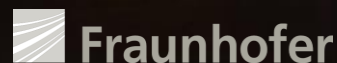




# INDUSTRIE 4.0

Prof. Dr. Eng. Jefferson Oliveira Gomes

SENAI SC/Fraunhofer Project Center for Advanced Manufacturing @ITA







200,000 years  
1860: 650 million  
2020: 7.8 billion

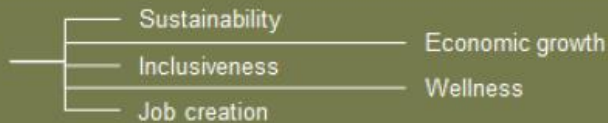


# Sources of value creation from emerging technologies



## Value to the individual

How does it change my life?



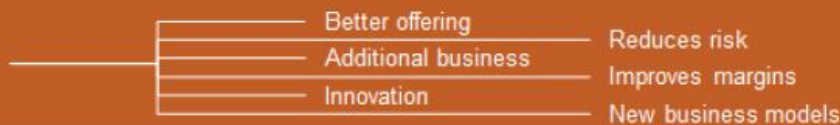
## Value to society

What value does it bring to society?



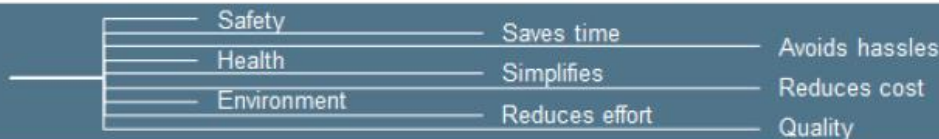
## Value to Industry

How does it change industry dynamics and supply networks?



## Value to the Firm

What does it do to production operations?









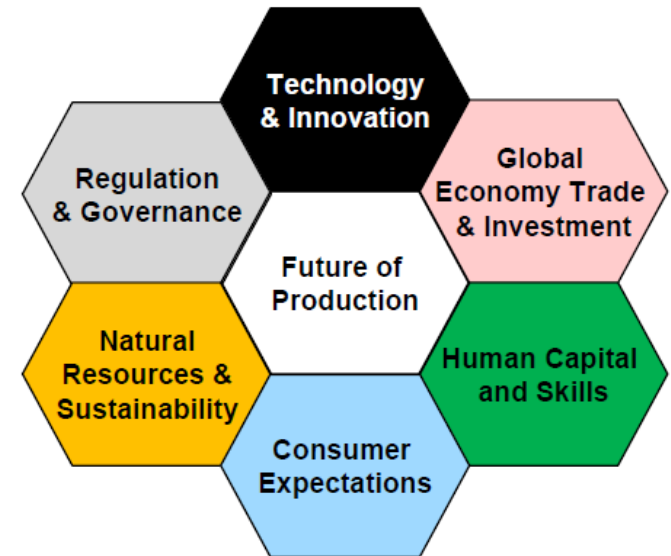
## Value on the Factory Floor

What does it do to production operations?

Source: WEF, Nov. 2016. NY, USA. Disruptive technologies shaping the future of production.

# Six drivers that will be most impactful in shaping the future of production

Drivers	Avenues of Interest
 <b>Technology and Innovation</b>	<ul style="list-style-type: none"> <li>• Understanding implications of advanced manufacturing technologies</li> <li>• Identifying technologies that will define the future of production</li> </ul>
 <b>Global economy, trade &amp; investment</b>	<ul style="list-style-type: none"> <li>• Distinguishing trends in relation to distributed manufacturing and expansions of global value chains</li> <li>• Assessing relevance of existing competitions to changing economics of production</li> </ul>
 <b>Human Capital and Skills</b>	<ul style="list-style-type: none"> <li>• Isolating essential skills required for the workforce for the future</li> <li>• Designing the role of governments and companies in reskilling the workforce</li> </ul>
 <b>Consumer expectations</b>	<ul style="list-style-type: none"> <li>• Detecting patterns of consumer behavior driving demand</li> <li>• Describing consumer consumption attitudes and expectations impacting production</li> </ul>
 <b>Natural Resources &amp; Sustainability</b>	<ul style="list-style-type: none"> <li>• Recognizing the role of new circular economy paradigm impacting production</li> <li>• Measuring and regulating environment and energy demand to incentivize green production</li> </ul>
 <b>Regulations and Governance</b>	<ul style="list-style-type: none"> <li>• Defining regulatory frameworks that would enable innovation, technology adoption and new models</li> <li>• Increasing transparency and protecting citizen's interest</li> </ul>



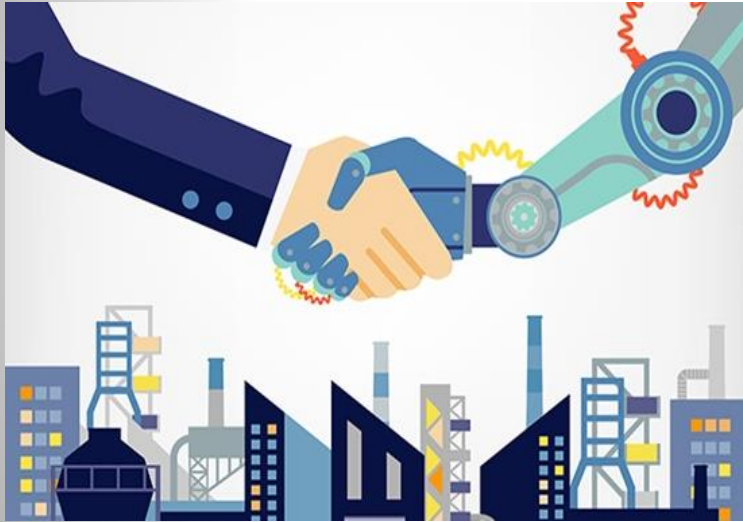
- We have developed a fact base around each of these drivers
- We then developed focal questions for each fact base

Source: WEF, Nov. 2016. Berlin, Germany. Scenario and Vision Development

# Technological Impacts just following Moore`s Law

## From the original Industry to Industry 4.0:

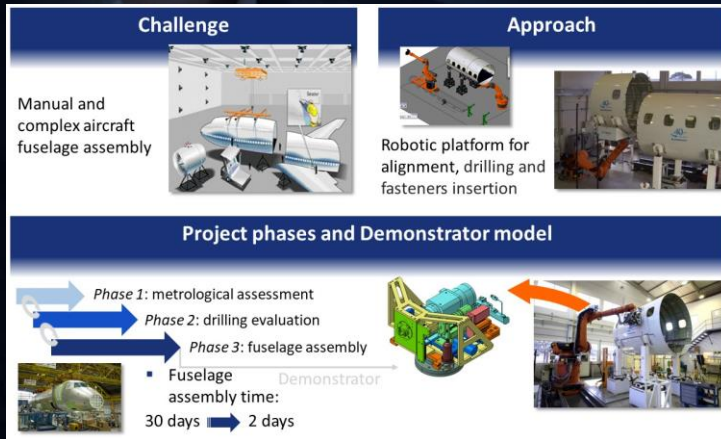
On the way to the 4th industrial revolution



- Digitalisation, sensing and weareables
- Autonomous and collaborative robotics
- Hybrid Processes and Products
- Analitcs and artificial Intelligence

**4<sup>th</sup> Industrial Revolution** | Based on Ciber-physical production systems





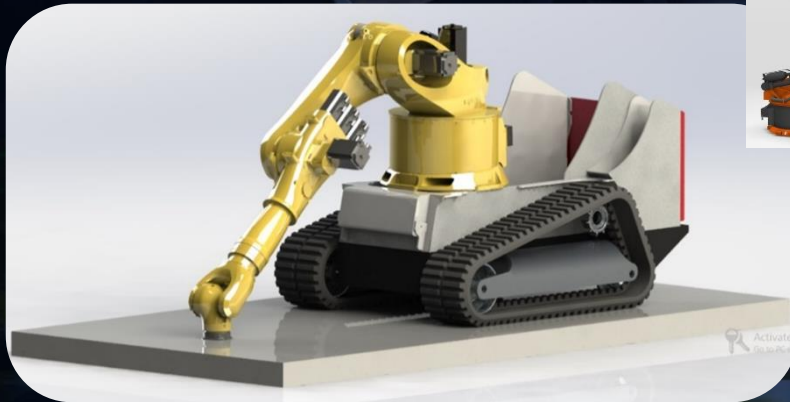
# LAME-ITA

Laboratório  
de Automação de  
Montagem Estrutural

# EMBRAER

Célula de Automação Industrial  
Dez 2011

# Automation and Robotic collaborative robotics



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# Sistemas de Manufatura

## Projeto: Robô de pintura (Aranha)



- Empresa:
  - Óleo e gás
- Propósito
  - Robô de revestimento
- Resultados
  - Segurança
  - Produtividades
  - Qualidade



# Automation and Robotics

## Flight simulator

- **Robotic Platform Flight Simulator (SIVOR, 2015-now)**

- Robotized flight simulator for training and engineering development.

- **Industrial Partner: EMBRAER**

- **Robots + Cockpit + Models**

- **Online Trajectory Generation**

- Systems Integration
- Software Development
- Mechanical Design (Structural & Journal Weight)

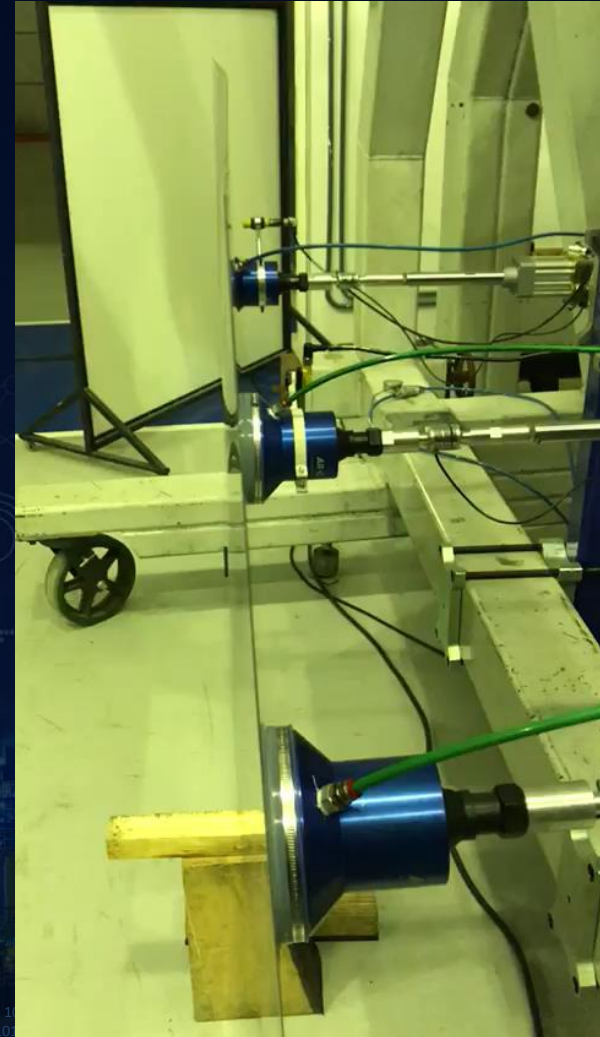
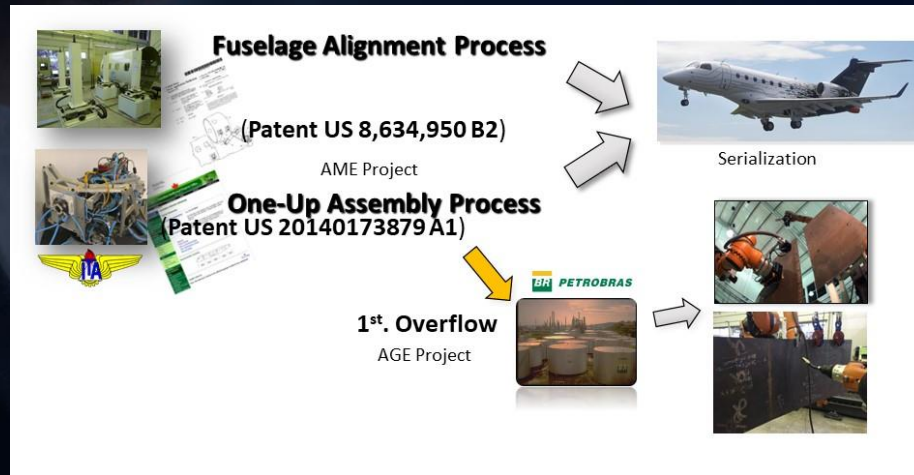
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# Technology Overflow

## Hybrid Processes and Products



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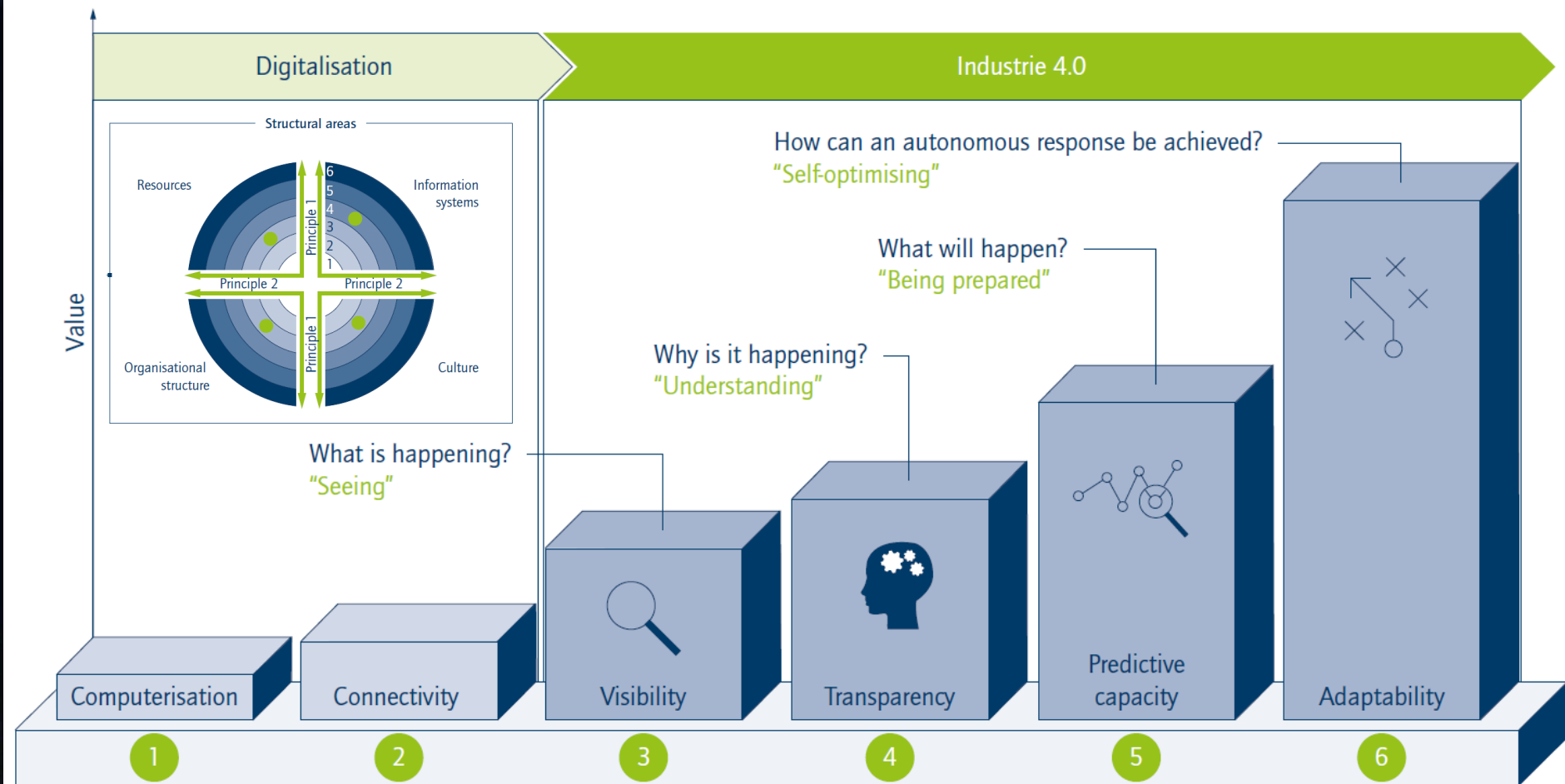
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What do the  
people really  
need?

# I.4.0 Stages of development

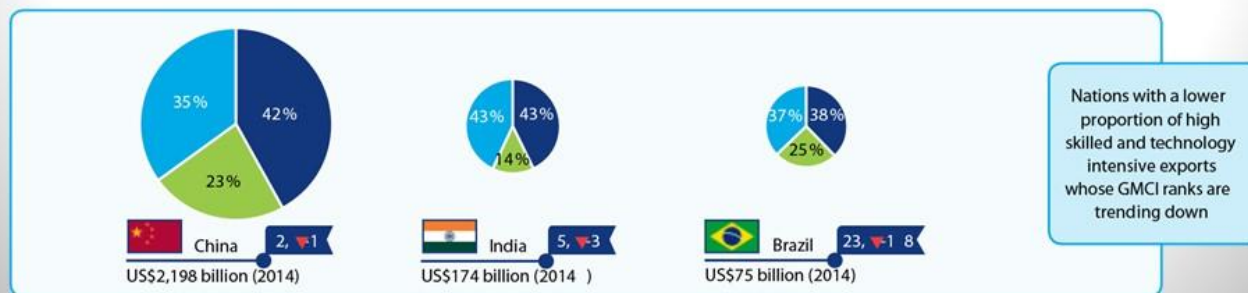
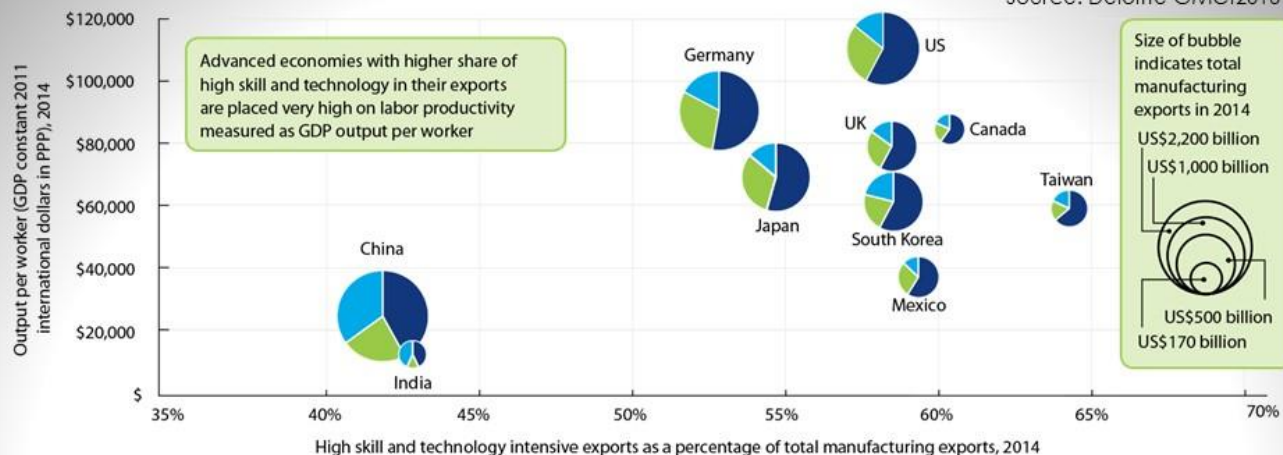




# Ranking of manufactured goods exports from countries based on their technological intensity

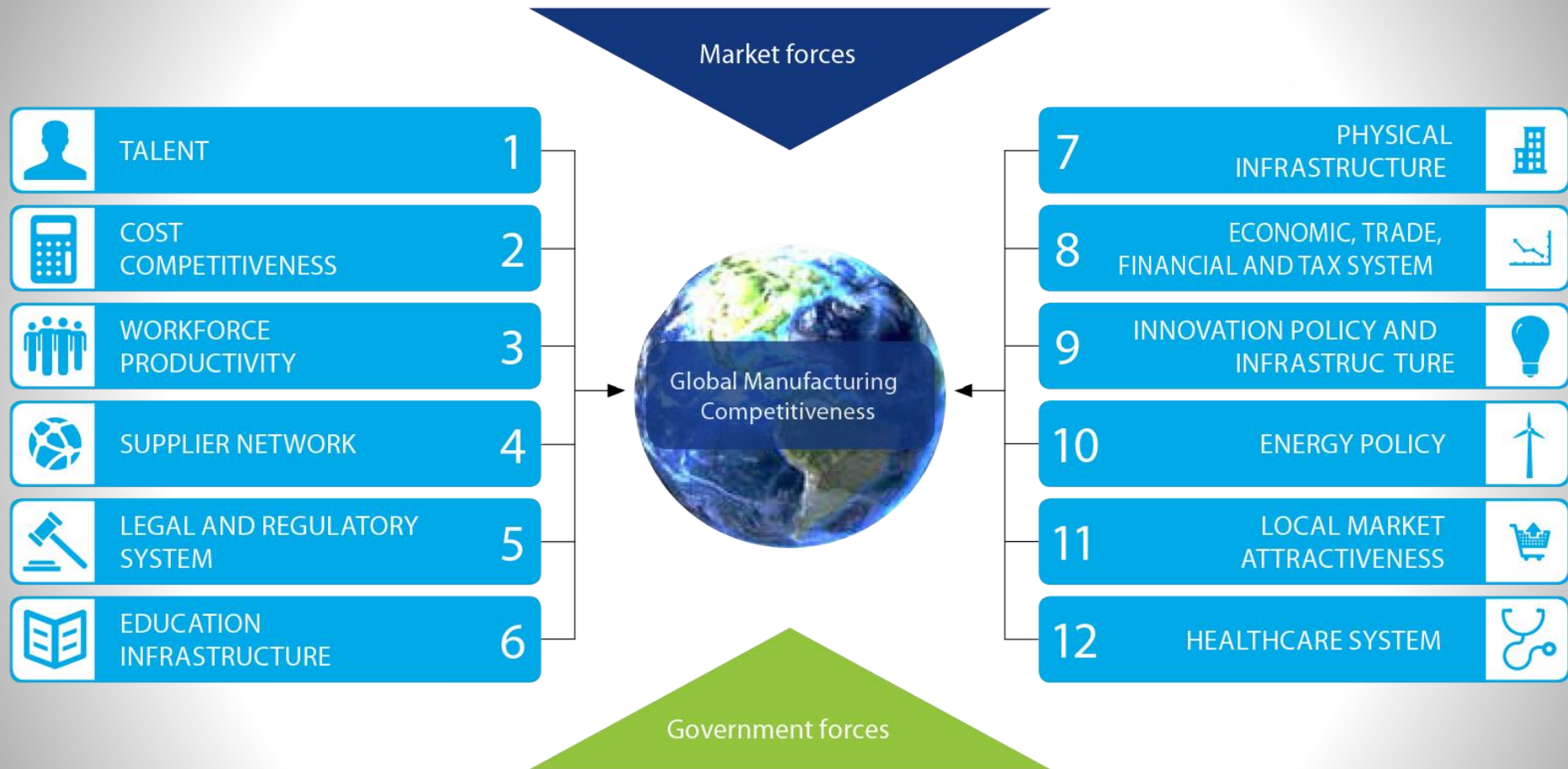


Source: Deloitte GMCI 2016



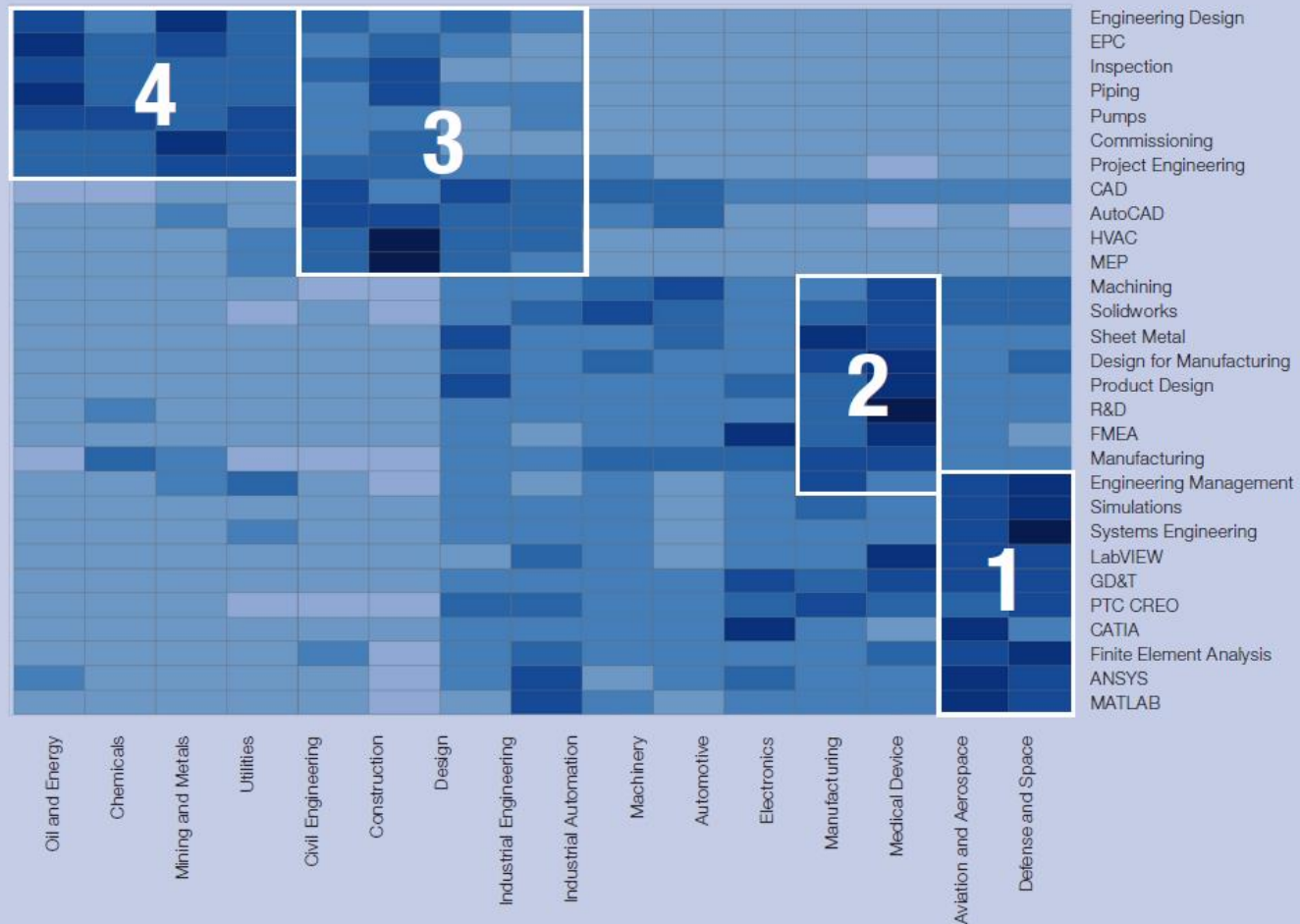
■ High skill and technology intensive manufacturing exports  
■ Medium skill and technology intensive manufacturing exports  
■ Low skill and technology intensive manufacturing exports

# Message





Heatmap: Distribution of skills, mechanical engineers, different industries



Highly relevant skill

Less relevant skill

Source: WEF, jan 2016

## Abilities

### Cognitive Abilities

- » Cognitive Flexibility
- » Creativity
- » Logical Reasoning
- » Problem Sensitivity
- » Mathematical Reasoning
- » Visualization

### Physical Abilities

- » Physical Strength
- » Manual Dexterity and Precision

## Basic Skills

### Content Skills

- » Active Learning
- » Oral Expression
- » Reading Comprehension
- » Written Expression
- » ICT Literacy

### Process Skills

- » Active Listening
- » Critical Thinking
- » Monitoring Self and Others

## Cross-functional Skills

### Social Skills

- » Coordinating with Others
- » Emotional Intelligence
- » Negotiation
- » Persuasion
- » Service Orientation
- » Training and Teaching Others

### Systems Skills

- » Judgement and Decision-making
- » Systems Analysis

### Complex Problem Solving Skills

- » Complex Problem Solving

### Resource Management Skills

- » Management of Financial Resources
- » Management of Material Resources
- » People Management
- » Time Management

### Technical Skills

- » Equipment Maintenance and Repair
- » Equipment Operation and Control
- » Programming
- » Quality Control
- » Technology and User Experience Design
- » Troubleshooting

Source: World Economic Forum, based on O\*NET Content Model.

Source: WEF, janeiro de 2016



Source: Future of Job Survey, World Economic Forum, 2016.

**30%**

of the current  
jobs did not  
exist 10 years  
ago



**65%**

of children will  
work on jobs that  
do not exist  
today

Over 3 bn people work  
with some type of  
professional contract

# Educação Inovadora

**MBI** em Educação para o Profissional do Futuro



Torneio de Situações de Aprendizagem



**SENAI**  
CHALLENGE



ENSINO MÉDIO  
**CONECTE**



**SENAI 4.0**

Despertar 4.0

Agir 4.0

Conectar 4.0

Engajamento e Referência



LABORATÓRIO  
*Aberto*  
SENAI



**ENGENHARIAS**

**Cursos de Engenharia**  
**Faculdades SENAI.**  
Inscrições abertas!



**MBA SMART**



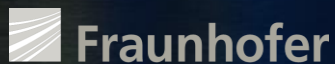


# RENOVAÇÃO DE PORTFÓLIO

47%

FATURAMENTO COM  
RECEITAS DE SERVIÇO

**that I do not have and I do not feel that I will have them**





## Immediate impact

- Increase of the geopolitical volatility
- Fast urbanization
- Mobile internet and Cloud technology
- Advancements in computing capacity and Big Data
- Crowdsourcing, shared economy and P2P platforms
- Changes in the workplace environment and restructure of work flexibility
- Climate change, natural resource scarcity and the transition to a greener economy

## 2016-2017

- New sources of energy and technologies
- Internet of things
- Advanced manufacturing and 3D printing
- Longevity and the aging of societies
- New consumer concerns over ethical issues and privacy
- Increasing women aspirations and financial power

## 2018-2020

- Advanced robotics and autonomous transportation
- Artificial intelligence and intelligent machines
- Advanced materials, biotechnology and genomics



How long will these changes take place?

Source: Future of Job Survey, World Economic Forum, 2016.