their network to drive the innovation capability of the CEE Supply Chains

- **Poland:** TU Wroclaw and …
- **Eastern Germany:** Fraunhofer IWU and TU Chemnitz with Automotive Cluster of East Germany (ACOD)
- **Austria:** TU Vienna and national platform (Magna, Infineon, BRP Rotax, etc.)
- **Hungary**: MTU Sztaki/TU Budapest and …
- **Greece:** LMS Patras …



Strong connection of CEE to the Vanguard Initiative as a cluster of innovative regions

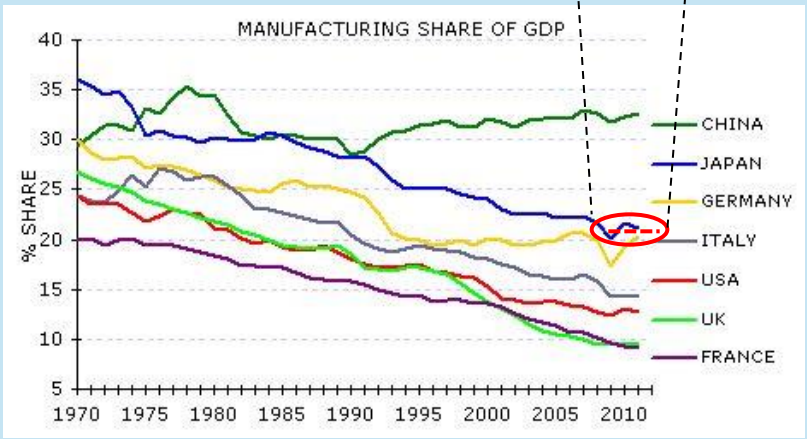
Regional situation and strengths

CEE is an important factor for the Manufacturing output of the European economy

- High **GDP ratios of manufacturing** in key-CEE countries
- **Complete supply chains** in CEE **enable competitve production** of OEMs and market leading SME (hidden champions) all over Europe
- Well networked **regional clusters** and **ecosystem** of education, research and industry

- **„To be a supplier = to be an enabler for technology !“**

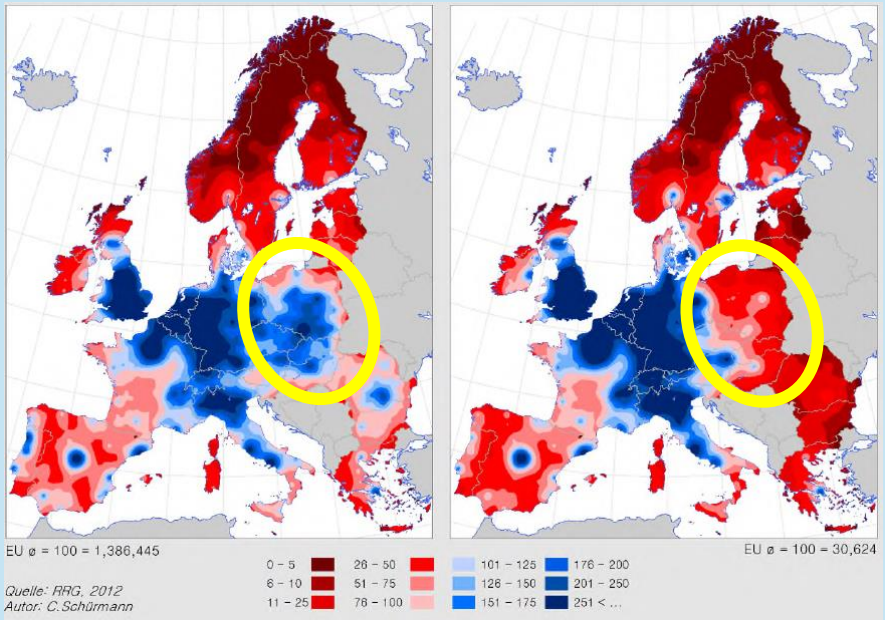
	2010	2011	2012	2013	2014
Austria	19	19	19	18	19
Croatia	14	14	14	14	14
Czech Republic	23	24	24	25	
Germany	22	23	23	22	22
Geece	8	8	8	8	8
Hungary	22	22	23	23	
Poland	17	18	18	19	
Serbia	16	17	18	19	
Slovakia	21	21	21	20	20
Slovenia	20	21	22	22	23



Challenge for CEE

Build on strength - Create added value in the Supply Chain trough Smart and Adaptive manufacturing

- **Use digitalization** to maintain and increase leading position as supply chain for OEM and leading SMEs
- Use opportunity of **smart and adaptive** manufacturing in I4.0 environment to advance supply chains
- Create even closer collaboration with OEMs and leading SMEs to **identify** their **demand** and **benefit** in digitalization
- **Connect education and research** output to industry demand in smart and adaptive manufacturing
- Enable added value in the region to **secure and increase employment** where it is needed



Spread of people in Europe

Spread of GDP in Europe

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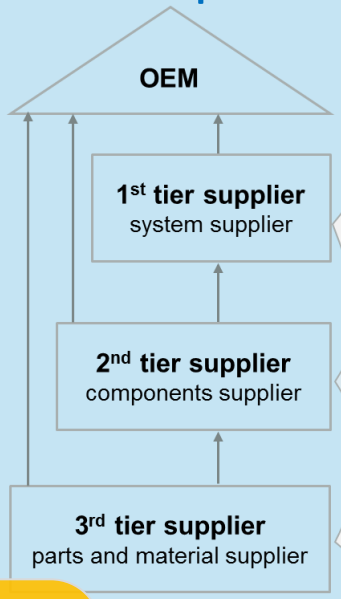
Our approach
Increase supplier readiness for I4.0 to maintain and advance position as leading European supply chain for the Automotive and Transport sector

- Develop and implement criteria for a **»Supplier readiness* for I4.0«**
  - ➔ Focus on SME
  - ➔ Support 2nd tier
  - ➔ Create new 3rd tier



Expectations and Requirements

SRL	Technology	System	R&D	Certification
5	state-of-the-art/ resource-efficient/ key enabling technologies	system competence / complete PEP + services	independent and contract research	ISO 9001 ISO/TS 16949 AEO ISO 50001 …
4	state-of-the-art/ resource-efficient technologies	system competence / complete PEP	independent and contract research	ISO 9001 ISO/TS 16949 AEO, EMAS …
3	basic technologies	single competence in PEP (design, development)	contract research	ISO9001 EMAS …
2	basic technologies	specific know how (materials, parts)		ISO9001 ISO 14001 …
1	basic technologies	specific know how (materials, parts)		ISO9001 ISO14001 …

Sample: Business field **MOBILITY** with Automotive, Aviation, Railway industry, Commercial vehicles, Ship building / water transport, others, …

*compare e.g.:

- »INDUSTRY 4.0 - The new industrial revolution, How Europe will succeed«; Roland Berger
- »4.0 Readyness Level in the Mechanical Engineering Sector«, VDMA
- »Industry 4.0 – The Capgemini Consulting View«, Capgemini Consulting

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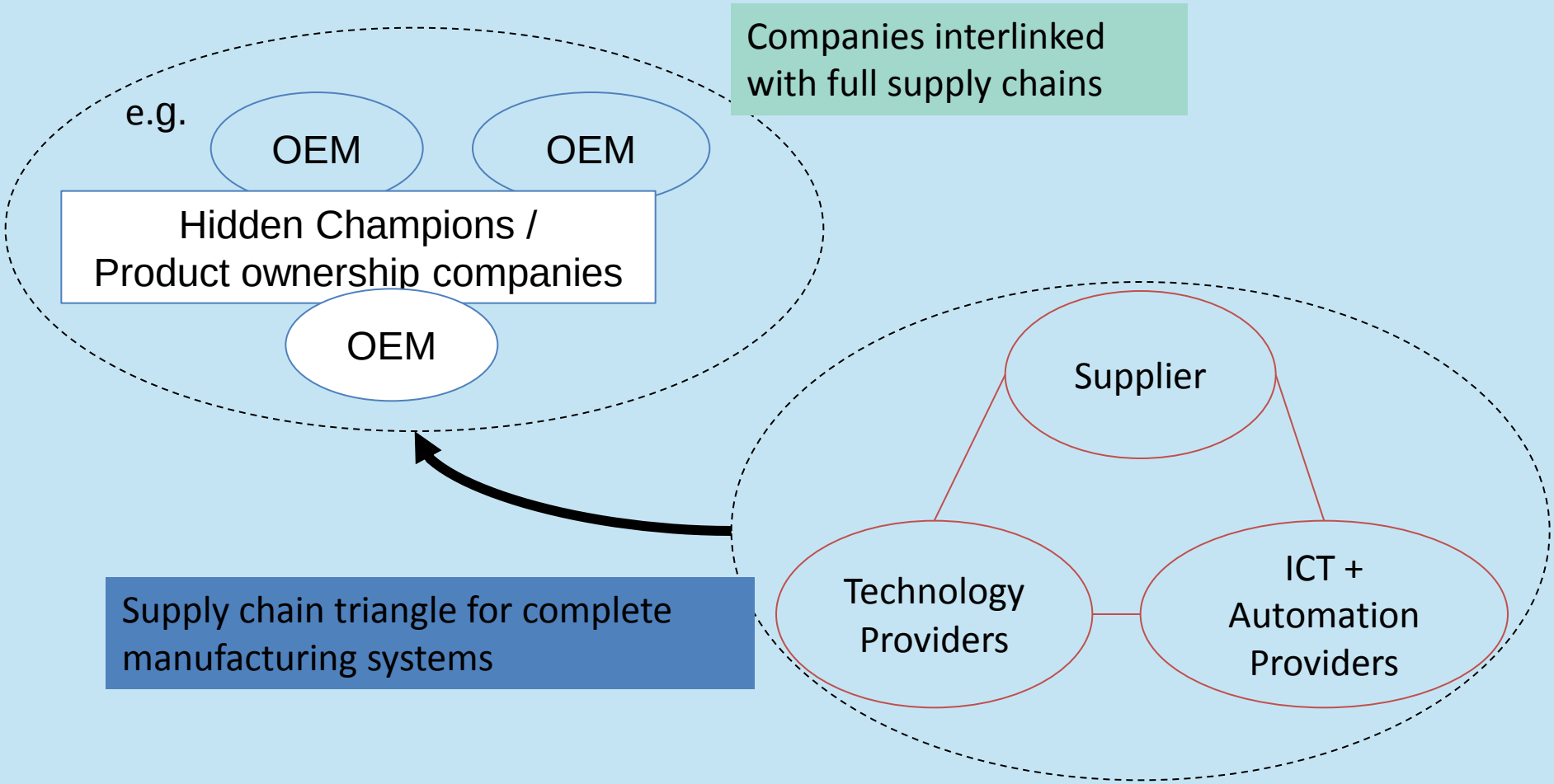
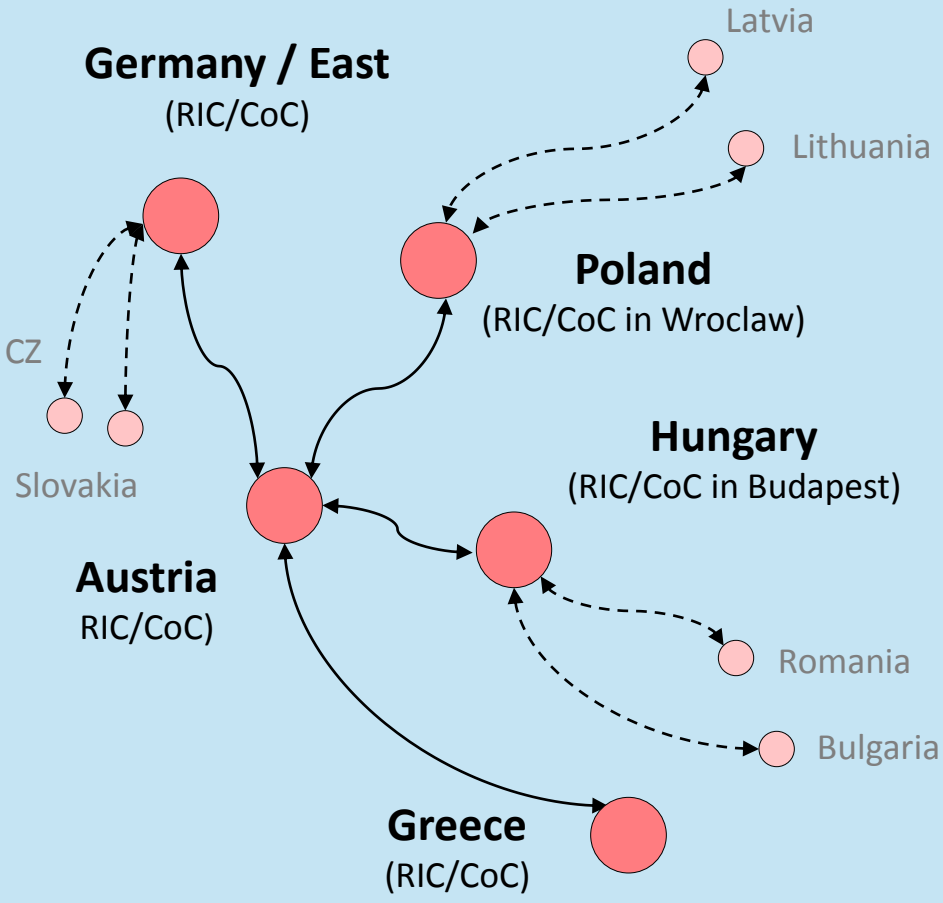
Focus on the Supply Chains, leveraging existing regional industry clusters



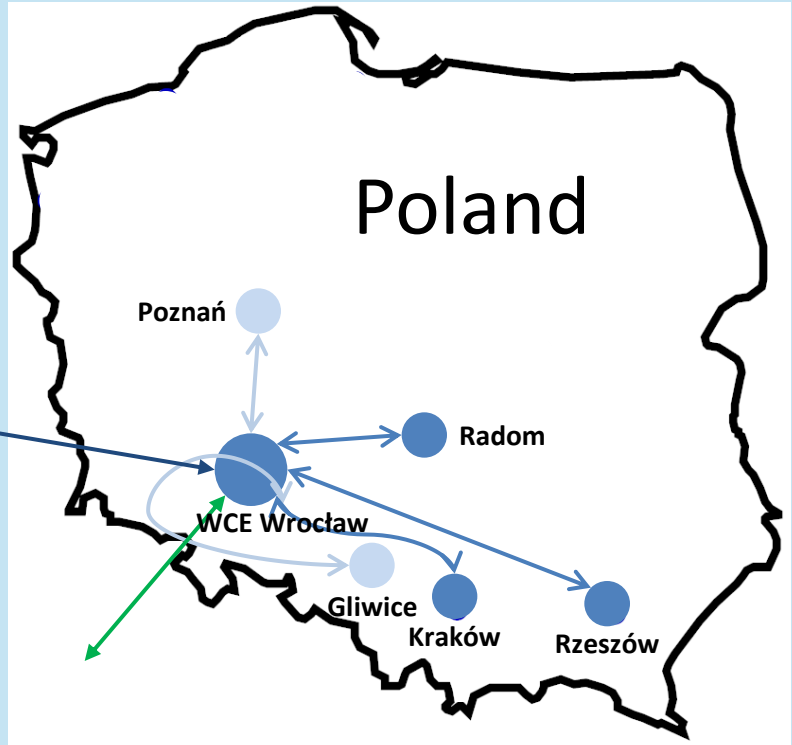
Structural approach for CEE CLC (proposal)

inclusive RIC‘s (Regional innovation/impact center) and/or CoC‘s (Center of Competence)



Proposed PL structure

- **Poland**: 16 technical universities, 38 industrial institutes
- KIC AVM declared partners:
  - **Wroclaw (WCE/CAMT-FPC) – Polish virtual office of CEE CLC**
  - Kraków (Cracow University of Technology and AGH University of Science and Technology) – automotive R&D
  - Warsaw/Radom (Institute for Sustainable Technologies) – advanced materials, R&D equipment
  - Rzeszów (Rzeszów University of Technology) – “Aviation Valley” with 86 aerospace companies
- Negotiations with next partners – Poznań and Gliwice



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Polish industrial clusters

No	Cluster name	Industry	Members
1	Cluster of Innovative Manufacturing Technologies CINNOMATECH	machine industry	53
2	Lower Silesian Metal Cluster	metal industry	13
3	Stone Cluster	stone industry	18
4	Bydgoszcz Industrial Cluster	plastics	87
5	Kutno Technology Cluster	machine industry	22
6	Eastern Metalworking Cluster	metal industry	82
7	General Aviation Construction and Technology Cluster	aviation	21
8	Technological Support of Innovative Aeronautical Projects	aviation	23
9	Lower Silesian Automotive Cluster	automotive	24
10	Lower Silesian Aviation Cluster	aviation	18
11	Aviation Valley	aviation	95
12	Plastics Processing Cluster POLIGEN	plastics	16
13	Subcarpathian Cooperative Connection – Light and Ultralight Aviaton Cluster	aviation	40
14	Metal Cluster	metal industry	206
15	Cluster of Pomeranian Special Economic Zone	machine industry	9
16	Mining Machines Cluster	machine industry	17
17	The Polish Wire Ropes Cluster	metal industry	11
18	Silesian Technopolis	production technologies	8
19	Silesian Aviation Cluster	aviation	76
20	Metal Cluster of Lubuskie Province	metal industry	26
21	Ostrów Cluster of Automatics	metal industry	11
22	Polish Cluster on Innovative Forging Technologies Hefajstos	metal industry	23
23	Greater Poland Railway Cluster	machine industry	26
24	Wielkopolska Aerospace Cluster	aviation	29
25	Metalika Metal Cluster	metal industry	30

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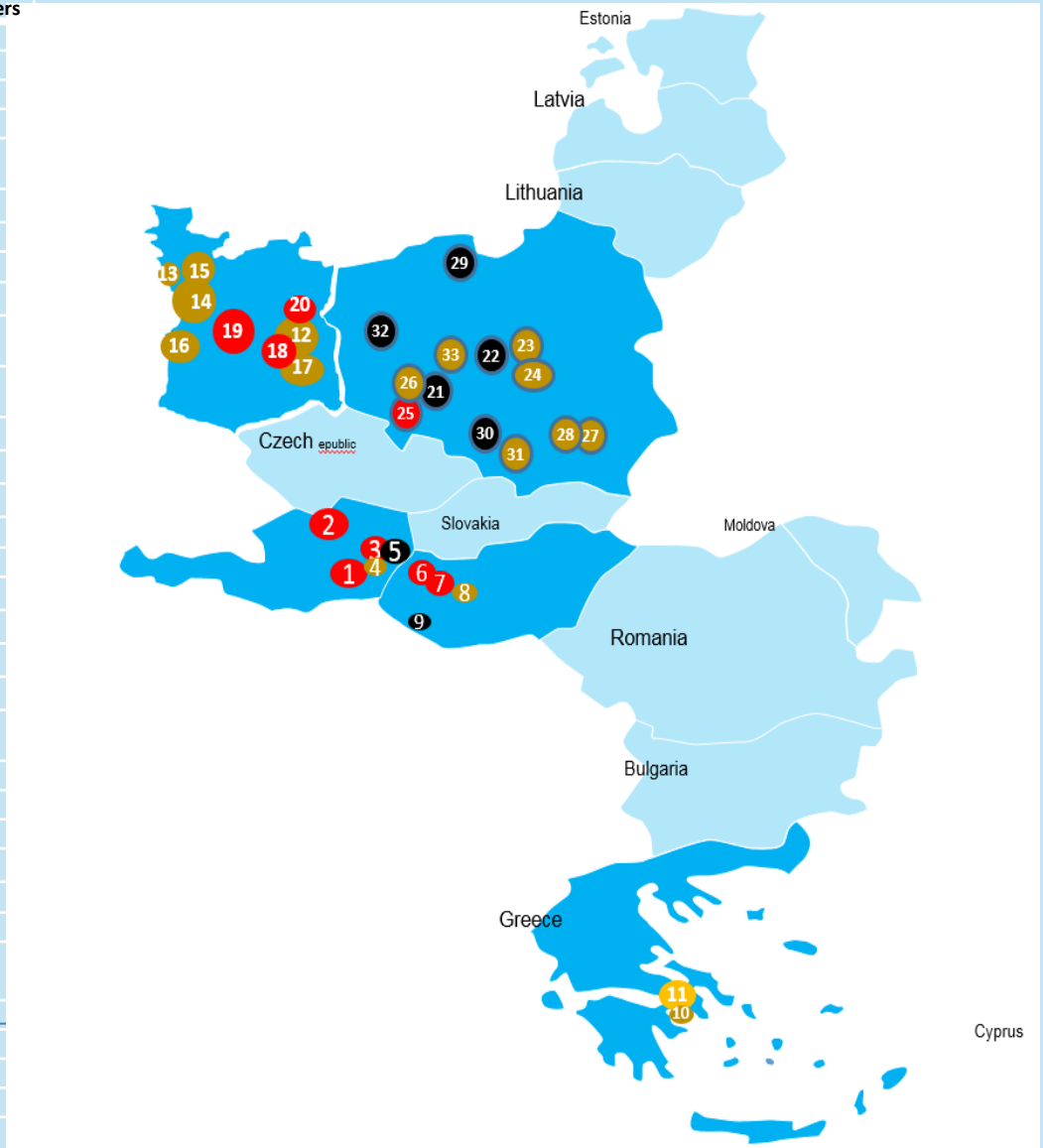
Biggest industrial clusters in CEE

No	Cluster name	Industry	Members
1	AAA Austrian Association	automotive	220
2	Automobil Cluster AC	automotive	200
3	Automotive Cluster in Vienna Region	?	?
4	AAI - Austrian Aeronautics Industries Group	aerospace	30
5	FMMI - Machinery & Metalware	machine building	?
6	NOHAC – North Hungarian Automotive Cluster	automotive	77
7	PANAC – Pannon Automotive Cluster	automotive	100
8	HAC – Hungarian Aerospace Cluster	aerospace	23
9	South West Hungarian Engineering Cluster		22
10	si-Cluster - Hellenic Space Technologies and Applications Cluster	aerospace	20
11	mi-Cluster - Nano/Microelectronics-based Systems and Applications Cluster	various	150
12	Berlin-Brandenburg Aerospace Alliance BBAA	aerospace	100
13	European Aerospace Cluster Partnership	aerospace	34
14	Hamburg Aviation	aerospace	303
15	HANSE-AEROSPACE e.V.	aerospace	166
16	Niedersachsen Aviation	aerospace	250
17	ASIS – AeroSpace Initiative Saxony	automotive	200
18	Automotive Cluster	automotive	141
19	Automotive Cluster of East Germany	automotive	200
20	Automotive Berlin Brandenburg	automotive	63
21	Cluster of Innovative Manufacturing Technologies CINNOMATECH	machine	53
22	Kutno Technology Cluster	machine	22
23	General Aviation Construction Technology Cluster	aerospace	21
24	Technological Support of Innovative Aeronautical Projects	aerospace	23
25	Lower Silesian Automotive Cluster	automotive	24
26	Lower Silesian Aviation Cluster	aerospace	18
27	Aviation Valley	aerospace	95
28	Subcarpathian Cooperative Connection-Light and Ultralight Aviaton Cluster	aerospace	40
29	Cluster of Pomeranian Special Economic Zone	machine	9
30	Mining Machines Cluster	machine	17
31	Silesian Aviation Cluster	aerospace	76
32	Greater Poland Railway Cluster	machine	26
33	Wielkopolska Aerospace Cluster	aerospace	29



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Thank very much for your attention

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