Industry 4.0 and Factory of the Future initiatives in Europe: focus on Italy

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Outline

1. Introduction: a snapshot of Italy
   • Industry
   • Academia

2. Italy’s Plan Industria 4.0

3. Towards Industria 5.0
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Demographics and statistics

The number of migrants is rapidly raising, year by year

Foreign population resident in Italy (million people)

Source: Italian Institute of Statistics (ISTAT)

World Economic Forum: Italy may have a struggling economy but its people are the healthiest in the world. The Bloomberg Global Health Index (April, 2017) ranks Italy top of 163 countries, followed by Iceland, Switzerland, Singapore and Australia.
A major socio-economic change. Migrants from / to ITALY: yesterday and today

YESTERDAY: from ITALY and EU countries to North and South America, and Australia

Today: from Africa to ITALY and EU countries

The Italian choice: inclusiveness

The effect of immigration:
- Lowering average age;
- Creating new industrial opportunities.

Examples of Italian migrants to the USA
Antonio Meucci
Enrico Fermi
Mario Andretti
Dino De Laurentiis
...
Fiorello La Guardia
Frank Sinatra
Nancy Pelosi
Rudolph Giuliani
Robert De Niro

Cecile Kyenge

Ellis Island
A snapshot of Italy

Strengths
• Italy is among the six leading manufacturing countries, second in Europe only to Germany.
• Our manufacturing companies represent the engine that drives the country’s economic growth and development.
• Our manufacturing companies are able to produce wealth and employment, make associated industries and services flourish, and contribute to the country's financial, economic and social stability.

Weaknesses
• Need for incentives (depreciation) to companies that invest in new capital goods, tangible assets and intangible assets (software and IT systems) for the technological and digital transformation of their production processes.
• Lack of support to private investment in Research and Development for product and process innovation to ensure the competitiveness of enterprises in the future.
• Businesses’ and professionals’ difficulty to access bank loans because they do not have sufficient guarantees.

** Updated with World Bank Data – ITA Analysis (2016)
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Italy, a leader in:

- Design and fabrication of advanced machines and systems for manufacturing and automation
- Use of advanced machines and automated systems for manufacturing a large variety of traditional and advanced products
- Design, fabrication and industrial application of MEMS
Italy is ranked **first** in Europe for number of manufacturing enterprises (most of them are SMEs) and **second** for value added, turnover and number of employees.

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**Contribution of manufacturing to GDP (in Italy): 17%**

**European target for 2020: 20%**

**Manufacturing machines**

Source: Eurostat

Manufacturing is an (economic) key-activity for Italy: export figures

**Total of industrial machine tools (export in 2014):**
Italy is ranked second (€81.40 billion) in Europe after Germany (€182.80 billion)

Source: Il Sole 24 Ore
Many agri-food companies adopt MEMS technologies for monitoring food quality and safety.

Miniaturized sensors are used throughout the production line, to improve safety and quality:

- Temperature sensors
- Humidity sensors
- Velocity sensors

The "Milan Protocol" will connect citizens and policy makers to address the issue of food sustainability with a triple objective:

- To promote healthy lifestyles and fight obesity
- To promote sustainable agriculture
- To reduce food waste by 50% by 2020

Sensorized systems are used to optimize the production process of many other Italian excellent products.
MEMS as key components in Italian machines for manufacturing automation

Vertical packaging machines  Vacuum packaging machines  Automatic packaging of pharmaceuticals  Wrapping machines, hermetic packages

The automated packaging process is optimized through MEMS sensors:

- Accelerometers
- Velocity sensors
- Pressure sensors
- Temperature sensors (for food and drugs)
Contemporary Italian Creativity - fashion
Contemporary Italian Creativity – tech for fashion

A BALE TALE
Loro Piana buy record-breaking wool, make 40 ultra-luxe suits

Jessica Keller
22 April 2013

world’s finest bale of Merino wool: 10.6-micron

Loro Piana has been manufacturing fabrics for six generations and is currently the largest cashmere manufacturer in the world with a capacity of 4.5million metres per year.
Innovation in manufacturing: digital printing in textile industry

Leading manufacturer of textile printing machines

Grassobbio (Bergamo)

Microfabricated nozzles significantly improve the performance of inkjet printers

ReNOIR - Digital Revolution
Italy’s production of machinery for paper industry covers 7% of the industry business worldwide

The surroundings of Lucca, in Tuscany, constitute an important **paper production district**, with:
- more than 100 companies
- 3.5 B€/year of total revenues
  - 6,500 employees
- 900,000 tons of paper produced every year (80% of the overall paper production in Italy, 17% in Europe)

**MEMS** used to improve paper production processes by semi-automatized machines:
- Position sensors
- Sensors for controlling ambient conditions
  - Micropositioners
COMAU: a world leader in industrial robots and automation systems

- 1 of the top 7 World Robotic Industries (ABB, KUKA, Fanuc, Yaskawa, etc.)
- 1 out of 3 vehicles in the world, over 20 million annually, is manufactured with Comau technology
- A network of 27 operating centres in 15 countries (70% of human resources work in emerging countries)
- One of the two greatest suppliers of complete automated manufacturing systems (first in China and the Americas, 1st or 2nd WW depending on the year)
- Over 1B€ yearly income

See presentation by Arturo Baroncelli
2014 - FIAT from Italy buys 100% Chrysler

FCA BRANDS

Alfa Romeo
Chrysler
Dodge
Ferrari
Fiat (Fiat 500X)
Maserati
Jeep (Renegade)
Ram

2008-2014: Fiat gradually buys Chrysler and achieves 100% of the shares. Fiat Group and Chrysler merge into FCA. FCA is listed on NYSE.

Fiat Chrysler Automobiles is now a recognized world leader in the automotive sector and a voracious consumer of MEMS.
Piaggio

A company grounded in Italy, with very advanced manufacturing solutions and worldwide production sites

Full-automatized motor vehicles painting process

See presentation by Massimo Maffei
Innovation in manufacturing: automotive

Brembo is world leader in the manufacture of breaking systems

Brembo breaking systems developed for Ferrari and Ducati

Brembo breaking system, developed for Chevrolet Corvette

Magneti Marelli is a world leader in the manufacture of automotive parts for all vehicles

Miniaturized on-board sensors allow enhanced performance

- Position sensors
- Temperature sensors
- Pressure sensors

Magneti Marelli offered its Kinetic Energy Recovery System (KERS) to F1 in 2009, for 1 M€/year
Innovation in manufacturing: boats and yachts

Fincantieri of Italy is the world leader in cruise ships. Several Italian companies lead the market of luxury yachts.

On-board MEMS are gaining an increasing importance:
- Accelerometers/gyroscopes for assisted navigation
- Temperature/humidity sensors
- Pressure sensors
- Flow sensors
Boats as smart cities

MSC Crociere recently launched the technological innovation program “MSC for Me”
Through distributed MEMS and wearable technologies, people will be able to connect with the boat in real-time and personalize the cruise according to his/her needs and style

The first ultra-modern ship “Meraviglia” (produced by Fincantieri, Italy) will be launched on June 3, 2017

- 700 digital access points
- 358 interactive information screens
- 2244 cabins provided with Rfid/Nfc technologies
Innovation in manufacturing: boats and yachts
Innovation in manufacturing: aircrafts, helicopters and trains

AugustaWestland (Finmeccanica group) is the world leader in the helicopter market. The company invests yearly the 12% of its revenues in R&D activities, concerning the integration of MEMS and other technologies.

AnsaldoBreda (Finmeccanica group) is the Italian leader of train manufacturing, but it is also the most important distributor of urban vehicles in the United States.

Frecciarossa 1000 “Pietro Mennea”
ST Microelectronics

Smart Watch
Activity Monitor
Sports
Heart Monitor
Glasses & Goggles
Accessories

A microelectronics company grounded in Italy, that enabled the functionalities of

MEMS & Sensors revenue shares for wearables

Top 10 MEMS sensor suppliers 2014-2015

Source: IHS - Sensors for mobile devices intelligence service © 2016 IHS
IoT and Industrial IoT concept are well known…

… ST enables “Smart Things”: What is a “Smart Thing”? 

- Understands the environment
- Manage information
- Connects to the world
- Protects your data
- Is energy Efficient
Connectivity 10 cm to 10 km

Signal Conditioning & Protection Nano Amps to Kilo Amps

Motor Control Power conversion

Power & Energy Management Nano Watt to Mega Watt

Sensing & Actuating Full range of sensors and actuators

Processing & Security Ultra-Low Power to High Performance

Smart Things

Smart Home Ultra-Low Power to High Performance

Smart City Scalable Security solutions

Smart Industry
Smart Industry

ST is enabling smarter, safer and more efficient factories and workplaces

What Smart Industry means

- Factories that produce in a more efficient manner
- More flexibility and customization possibilities in the supply chain
- More sustainable production with less waste and less energy used
- Safer working environments for people
- Better man-machine cooperation in the work place
- Optimized usage of machines and tools

Smart Factory Enablers

Connectivity, Microcontrollers, Sensors, Motor Drivers. Smart Drivers & SIP, Galvanically Isolated Gate Drivers and IPS. IO-Link Transceivers, Safety Integrity Level ICs, Industrial ASICs, analog
IoT Devices Come in Many Form Factors
Next Step From preventive to predictive maintenance...

With the Industry 4.0 the factory is modifying its equipments maintenance. *From preventative to predictive*...

The aim of *predictive maintenance* is to predict equipment failure and prevent failure by performing proactive maintenance. That allows to:

- Reduce maintenance costs
- Increase uptime
- Increase energy efficiency

Picture source: Sequoia
How does ST enable this?

**Power Discretes & Modules**

**Smart power**

**Microcontrollers & Secure solutions**

**Connectivity & Communication**

**Sensors & actuators**

**Analog & Signal conditioning**

**Smart manufacturing**

**Factory automation**

**Smart Motion control**

**Industrial robots**

**Industrial lighting**

**Power Management**
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Number of researchers in Italy
Quantity and quality of scientific research in Italy
Collaborations between Academia and Industry
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Industria 4.0: the Italian way

**Italian industrial sector peculiarities**

- Few large industrial and ICT private players able to lead Italian manufacturing transformation
- Limited number of industry champions able to coordinate the evolution process of value chains
- Industrial sector deeply based on Small and Medium enterprises
- Key role of illustrious universities and research centers in development and innovation
- Strong cultural traits of finished products

**Government guidelines**

- Operate in a technological neutrality logic
- Implement horizontal actions avoiding vertical or sector-based ones
- Operate on enabling factors
- Steer existing instruments to promote technological leap and productivity
- Coordinate key stakeholders without acting as a controller or decision maker

Source: Italy’s Plan Industria 4.0, MISE
The roadmap towards Italy’s Plan Industria 4.0

- December 2016: approval of the financial statements 2017 with allocation of resources for Italy’s Plan Industria 4.0

- November 2016: deliberations by the Region of Tuscany on a regional platform Industria 4.0 and launch of a regional Technological District “Advanced Manufacturing 4.0”

- October 2016: visit of the Italian Prime Minister and of the Minister of the Economic Development at the Scuola Superiore Sant'Anna, nominated to be part of the direction cabinet

  - September 2016: Italian Government’s announcement of the Italy’s Plan Industria 4.0

- August 2016: creation of a direction cabinet for the Italy’s Plan Industria 4.0

- June 2016: launch of a survey on Industria 4.0 by the Italian Parliament’s Commission for the Production Activities

Source: Italy’s Plan Industria 4.0, MISE
Industry 4.0 plan in ITALY: SMART FACTORY

- **3D PRINTING/ADDITIVE MANUFACTURING**
  - Waste minimization
  - Mass customization
  - Rapid prototyping

- **SENSORS**
  - No errors/deviations
  - Reactivity
  - Traceability
  - Predictively

- **NANOTECHNOLOGIES/ADVANCED MATERIALS**
  - Smart products with added features
  - Technical differentiation
  - Connectivity

- **ROBOT**
  - Collaborative
  - Real time – Autonomy – Productivity
  - Complete transparency on data reporting

- **AUTONOMOUS VEHICLES**
  - Flux optimization
  - Enhanced security
  - Costs reduction

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- **FUTURE RESOURCES:**
  - Clean and renewable energies, everywhere
    - Energy storage
    - Alternative materials
  - Wind, Sun, Geothermal, Alternative

- **CLIENTS**
  - Client – marketing proximity
  - Flexibility
  - Matching between client needs and mass production efficiency

- **MASS CUSTOMIZATION**

- **INTERNET OF THINGS**
  - Electronic Thing control
  - Internet-Thing communication
  - Real-time data
  - Optimized storage
  - Less production waste

- **LOGISTICS 4.0**
  - Fully-integrated supply chain
  - Interconnected systems
  - Perfect coordination

- **SUPPLIERS**

- **CYBERSECURITY**
  - Security for «internet based manufacturing»
  - Technological products life cycle extension

- **CLOUD COMPUTING**
  - Complexity management
    - Creativity
    - Collaborative manufacturing

- **BIG DATA**
  - Cyber Physical System (CPS)
    - Numerical control
    - Full automation
    - Fully-interconnected systems
    - «Machine to Machine» communication

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- **FUTURE RESOURCES:**
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December 2016: approval of the “legge di bilancio“ 2017 with dedicated resources for “Industria 4.0” national plan

Italian government guidelines:
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- Implement horizontal actions avoiding vertical or sector-based ones;
- Operate on enabling factors;
- Steer existing instruments to promote technological leap and productivity;
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Carlo Calenda (born 9 April 1973): Minister of Economic Development

Source: Italy’s Plan Industria 4.0, MISE
Industry 4.0 national plan: 2017-2020 targets

**Strategic measures**

**Innovative investments**
- >10 bn € private investments increase in 2017/18
- +11 bn € R&D&I private expenditure over the '17-'20 period (exceeding 2% of GDP)
- +2,6 B volume of early stage investments mobilized over the '17-'20 period

**Skills**
- ~1,400 Industrial PhDs focused on I4.0 (out of ~5,000 included in NRP¹)
- 200,000 academic students and 3,000 managers qualified on I4.0 topics
- +100% Doubling students attending vocational schools on I4.0 topics

**Enabling Infrastructures**
- 100% of Italian companies with access to 30 Mbps connectivity within 2020
- 50% of Italian companies with access to 100 Mbps connectivity within 2020
- 6 consortia regarding IoT standards, monitored by Italian representatives

**Additional measures**
- +1 bn € Reform and refinancing of Public Guarantee Fund for 2017
- +1 bn € Support measures on large scale investments focused on I4.0
- +0.1 bn € Strong investment on digital sales chains (Made in Italy plan)
- Strengthening of productivity-salary taxation exchange

*¹ National Research Plan - Source: Steering Committee Industry 4.0

Source: MISE
Industry 4.0 innovative investments: Tangible benefits for enterprises

Hyper-Depreciation
- Increase of amortization rate for investments in I4.0 technologies

As is 140%  
To be 250%

Super-Depreciation
- 1 year extension of the Super-Depreciation with a flat rate (140%) for all investments, both tangible and intangible (when related to I4.0 technologies)

Deadline
- In order to guarantee a broad diffusion of Hyper and Super-Depreciation schemes, the item delivery date is extended to 30/06/18; however, the order and a >20% deposit must be finalize by 31/12/17

Source: Italy’s Plan Industria 4.0, MISE
Skills: Digital Innovation Hub and I4.0 Competence Center

Digital Innovation Hub

Features:
- Selected DIH located at Confindustria’s and R.E.TE. Imprese Italia’s branches
- Contact point between companies, research institutions and public/private investors

Mission:
- Create awareness on I4.0 opportunities
- Support in developing innovative investment plans
- Orientation to I4.0 Competence Centers
- Support in accessing to public and private financing solutions/investors
- Interactions with European DIHs

I4.0 Competence Center

Features:
- Few and selected national Competence Center
- Strong involvement of leading Italian universities and large private players
- Support to key stakeholders (e.g. research institutions, startups,...)
- Mission-oriented and focused on facilitating I4.0 transformational projects in all domains
- Appropriate legal and managerial skills

Mission:
- I4.0 training and awareness
- Live demos on new technologies and access to I4.0 best practices
- Technical advisory on I4.0 for SMEs
- Launch and acceleration of technological development and innovative projects
- Trial support and "on-site" development of new I4.0 technologies
- Coordination with European CC

Source: Italy’s Plan Industria 4.0, MISE
The Competence Center of the Scuola Superiore Sant’Anna

- The Scuola Superiore Sant’Anna (SSSA) is part of the direction cabinet for the Italy’s Plan Industria 4.0.
- SSSA will participate to the competitive call for the establishment of few and selected national Competence Centers.
A challenge: the best product from the best process

Just producing is not enough: it is necessary to develop products of highest quality and to sell them the proper market.

Factory in Cassino
1400 COMAU robots
3500 employees
Collaborative industrial projects of The BioRobotics Institute of Scuola Superiore Sant’Anna
CENTAURO: the Flagship project in Tuscany within the Industria 4.0 paradigm

Tuscany Region - Duration 04/2016 – 02/2020
Total cost: 4.9 M€
CENTAURO: the Flagship project in Tuscany within the Italian Industria 4.0 initiative

3 COMAU robots to be delivered in June to the Consortium
Scientific and technological results of the industrial collaboration with COMAU Robotics presented at the international AUTOMATICA robotic trade fair on 21-24 June, 2016 in Munich, Germany (>43,000 visitors from approx. 100 countries)
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Towards Industry 5.0

- LOGISTICS 4.0: Fully integrated supply, interconnected systems, perfect coordination.
- 3D PRINTING/ADDITIVE MANUFACTURING: Added value smart products, technical differentiation, connectivity.
- NANOTECHNOLOGIES/ADVANCED MATERIALS: Collaborative, real-time - autonomous, productive, full transparency of data reporting.
- ROBOTS: Collaboration, technical differentiation, connectivity.
- AUTONOMOUS VEHICLES: Optimization of workflows, enhanced safety, reduced production.
- INTERNET OF THINGS: Electronic control of objects, internet-objects communication, real-time data.
- Circular economy: Ethics, legal issues, socioeconomic issues, robots and jobs, social responsibility.

- Crafts 4.0
- Agriculture 4.0
- Food 4.0
- Fashion 4.0
- Healthcare 4.0
- Training and Education 4.0

Internet of Things and Internet of Humans

- IoT & IoH: Client, marketing, proximity, flexibility, full automation, full interconnectivity, "Machine to machine" communication.

- Sharing and social economy

- Information and communication
Going beyond? **Society 5.0**
Digitalization across all levels of the Japanese society
Digital transformation of society for an aging population

Why called “5.0”?  
1. Hunting society  
2. Agrarian society  
3. Industrial society  
4. Information society, and  
5. **Super-smart society**
The Waves of Robotics Innovation

Third wave
Industry 5.0

Second wave
Industry 4.0

First wave

Future of Robotics

Robotics body of knowledge

Industry 5.0 would require a new generation of robots: the Robot Companions for Citizens FET Flagship initiative

FET-Flagship Proof-of-concept project

The objective the RoboCom++ is to lay the foundation for a future global interdisciplinary research programme on a new science-based transformative Robotics, to be launched by the end of the H2020 Programme.

RoboCom++ will aim at developing the cooperative robots (or Companion Robots) of the year 2030, by fostering a deeply multidisciplinary, transnational and federated effort.
08:45 – 10:00 Introduction
08:45 – 09:10 Industry 4.0 and Factory of the Future initiatives in Europe: focus on Italy (Paolo Dario)
09:10 – 09:35 Industry 4.0 and Factory of the Future initiatives in Europe: focus on Germany (Yannick Morel)
09:35 – 10:00 Automating machining and assembly tasks for large aeronautic structures: scientific and technological challenges (Lakmal Seneviratne)

10:00 - 10:30 Coffee break and networking session