Industry 4.0
Value Chain, Enabling Technologies and Cyber Security

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Ravenna, 9th of April, 2017

LEONARDO

Agenda

1. A short brief about Leonardo
2. Introduction about Industry 4.0
3. Product Line Efficiency and Value Chain
4. Technologies, tools and capabilities for Industry 4.0
5. Industry 4.0 for Aerospace and Defence
6. Focus on Cyber Security
7. Challenges and Opportunities
8. Potential Disruptions

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SECTORS

Helicopters	Aeronautics	Electronics, Defence and Security Systems	Space

DIVISIONS

Helicopters	Aircraft	Aerostructures	Airborne & Space Systems	Land & Naval Defence Electronics	Security & Information Systems	Defence Systems

ATR

SuperJet International

DRS Technologies

MBDA

Telespazio

Thales Alenia Space

■ **owned company**   ■ *joint venture*

Innovation and Technology Governance

✓ Identify the required technologies to face market challenges, foster their development and timely adoption to sustain current products and develop new products

✓ Secure the continuous improvement of the Engineering efficiency and effectiveness

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Technology Innovation

- Coordination of the activities aimed at **technological *scouting*** adopting ***"open innovation"*** approaches
- Definition of the **Group technological strategies**, pinpointing e enhancing emerging innovative technologies
- Fostering and coordination of **R&D initiatives** at Group level
- **Intellectual property** valorization

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Product Policy

- Coordination of technological development of **strategic platforms**
- **Investment assessment** by area of competence

Engineering Excellence

- Identification of **metrics and measures** to secure the continuous improvement of Engineering
- Sharing of excellent **processes, experts, methodologies and tools** among our engineering departments

Product & Technology Innovation Plan (P&TIP)

Process to support the **Leonardo Technology Governance** defining and driving the capture of the strategic objectives, enhancing our technological and product competitive advantages

Industry 4.0 - Introduction and Terms of Reference

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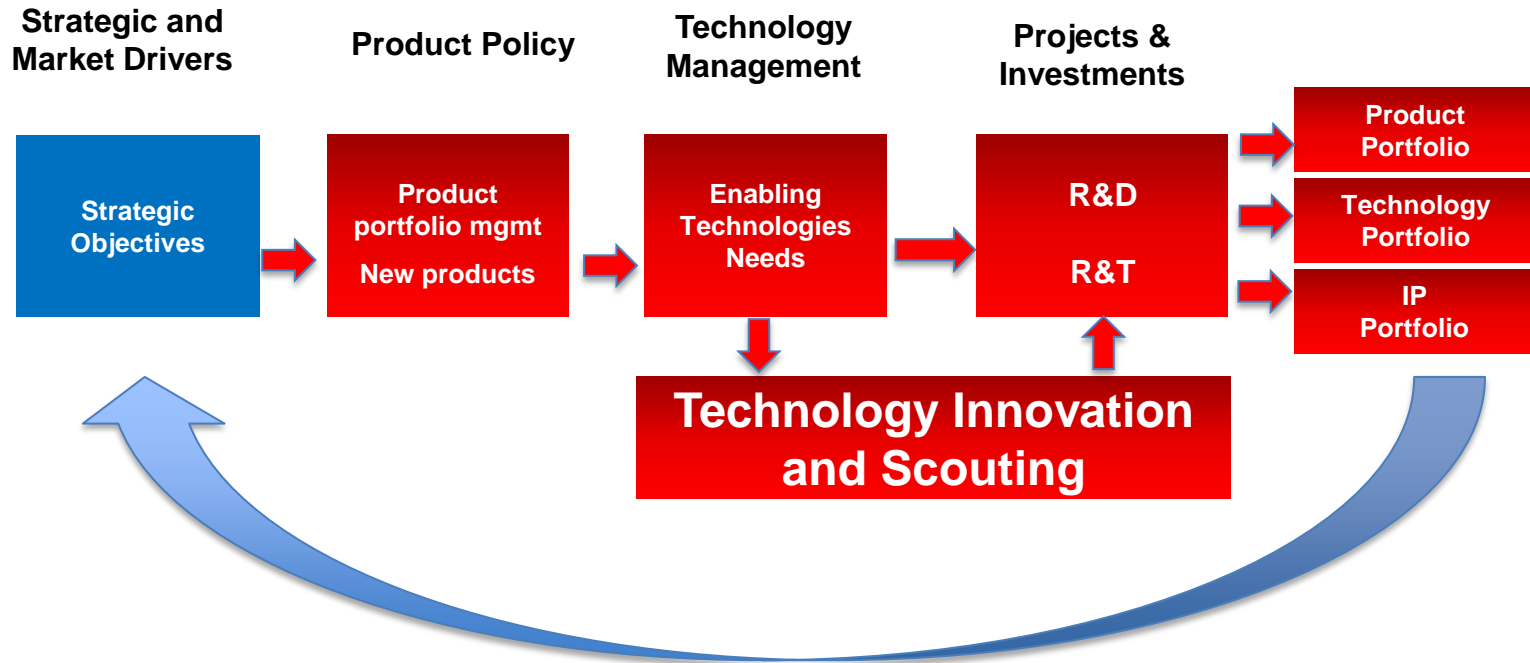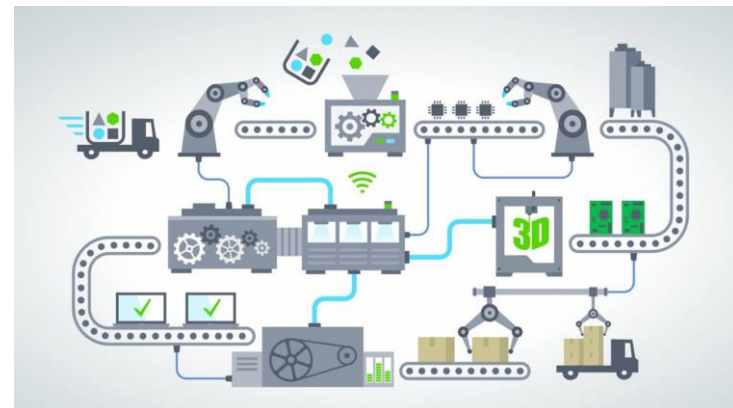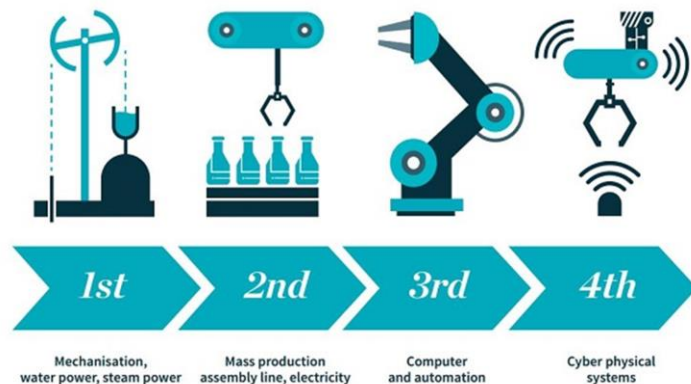
German Chancellor Angela Merkel defined 'Industry 4.0' as

"*the comprehensive transformation of the whole sphere of industrial production through the merging of digital technology and the internet with conventional industry*"
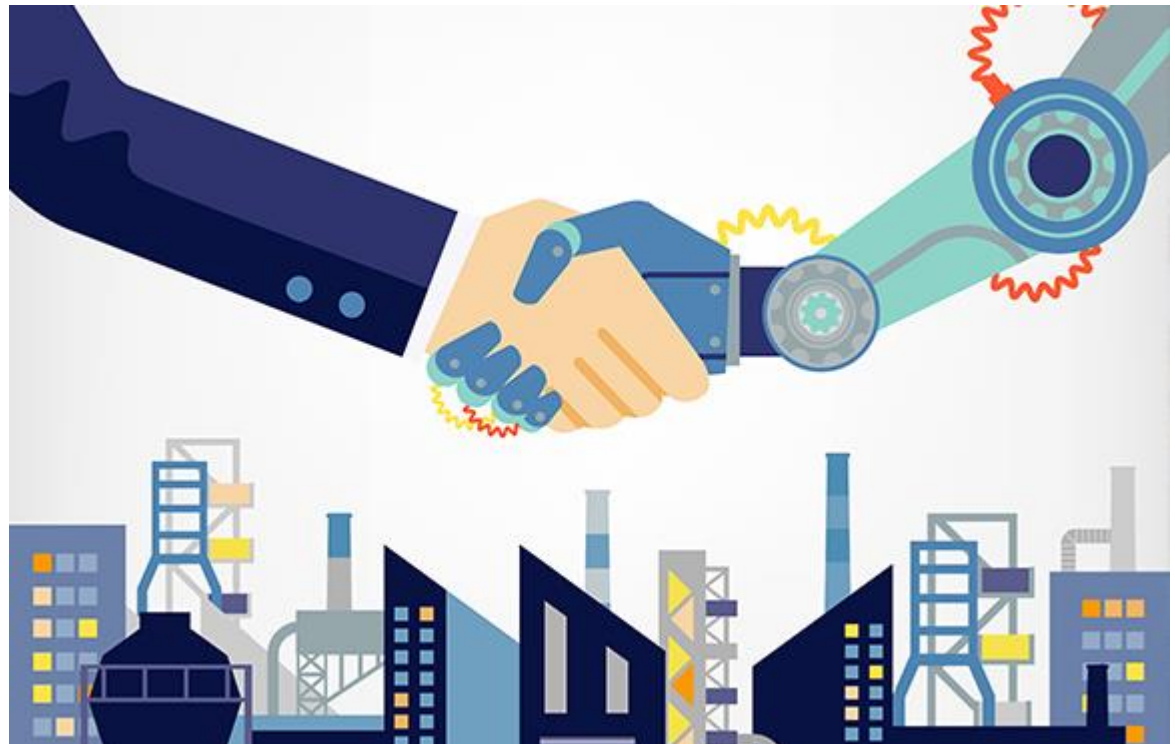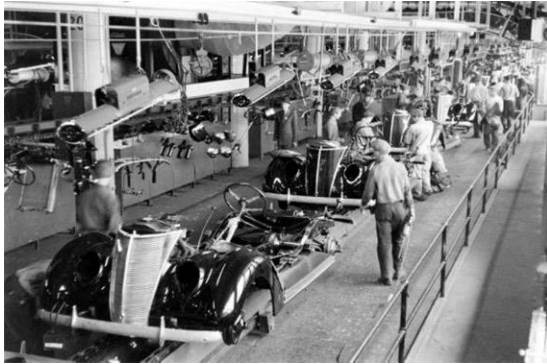
The 4ᵗʰ industrial revolution

According to Philippe Bartissol, VP Industrial Equipment at Dassault Systèmes, the **fourth industrial revolution** is characterized by:

- a **social production** that brings all stakeholders together to boost productivity and competitiveness;
- a **flexible production** schemes that enables to deliver exactly what consumers want and still control costs and make a profit;
- a **smart production** systems that connects products, machines, plants and people;
- **producing services** that provide consumers with the best experiences and ensure a better margin for producers.

1st Mechanisation, water power, steam power
2nd Mass production assembly line, electricity
3rd Computer and automation
4th Cyber physical systems

Product Line Efficiency and Value Chain (1/2)



1. Batch size tends to be one without any impact on production efficiency,
2. Through the Internet, the customer enters into the design phase of "one-of-a-kind" products matching individual requirements,
3. Through the Internet, the customer negotiates product delivery details,
4. Through the IoT, the entire product lifecycle is kept under control,
5. A whole set of IoT-based and data-based additional services (XaaS) beyond the product can be made available,
6. Consumers becoming "Prosumers",
7. Data as the most valuable asset,
8. Integration and cross-fertilization of different sectors as a success key.
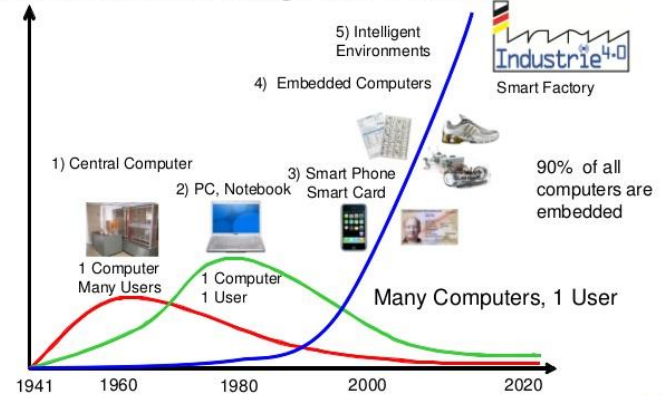
Product Line Efficiency and Value Chain (2/2)
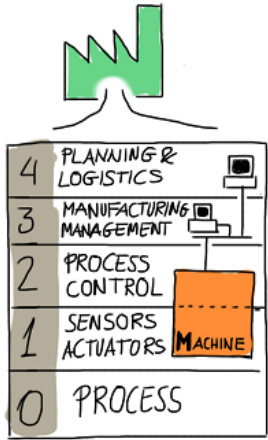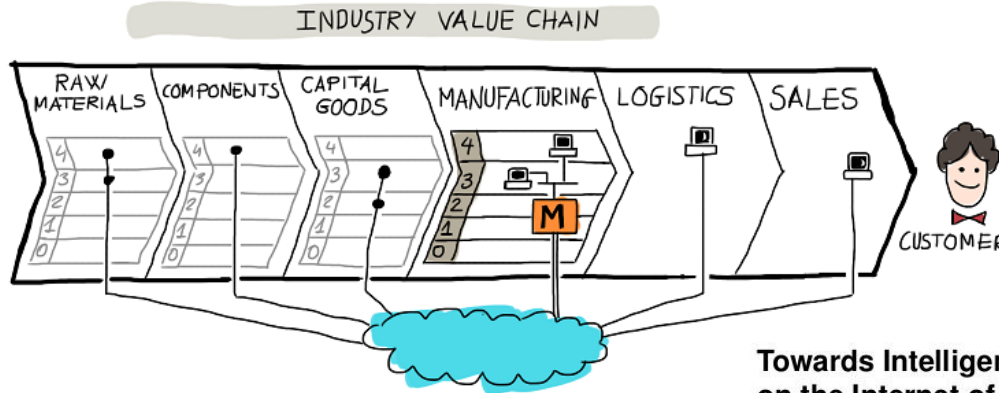
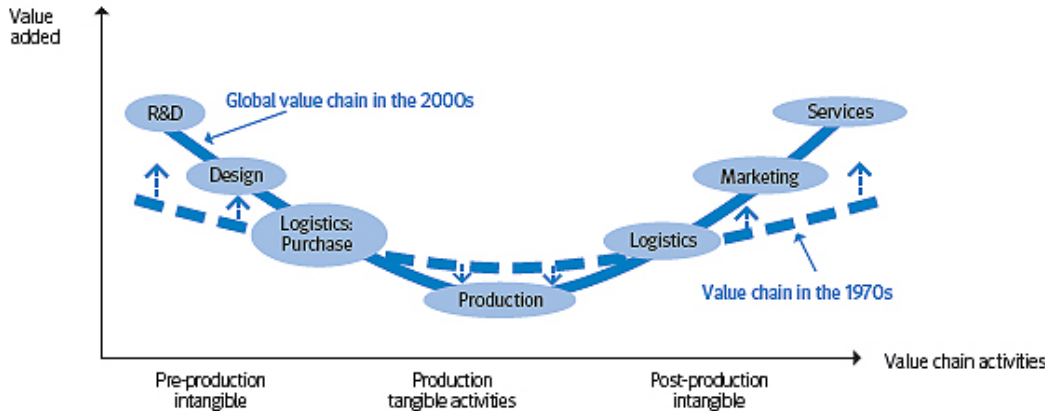# Technologies, Tools and Capabilities for Industry 4.0 (1/2)

Industry 4.0 is grounded on a proper 'blend' of underlying technologies, tools and capabilities, effectively integrated with manufacturing:

- **Microelectronics & Materials**
- **Power supply (Batt., Harv., …)**
- **Ubiquitous sensing & computing**
- **Internet of Things**
- **Big Data and Analytics**
- **Machine Learning**
- **Processing (Multicore, FPGA, …)**
- **Cloud computing**
- **Digital fabrication (3D Printing, …)**
- **Advanced Manufacturing**
- **Systems Integration**
- **Augmented Reality**

- **Robotics (Cooperative Robotics)**
- **Artificial Intelligence**
- **Autonomy (Drones, …)**
- **Communications (4G, 5G, …)**
- **Cyber security**
- **Personal devices (wearable…)**
- **Modes of collaboration (Integration, Open Source, Open Innovation, Crowdsourcing)**
- **Customer interaction (Social Networks, Communities of Interest, …)**

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Technologies, Tools and Capabilities for Industry 4.0 (2/2)
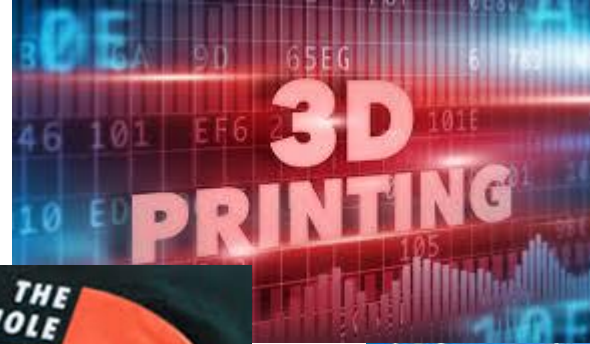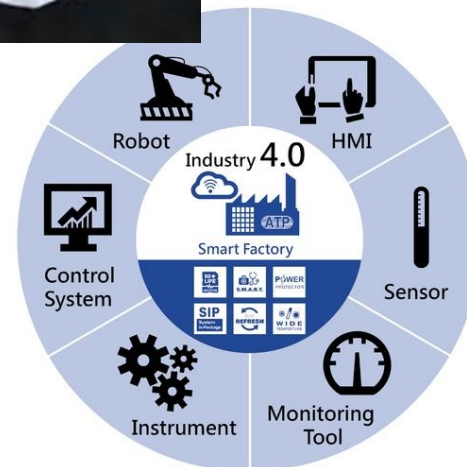
The Right Mindset for steering Industry 4.0 change (my very personal opinion)
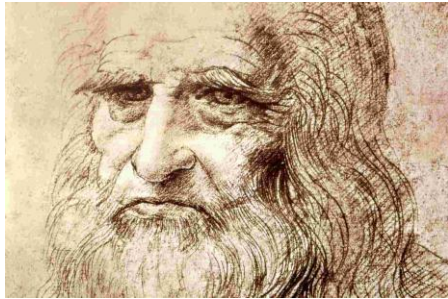
Universal genius, prime exemplar of the Renaissance man, he was an individual of unquenchable curiosity and feverishly inventive imagination. Credited with the inventions of the parachute, helicopter and tank
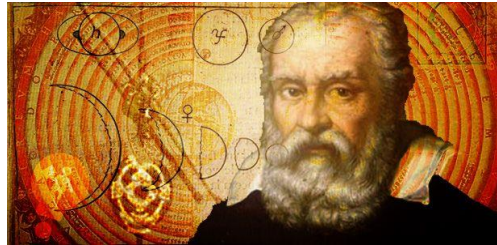
He played a major role in the scientific revolution of the seventeenth century. He used experiments as a research tool. He also worked in applied science and technology inventing an improved military compass and other instruments. He was tried by the Inquisition and found "vehemently suspect of heresy"

He held that passion rather than reason governs human behavior and argued against the existence of innate ideas, positing that all human knowledge is ultimately founded solely in experience
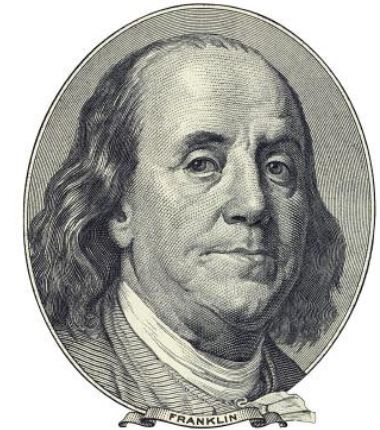
He was one of the Founding Fathers of the United States. He was a renowned polymath and a leading author, political theorist, politician, scientist, inventor, civic activist, statesman, and diplomat

Industry 4.0 for Aerospace and Defence

Aerospace, **Defence** and **Security** Sectors are among the most receptive ones to the change brought by Industry 4.0.
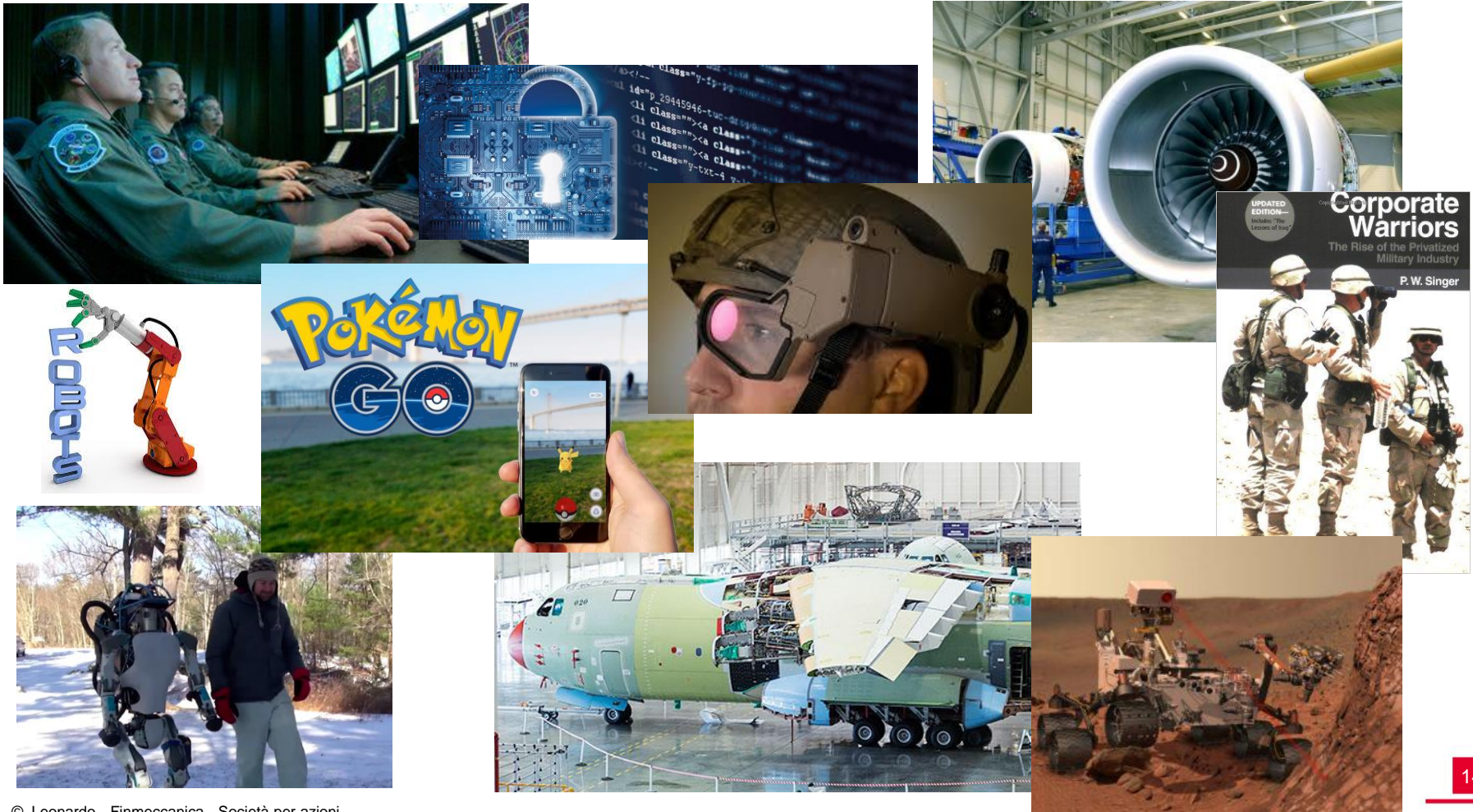
Example 1: Big Data and Predictive Models for Maintenance

Leonardo's co-innovaton with SAP

- The innovation project about Big Data for Predictive Maintenance carried out with SAP has been awarded with a special mention in the category "ideas"

- It could have a significant impact on the business, as the first example of predictive maintenance of a Leonardo system

- It could enable a shift toward "servitization", transforming products into services (pretty the same model Rolls Royce adopted for jet motors)

LEONARDO
LAND & NAVAL DEFENCE ELECTRONICS

Roma Tiburtina, 9 Novembre 2016

RaaS - Radar as a Service -
SAP HANA e Predictive Analytics
per la Manutenzione Predittiva di
Radar e di Apparati Complessi

CATEGORIA: IDEA
MENZIONE SPECIALE

Team Leader: Alessandro Garibbo
Team: Enrico Boccola
Gianfranco Caminale
Andrea Canziani
Giovanni Di Marco
Valentino Di Prisco
Massimiliano Filippi
Elio Giusto
Vincenzo Guarino
Luigia Paccoia

PREMIO INNOVAZIONE

Lorenzo Mariani
Division Managing Director

SAP HANA

Example 2 : Additive Manufacturing in Leonardo

Microwave waveguides for Radar system

Ducts for M346 trainer

Antenna Pedestal Arms for Radar system

Winch case for Helo equipment

Focus on Cyber Security
Markets and Value Proposition

PUBLIC SECTOR

Public Administrations, UE

We are Global Provider of secure-by-design & integrated digital platforms, solutions and services supporting top critical programs in *e-Government, Welfare, Education, Justice* addressing the country-system digital transformation within *EU/Italian Digital Agenda* enabling citizens, enterprises and organizations to carry out their collaborative dialogue and business relationship with government institutions in a more inclusive, efficient and cost-effective way.

DEFENCE

MoDs, Blue Lights, NATO

We partner Law Enforcement Agencies and Blue Lights in national investigation, strategic intelligence and interdiction of the crime through evolved Investigation Support Systems for the research, collection and analysis of critical information.

We **support Governments to prevent and manage cyber threat** within *national/international/sovranational Security Programs*.

LARGE ENTERPRISE

Oil , Gas & Energy, Manufacturing, Aerospace, Services

We deliver services, products, and turn-key solutions for the **Global Security Governance of the National Critical Infrastructures (CNI):** from information and events interception/ capture/ management/ elaboration/ correlation up to ICS SCADA systems cyber security.

Leveraging deep knowledge of key industrial processes and emerging digital technologies, we offer to the Large National Enterprise innovative solutions & services **supporting customers in their transformation path of production, maintenance and supply chain processes** towards *"high-velocity & hyper-connected & hyper-convergent enterprise" models Industry 4.0.*

Cyber Security

Offer portfolio, technological assets and competences

We offer solutions and services that enable our customers to proactively protect their sensitive information and assets through the prevention and identification of vulnerabilities, last generation threats and cyber attacks, managed security and incident handling

	PREDICTIVE	PROACTIVE & REACTIVE	SECURITY QUALITY MANAGEMENT
SOC / **TACTICAL**	• Early Warning • Data Breach	• Log Management • Security Device Mgmt • Real Time Security Monitoring • Advanced Threat Protection • DDoS Mitigation • Data Loss Prevention • Database Security	• Anti-phishing • Black Market monitoring • Brand Reputation • Socio-political events monitoring
CSIRT / **STRATEGIC**	• Pre-planned attack • Hacktivism	• Incident Response • Malware Analysis • Vulnerability Assessment • Penetration Test • Code Review • Digital Forensics	• Brand Abuse • Identity Fraud detection • GEO • Activism • Counter Terrorism • Law enforcement investigation
PROFESSIONAL SERVICES	• Threat Intelligence Case Report	• Security posture review • Security Device Policy Review • Security SCADA • SIEM Review and Development	• Compliance • Assessment/Audit • Risk Management • BC & DR planning • Security awareness • Training • Certification • Social & Security Threat Intelligence Case Report • Fraud Detection Case Report

(ASSET / IoC shown as row grouping labels on left)

Our technological assets:

► **3 Security Operation Centers in IT and UK**

► **1 Intelligence Operation Center** (IoC) fully specialized in open-source intelligence (OSINT)

► **First Next Generation SOC intelligence-driven** in Italy (Chieti)

► **High Performance Computing Center**

125 cyber security professionals & experts

Outsourcing / co-sourcing / on-demand service model for **on premises/ partially remote/ full remote support** on Delivery, Managing, Monitoring & Incident Handling

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Current top customers & projects:

► **For Public Sector**: *INPS* Fraud management system, *Italian Foreign Affair* managed cyber security

► **For Defence**: *NATO* Cyber Defence, *Italian Army* CERT, *Italian MoD* SOC & CERT, *Italian Navy* SOC,

► **For Large Enterprises**: *Telecom Italia* SOC, *ENEL* security assessment ICS SCADA, *ENAV* SOC and E-net
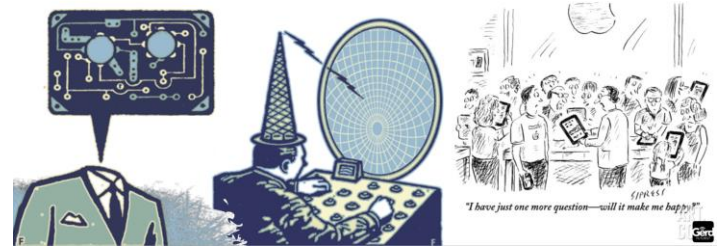
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Challenges and Opportunities

Machine Thinking & Internet Centrism: all that's missing is **human** happiness!

New business models

❑ The potential uses of Industry 4.0 go far beyond the optimisation of production technologies. In fact, new business models are emerging. According to McKinsey's Cornelius Baur and Dominik Wee, new business models created by Industry 4.0 can be classified in four categories:

- Platforms,
- Pay-by-use and subscription-based services,
- Licensing intellectual property,
- Businesses that monetize data.

❑ However, social issues Industry 4.0 would introduce on a global scale are even more challenging, because this fourth industrial revolution is likely to increase the gap between the richest and the poorest countries, worsening income inequality.

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What are the developments we should expect

❑ The majority of business models related to manufacturing and maintenance will be reinvented.

❑ The emerging concept, known as 'product-as-a-service' (→ XaaS, Offer as a Service) transforms service from a standalone function within a manufacturer to an integrated product and service offering that delivers value as the product is in use.

❑ Probably, a limited number of machinery suppliers will gain the Industry 4.0 standards competition and will impose their network-enabled products on the global market anticipating the obsolescence of most of legacy machinery.

❑ Countries, or regions, where SMEs have been 'vertically' grouped and organised in so-called 'Productive Districts' will enjoy a conspicuous advantage in implementing Industry 4.0 concepts, since - in general - Productive Districts are endowed with shared ITC infrastructure and common data bases.

Potential Disruptions (1/4)

Potential disruption (2/4)

- ❑ A world of customer experiences, data-based services, and asset performance through analytics requires new forms of collaboration and interaction, evolving at the speed at which innovation and disruption are taking place.

- ❑ This will produce conspicuous effects at societal level, the same way social networks have changed individual and collective habits and customs.

- ❑ Business leaders and senior executives, as well as policy-makers, need to understand and properly deal with this restlessly changing environment.

- ❑ One aspect to be kept in mind is the necessity to protect individual aspirations against their consolidation into groups' behaviour, needs and requirements.

- ❑ The ability of government systems and public authorities to adapt will determine their success.

❑ The fourth industrial revolution will surely affect the labor market. The majority of jobs created by Industry 4.0 in developed countries will probably be 'freelance', temporary jobs rather than full-time permanent ones.

❑ The trend toward a 'gig economy' , or – pretty equivalently - toward an 'Uber-ization of the workforce', has begun, resulting in a shrinking of the middle-class.

❑ A mobile, global, free-floating workforce can mean talent shortages, intense competition for top talent and a workforce where the expectations of one generation may be opposite of those of previous generations.

❑ Disgruntled workers could put in place a sort of 'neo-Luddism' characterized by forms of sabotage from inside the system, with effects even more devastating than those provoked by the practice of 'hacking' and 'hacktivism' on computer systems.

❑ Concerning sabotage and terrorism, it is apparent that data security is crucial for all industries. This is even more concerning in an Industry 4.0 context, given the sharing of multiple industries' data on the same system of systems and the massive level of interconnection.

❑ A single well-targeted cyber-attack may succeed in taking the control of an entire nation level industrial system.

❑ Therefore, the acceptability and operability of Industry 4.0 depends on how robust security standards are, while Industry 4.0 infrastructure should be considered, managed and protected - as a critical national (or transnational) infrastructure.

Emerging Countries

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Emerging Economies: Dramatic Gains

Ranking by share of global nominal manufacturing gross value added

Rank	1980	1990	2000	2010
1	U.S.	U.S.	U.S.	U.S.
2	Germany	Japan	Japan	China
3	Japan	Germany	Germany	Japan
4	UK	Italy	China	Germany
5	France	UK	UK	Italy
6	Italy	France	Italy	Brazil
7	China	China	France	South Korea
8	Brazil	Brazil	South Korea	France
9	Spain	Spain	Canada	UK
10	Canada	Canada	Mexico	India
11	Mexico	South Korea	Spain	Russia
12	Australia	Mexico	Brazil	Mexico
13	The Netherlands	Turkey	Taiwan	Indonesia
14	Argentina	India	India	Spain
15	India	Taiwan	Turkey	Canada

Relative Role of Manufacturing

Manufacturing as a percentage of national GDP in 2010

Country	Average 17
China	33
South Korea	28
Indonesia	25
Japan	20
Germany	19
Mexico	17
Italy	15
Russia	14
Brazil	13
India	13
Spain	12
U.S.	12
Canada	11
France	10
UK	10

Source: McKinsey Global Institute, IHS Global Insight, United Nations Statistics Division, BEA

Source: Mc Kinsey

THANK **YOU** FOR YOUR ATTENTION

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