

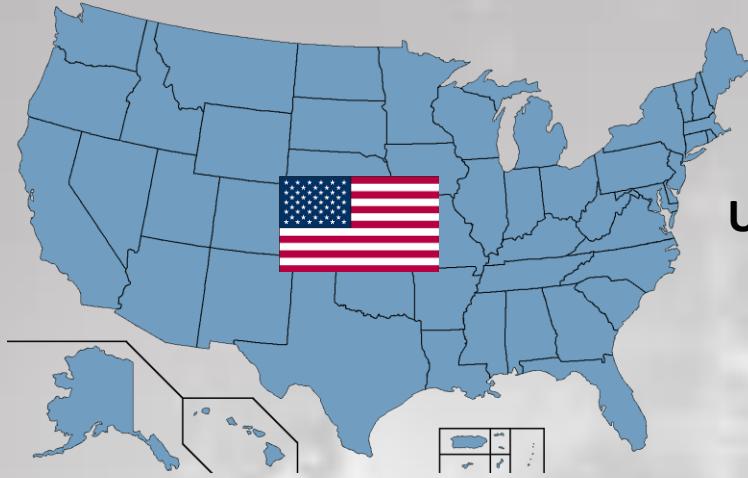
# *International Collaboration Tools for Industrial Development*

**6<sup>th</sup> CSIR Conference**

**5-6 October, 2017**

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U.S. DEPARTMENT OF  
COMMERCE  
(NIST)

NATIONAL COUNCIL FOR SCIENCE  
& TECHNOLOGY  
(CONACYT)



DEPARTMENT OF SCIENCE AND  
TECHNOLOGY  
(Advanced Manufacturing Technologies)



28 Countries

EUROPEAN COMMISSION  
(DIRECTORATE GENERAL RESEARCH,  
DIRECTORATE GENERAL COMMUNICATION  
NETWORKS, CONTENT AND TECHNOLOGY)



### **Pierre Nanterme, CEO of Accenture**

“Digital is the main reason just over half of the companies on the Fortune 500 have disappeared since the year 2000.”

### **Klaus Schwab, Founder and Executive Chairman, World Economic Forum**

“We must develop a comprehensive and globally shared view of how technology is affecting our lives and reshaping our economic, social, cultural, and human environments. There has never been a time of greater promise, or greater peril.”

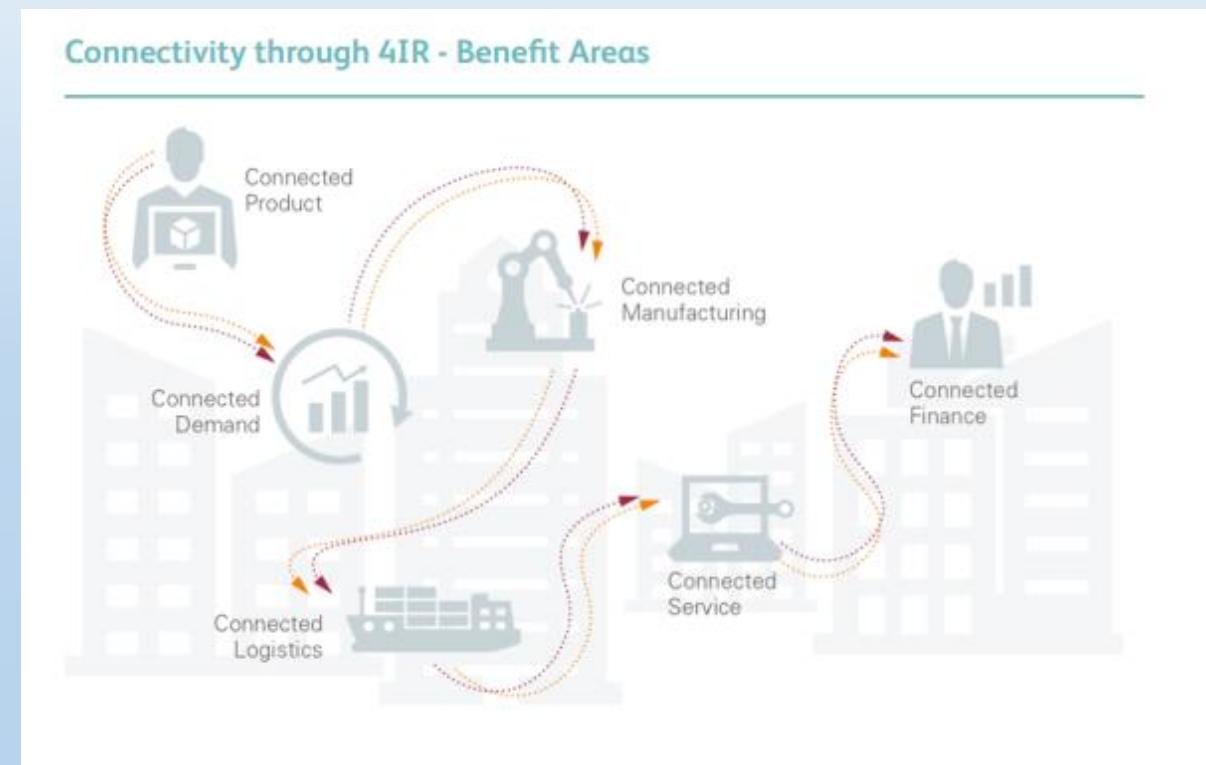


## The Benefits of 4IR in Manufacturing

**Smarter supply chains** – greater coordination and real-time flow of information across supply chains and relationships allows better tracking of assets and inventory and integrated business planning and production. This unlocks new ownership and collaboration models across supply chains.

**Smarter production** – the use of data analytics and new production techniques and technologies (such as autonomous robots, multi-purpose production lines and augmented reality) helps to improve yield and speed up production. This allows new business models to be pursued such as mass customization.

**Smarter products** – Rapid innovation and a faster time to market are enabled by data collected from products along with user feedback, whether direct or collected via social sentiment on the internet. This data also allows remote diagnostics and remote/predictive maintenance.



Source : [\*The 4th Industrial Revolution \(4IR\): A primer for manufacturers\*](#)

# *IS SOUTH AFRICA READY FOR INDUSTRY 4.0?*

- *Dr. Thulani Dlamini*  
*6<sup>th</sup> CSIR Conference*



## Top 10 countries that are ready for Industry 4.0

World Economic Forum investigated different countries and scored them on a 7-point scale. This is the top 10 countries scored on the ability to capitalize on the digital revolution:

### Network Readiness Index

- Overall environment
- Readiness in terms of infrastructure
- Affordability and skills
- Usage by individuals, businesses and the government.

1. Singapore: 6,04
2. Finland: 5,96
3. Sweden: 5,85
4. Norway: 5,83
5. United States: 5,82
6. The Netherlands: 5,81
7. Switzerland: 5,75
8. United Kingdom: 5,75
9. Luxembourg: 5,67
10. Japan: 5,65

1. Is there something to be learned from manufacturers in other countries?
2. How can MNEs drive I4.0 technologies through their supply chain, especially SMEs?

Scandinavian countries score high on the NRI. Germany, being one of the leading countries in Industry 4.0, only takes the 15<sup>th</sup> position on the list. China does have the right ambitions, but the country finds itself on a 59<sup>th</sup> place in the NRI. Whether this has an impact on their current number one position as a manufacturing country and their ambitions as stated in Made in China 2025, depends on how quickly they can improve their networks. In addition, the question is whether having the right circumstances as a country is enough to boost competitiveness.

### Sources

[World Economic Forum](#)

[Report WE Forum](#)



## 1. Is there something to be learned from manufacturers in other countries?

### Industry 4.0 for SMEs - EU Horizon 2020 RISE program

**Goal:** A great challenge for the future lies in the transfer of Industry 4.0 expertise and technologies in small and medium sized enterprises (SME). Although the high potential of Industry 4.0 in SMEs, the main limitation is a lack of concrete models for its implementation and application in small and medium enterprises. Thus, this research project titled “SME 4.0 - Smart Manufacturing and Logistics for SMEs in an X-to-order and Mass Customization Environment” aims to close this gap through the creation of an international and interdisciplinary research network.

Identifying the needs and enablers for a smart and intelligent SME-Factory, creating adapted concepts and design solutions for SME production and logistics systems and developing suitable organisation and business models will be the main objectives of this research network. The research network includes partners from all over the world (Italy, Slovakia, Austria, Thailand, USA, India).



Susanne Altendorfer-Kaiser  
added an update

Feb 22



Group photo Kick Off meeting 8-9 February 2017 - Free University of Bolzano (Italy)

76 Reads

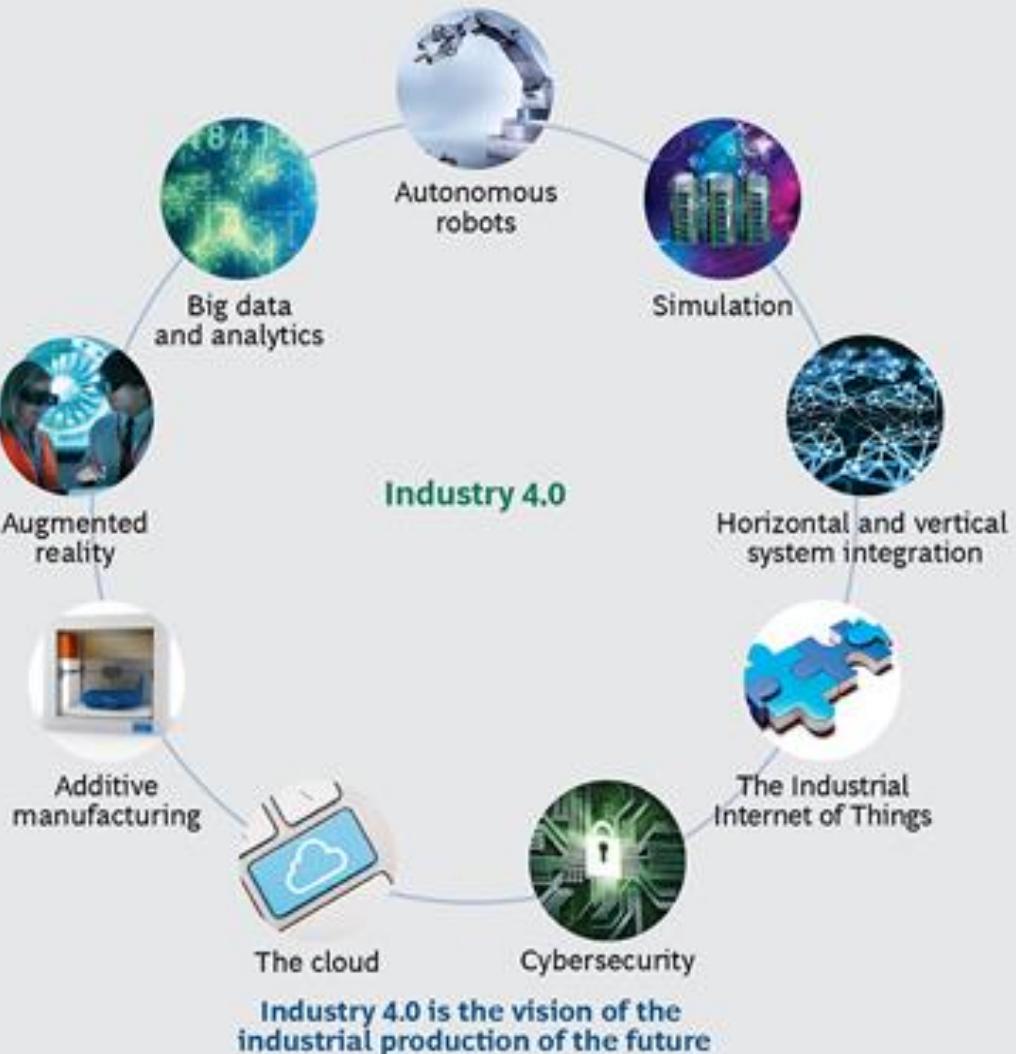


EXHIBIT 1 | Nine Technologies Are Transforming Industrial Production

2. How can MNEs drive I4.0 technologies through their supply chain, especially SMEs?
- Understanding benefits
  - Learning about applications relevant to their processes
  - Provide/join a platform to share best practices for integration
  - Involve SMEs in RDI projects

Challenges:

- Competing companies don't want to share
- SME's have difficulty committing resources
- SME's may lack capabilities to transform





**IS UNITED STATES INDUSTRY READY FOR INDUSTRY 4.0?**



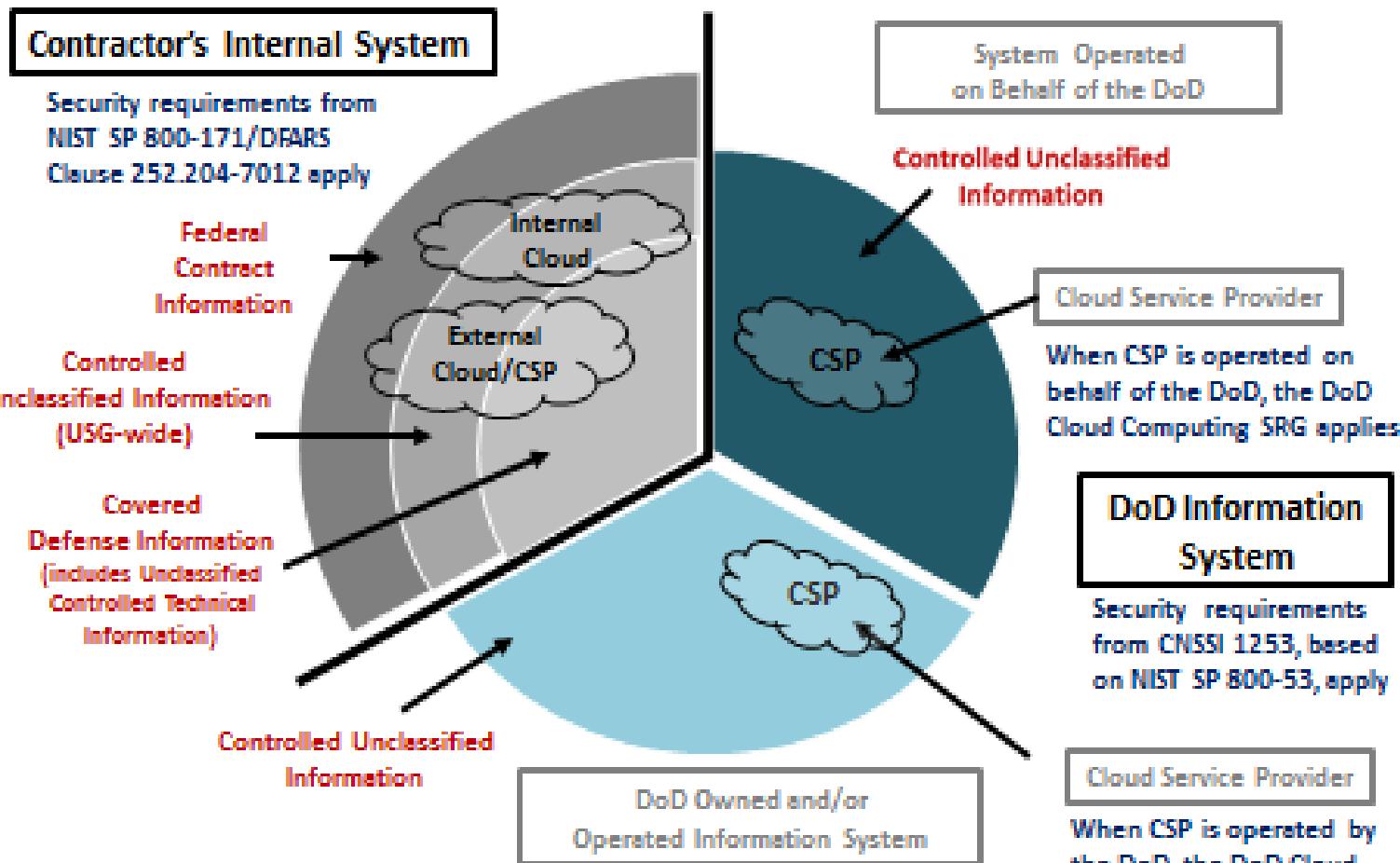
Protecting the DoD's Unclassified Information...

## Information System Security Requirements

### CASE-IN-POINT

#### New DoD Requirements for Cyber Security

- Defense industry MNEs are mostly consolidators
- Supply chains have large percentage of SMEs



## *What we believe...*

- *It is critical that SMEs adopt I 4.0 technologies*
- *SMEs cannot do it alone*
- *Collaboration is essential*

## *What we offer to collaborators...*

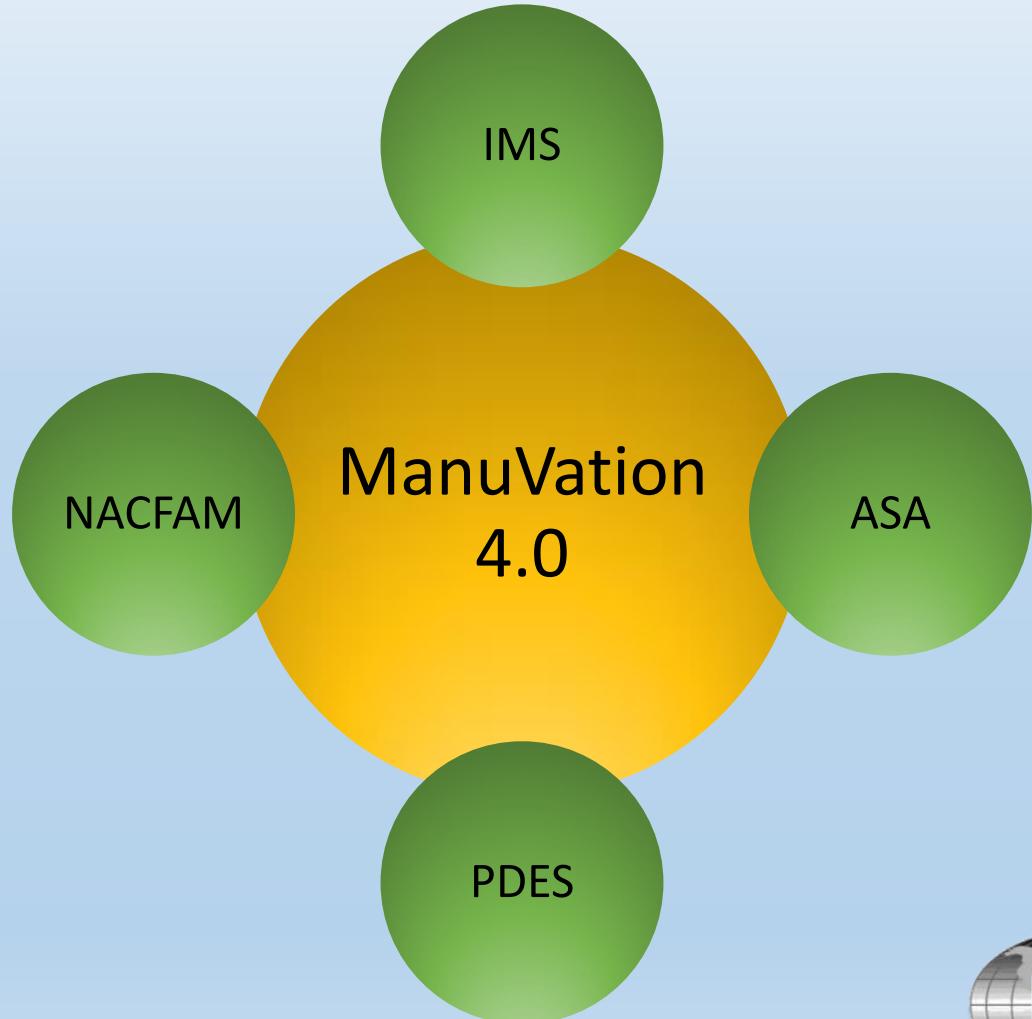
- *Help in formation of collaborative federations*
- *Expert-assisted clustering activities*
- *Platform to assist SMEs adoption of I4.0*
- *World Manufacturing Forum - global platform to discuss manufacturing challenges*



## *Collaborative Federations*

*What's a federation?*

- A formation of complimentary organizations working together towards a common goal





## IMS - U.S. Launches ManuVation 4.0

- U.S. Aerospace States Association, NACFAM, PDES Inc. and IMS are partnering to focus on SME sustainability and growth
- Piloted an industry driven workshop in March 2016 on Additive Manufacturing with follow on participation in IMS international workshop May 2016
- Using the Additive Workshop model held an Industry 4.0 workshop March 2017, partnering with the state of California A&D sector
- Developed an industry survey to get a sense of SME business issues
- Another workshop is scheduled for October 26, 2017 in the Quad Cities of Iowa and Illinois
- An international workshop will be held during the World Manufacturing Forum November 9, 2017 in Monterrey, Mexico





## *Expert Assisted Clustering Activities*

- IMS Project Clustering Platform
  - Adds the international dimension to take advantage of global RDI
  - New platform for project clustering to leverage R&D, reduce risks, provide global solutions
    - Facilitators
    - International project matching
    - Regional workshops
    - International workshops
    - Proven methodology for cluster formation
    - *No charge for IMS services or workshops!*
  - IMS is an industry-led program for international collaboration
  - Established networks for 22 years.

Text



## Methodology Example

### Additive Manufacturing Platform

- Additive Manufacturing Project Cluster Workshop
  - 2 May 2016, Barcelona Spain
  - 38 projects attended worth an estimated 100 million in R&D from the European Union, Mexico, South Africa, and United States
  - 6 new project research clusters formed under IMS





## Workshop Methodology

- Topic selected
- Project search
- Request project summaries, top 3 exploitable results, TRL levels
- Circulate summaries and request cross interest (weighted)
- Weighted interest levels charted
- Themes emerge, workshop held





Spreadsheet created from 38 submissions

- Request project summaries, top 3 exploitable results, TRL levels
  - Circulate summaries and request cross interest (weighted)
  - Weighted interest levels charted
  - Themes emerge, workshop held



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT
1	<b>Expression of Interest - All Projects</b>																																												
2	© 2016 Intelligent Manufacturing Systems All Rights Reserved																																												
3	Project ID	Exploitable Result	Abbreviated Name	M1-US-QUESTEK	M2-US-EXOVA	M3-US-NIU	M4-SA-DEDREF	M5-SA-FORMING	M6-SA-MEDAERO	M7-MX-FRISA	M8-MX-SISAMEX	M9-EU-AMAZ	M10-EU-REPtoMag	M11-EU-REPAIR	M12-EU-BOREALIS	M13-EU-AA-TID	M14-EU-NANOTUN3D	M15-EU-OXYGEN	M16-MX-METALSA	PB1-SA-FDMFINISH	PB2-SA-POLYAM	PB3-EU-BIOSCAFFOLS	PB4-EU-TOMAX	PB5-EU-HYDROZONES	PB6-EU-IBUS	PB7-EU-LOCKHEED	PB8-MX-UNAM-MADIT	PB9-EU-NDTBM	PB10-EU-EDUCATE	PB11-EU-SAND	PB12-EU-HIGIENE	PB13-EU-MACIATEQ	PB14-EU-VITRO	PB15-EU-CAIXMAN	PB16-EU-FOFAM	PB17-EU-MANSYS	PB18-EU-CASSAMOBILE	PB19-EU-UNFACTORY	Strength of Interest (ER)	Strength of Interest (project)					
4	M1-US-QUESTEK																																												
5	ER1	Al powder		Yes	3	3	2	1		3		3	3	1	3	2	3	3																			33	109							
6	ER2	Ti 6-4 Mod alloy		Yes	3	3	2	1	3	3		2	3	2	3	3	3	3																			40								
7	ER3	New Co, Ni or other alloy		Yes	3	3	3	1	1	3		1	3	1	3	2	3	3																			36								
8	M2-US-EXOVA																																												
9	ER1	Design allowable database		3	Yes	3	1	3	3	2		2	1	3	1	3	2	2			1				1	2										32	141								
10	ER2	Standard test & qualification protocols		3	Yes	3	1	3	3	2		3	3	3	2	3	3	3	1		1			3	3										41										
11	ER3	Surface finish for net shape parts		2	Yes	3	2	3	3	2	2	2	3	2	2	3	3	2			1			2											39										
12	ER4	Use of irregular shape powders		1	Yes	3	1	1	2	2		2	1	3	2	2	2	3			1			3											29										
13	M3-US-NIU																																							53					
14	ER1	Calorimeter to monitor heat input		1		Yes	2		3	2		2	1	2	3	2	3	1						1	2				2	2						28	66								
15	ER2	Acoustic monitoring of powder flow			1	Yes	2		3	2		3	1	2	2	2	2	1					1	2				1								25									
16	M4-SA-DEDREF																																												
17	ER1	DED procedures for repair			1	3	Yes	2				3	2	3	3	2	3	2			1			3	3												32	66							
18	ER2	Image processing		2	1	3	Yes	2				1	2	3	3	2	2	2			1			2	3											28									
19	ER3	Minimising residual stresses in DMD						Yes	3																														6						
20	M5-SA-FORMING																																								55				
21	ER1	Hot sheet forming tool			2	2		Yes				1	1			2	1	2	3					1	1												17	99							
22	ER2	Reconfigurable tool			1	3		Yes				1	1		1	2	3	2	2					1	1												19								
23	ER3	Improved scanning				3		Yes				2	1	1	1	2	3	2					2	1													19								
24	M6-SA-MEDAERO																																												
25	ER1	SLM of Ti6Al4V powder		3	3	3		2	Yes	1		3	2	2		3	2	3			1			2													30	99							
26	ER2	Post processing of Ti6Al4V		3	3	3		2	Yes	1		3	3	2	2	3	3	2			1			2	1											34									
27	ER3	Process chains for Ti6Al4V products		2	3	3		2	Yes	1		3	3	3	2	3	2	1			1			2	3											35									
28	M7-MX-FRISA																																												70
29	ER1	Characterization of superalloy wires		2	3	1	1	1	Yes		1	1			2	2	2							3	1													22							
30	ER2	Cladding and repair of forge tool			2	3	1	3	Yes	3	1	1			2	2	1						1	1													22								
31	ER3	Adding features to forges		2	2	3	1	2	Yes		1	1			2	1	1						1	1												17									
32	ER4	Superalloy components		3					Yes	2		3			2								1																9						
33	M8-MX-SISAMEX																																												
34	ER1	Peripherals for production lines			3	2				2	Yes	1	2			2	1	2					1																17	49					
35	ER2	Fabrication of critical space parts			2	2	2			2	Yes	1	2	2		2	1	2					1															21							



## PROJECTS TO BE CLUSTERED

M1 QUESTER M2 EXOVAL M12 - BUREAUS M16 - METALU M7 - FRISH  
GT12 - MAWSYC GT11 - FOFAM GT3 - NDT LRM M9 - AMAZC

## CLUSTER NAME

Industrial  
Robust AM  
Chain

## CHAMPION

PRABIR  
CHAUDHURY

## REGIONAL LEADERS

US - Jeff  
SA - Hardus  
EU - Paolo  
MX - Dante

## GOALS & OBJECTIVES

MACHINE  
MOD FOR  
LOW COST  
INDUSTRIAL  
PROD OF P.

TEST &  
QUALIFICATION  
PROTOCOL  
DEVELOP

DEVELOP  
Properties  
Database

Develop  
MATERIALS  
FOR AM

DEVELOP  
NDT Techni  
QUE

INVESTI  
GATE  
INITIATIVE

## KEY ACTIVITIES & SCOPE

NOW - WORK  
PLAN  
6/05-6/25 ACTION  
PLAN  
6/20 PLENARY

## WORK PLAN

## ACTION PLAN

Research  
current  
Machine capa  
bility for  
low cost  
non-spher  
ical powder  
s  
Foster  
Int'l collab  
on STD  
BODIES  
Define  
Process  
Groups  
Policy  
Qualif  
cation  
Machine  
Qualification

CLUSTER  
NAME

WHAT  
STEPS

HOW

BY  
WHOM

BY  
WHEN

HOW  
MEASURE  
SUCCESS



## Outcomes

- AM Cluster workshop had access to 38 projects worth an estimated 100 million in R&D. Shared R&D conducted at a fraction of the cost.
- Expand knowledge networks beyond borders.
- 3 New Project clusters to be formed, next Industry 4.0. Similar activity expected.
- Global networking for your institution to elevate visibility.
- Companies involved in IMS projects often become part of supply chains
- New project: Global AM Material Properties Database

### ***How can I get involved?***

26 October

- I 4.0 Workshop, Quad Cities

7-9 November

- AM Metals Cluster to hold workshop at the World Manufacturing Forum
- I 4.0 international Workshop



## *Platform to assist SMEs adoption of I4.0*

### **New program under consideration**

- Designed to enable SMEs to take their first steps towards Industry 4.0. SMEs in particular are often lacking the necessary resources to implement these new, technically demanding processes.
- Intent to set up Centers of Excellence
  - Learn about new I 4.0 technologies
  - Learn how to apply these technologies to their company
  - Share best practices





The World Manufacturing Forum brings together policy experts, industry leaders of large multinationals and small to medium-sized enterprises, as well as academic leaders across the globe to discuss the economic, social and technical challenges that will impact global manufacturing in the near future.

MONTERREY - MEXICO  
7-9 November 2017

"Towards a Digital Market & Connected Manufacturing Ecosystems"

[www.worldmanufacturingforum.org](http://www.worldmanufacturingforum.org)

## KEY FACTS



30+  
SPEAKERS



400+  
ATTENDEES



20+  
COUNTRIES



# WMF MONTERREY, MEXICO

WORLD MANUFACTURING FORUM™ 2017

November 7-9 • The Event Center at the horno<sup>3</sup> Museum of Science and Technology

## 25+ Qualified Speakers • 6 Challenging Sessions • Industrial Tours • Workshops & Exhibitions

**OVERVIEW:** The fifth edition of the World Manufacturing Forum will assemble in Monterrey, Mexico on 7-9 November 2017 at the Parque Fundidora to explore the theme "*Towards a Digital Market and Connected Manufacturing Ecosystems*". Global policy experts and industry leaders from large multi-nationals to small-to-medium sized enterprises, and academic leaders will discuss the policy, economic, social, and technical challenges that influence global manufacturing. The sessions will explore:

**Opening Session:** Mexico's Manufacturing Competitiveness & Global Partners Mexican authorities will provide an overview of the influence of design, engineering and advanced manufacturing activities at the WMF host country, Mexico, as strong drivers for economic prosperity, highlighting infrastructure development, job creation, and contribution to the GDP. Such overview will include the presentation of national industrial and trade policies as well as science & technology policies.

**Session 1: Industrial Policies for Digital & Interconnected Manufacturing Market.** The Digital Marketplace, which forms the "digital thread", is expected to connect and drive future manufacturing supply chains. This marketplace will further drive rapid innovation, efficiency, and global collaboration. Cross-border policies and cooperation are needed to enable ecosystems of this scope and size.

**Session 2: Connected Factories and Value Chains** Platforms for connected factories along a value chain ecosystem must be developed in a standardized way so that those entering or exiting a value chain may easily participate or disconnect. What are the reference architectures currently in development and how can they be implemented in create a value chain ecosystem?

**Session 3: Digital Workforce & Future Manufacturing Jobs** Connected manufacturing ecosystems will drive new architectures, but will also change how we utilize our workforce. The future company workforce will

extend beyond its walls to also become interconnected as a shared resource. These employees will need to be agile, highly trained, and able to address rapid-fire challenges and changes. How do we train for such a workforce?

### **Session 4: Energy and Resource Efficient Manufacturing**

Efficient use of resources will continue to drive manufacturing from business and social drivers. What are the major barriers for further efficiencies in manufacturing ecosystems? How can value chains drive these efficiencies in a cooperative way to spur innovation, reduce costs, and be environmentally responsible?

### **Session 5: New Business Models & Service Engineering**

The distinction between products and services has blurred as they are integrated into global manufacturing value chains. This major evolution will continue to expand and innovate thanks to powerful digital networks transforming regional businesses to globally integrated enterprises, and global enterprises to reach regional resources. What are the requirements and barriers for this new business model?

### **Session 6: Technology Trends for the Factory of the Future**

New manufacturing technologies to enable production of innovative products, drive resource efficiencies to lower costs, and provide better communication and satisfaction with customers. What are these technologies, materials, and processes on the horizon?

Speakers are expected to present policy views supporting and defining manufacturing megatrends such as the digitalization of industry, challenges for SMEs in the global marketplace, manufacturing intelligence, social innovation as a driver for new products, services, and technologies, financial challenges that affect industrialized and emerging economies, the circular economy and zero waste, and other disruptive technologies.



## ***IMS can...***

- *Help in formation of collaborative federations*
- *Provide expert-assisted clustering activities*
- *Create new platforms to assist SMEs adoption of I4.0*
- *World Manufacturing Forum - global platform to discuss manufacturing challenges*

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*Thank you!*