XIII Italian-German Economic Forum
Research, development and innovation: a comparison between Italy and Germany

Deloitte and AHK Italien, June 2019
The importance of Innovation: a complex phenomenon

Italy and Germany: a macro-economic point of view

Italy and Germany: AI’s current state and development

Survey result analysis

Conclusions and key messages
The importance of Innovation
Innovation is complex but opens up new perspectives

Where are we going?

~50% executives say they don’t know what their industry will look like in 3 years

Where are we going?

One out of 2 Italian says they have fallen into the trap of fake news, which spreads 6 times faster than real news

...will be true?

Is it useful?

The safety of CRISPR-Cas9 gene editing is being debated

‘T. Cook says: personal data are weaponised against us’

An ever-smaller world

- **Hyperloop** will connect Dubai and Abu Dhabi in **12 min** (1.200 km/h)
- **I-Plane** will allow you to travel between the U.S. and China in **~2 hours** (8.600 km/h)

Increasingly smarter communities

- **Artificial moon** in Chengdu for **night lighting** by 2020
- Already in progress **home deliveries** with **autonomous vehicles** in Arizona

An increasingly healthy life

- Teams of **nanobots** to **operate inside** the **heart** and **brain**
- In **vitro "cultivated" burgers** instead of intensive farming
1. The importance of Innovation: a complex phenomenon
2. Italy and Germany: a macro-economic point of view
3. Italy and Germany: AI’s current state and development
4. Survey result analysis
5. Conclusions and key messages
Italy and Germany: a macro-economic point of view

The innovation context of a country is directly influenced by its industrial context, and it is especially true in developed countries such as Italy and Germany. Among the variables that determine the industrial context of a country, Italy and Germany present differences in terms of industrial structure, firms collaboration with research institutions, organizational capabilities.

**Industrial structure**

- Firms with 0-9 employees: 82% (Italy) vs. 61% (Germany)
- Large firms collaborating: 28% (Italy) vs. 6% (Germany)
- SMEs collaborating: 6% (Italy) vs. 15% (Germany)
- Qualification mismatch (under): 22% (Italy) vs. 11% (Germany)
- Qualification mismatch (over): 13% (Italy) vs. 23% (Germany)

**Firms collaboration with research institutions**

- SMEs collaborating: 44% (Italy) vs. 15% (Germany)
- Large firms collaborating: 15% (Italy) vs. 6% (Germany)

**Organizational capabilities**

- Qualification mismatch (under): 11% (Italy) vs. 23% (Germany)
- Qualification mismatch (over): 13% (Italy) vs. 23% (Germany)

Source: Eurostat, OECD
Italy and Germany: a macro-economic point of view
The innovation capabilities of a country can be measured in different ways as suggested by international report and studies

According to a Deloitte framework focused on digital innovation capabilities, three main pillars of variables should be used, that are: talent, start-ups, investments and patents

In some performances and indicators, Italy and Germany are close... ...in other ones, they present some differences

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>35%</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Start-ups</th>
<th>Total tax and contribution rate(2018)</th>
<th>Early-stage VC investment as % of GDP (2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>53%</td>
<td>0,4%</td>
</tr>
<tr>
<td></td>
<td>49%</td>
<td>2,4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investment &amp; Patents</th>
<th>Value added of ICT sector as % of total value added (2017)</th>
<th>Business Enterprises Expenditure on ICT R&amp;D as % of GDP (2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,6%</td>
<td>0,1%</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>0,4%</td>
</tr>
</tbody>
</table>

Source: OECD, THE, GEM-World Bank, ITU
Italy and Germany: a macro-economic point of view
In recent years, there has been a sharp slowdown in labour productivity growth

Italy and Germany have some differences in terms of industrial structure and digital innovation capacity. However, both countries and the most developed economies are suffering a slowdown in industrial productivity.

In this scenario, new technologies have a large potential to contribute to global economic activity.

In the past, the introduction of steam engines during the 1800s boosted labour productivity by an estimated 0.3% a year, the impact from robots during the 1990s around 0.4%, the spread of IT during the 2000s 0.6%.

It has been simulated that Artificial Intelligence could potentially deliver 1.2% additional growth by 2030.

Source: OECD, ITU
1. The importance of Innovation: a complex phenomenon
2. Italy and Germany: a macro-economic point of view
3. Italy and Germany: AI’s current state and development
4. Survey result analysis
5. Conclusions and key messages
There are different ways to incorporate AI technologies.

**Artificial Intelligence**

**Machine Learning (ML)**
The ability to automatically learn and improve from experience, without being explicitly programmed

- Deep learning, supervised, unsupervised

**Natural Language Processing (NLP)**
The ability of a computer program to understand human language as it is spoken

- Content extraction, classification, machine translation, question answering, text generation

**Expert Systems**
Computer system that emulates the decision making ability of a human expert

**Vision**
The ability to see and understand digital images and video

- Image recognition, machine vision

**Speech**
The ability that enables the recognition and translation of spoken language into text and vice versa

- Speech to text, text to speech

**Planning**
The ability focused on increasing autonomy and flexibility through the construction of sequences of actions to achieve a goal

**Robotics**
The creation of devices that move and react to sensory input

Italy and Germany: AI’s current state and development
Italy and Germany: AI’s current state and development
Countries have understood the importance of having a national agenda

The Italian government has created a task force to develop and define the Italian AI strategy. The themes are:
- Enhancing AI research from lab to the market
- Permanent education and formation
- Promotion of qualified investments
- Data as a driver for production
- Regulations and ethics
- Improvement of the public services

The German government has invested €600M by 2020 (with EU contributions) with the aim to become leaders in the development and application of AI technologies. Germany’s competitiveness is to be underpinned with the strategy, it is to be ensured that the development and use of AI is responsible and that it is pursued for the common good. Within the framework of a broad dialogue within society and active political steering, AI is to be firmly anchored in society in ethical, legal, cultural and institutional terms.

Europe is currently behind in private investments in AI, for this reason:
- All member states have been encouraged to develop their national AI strategy
- AI investment for public and private sectors will have to scale up to reach the target of €20 billion per year in the next decade

Global leaders in AI benefit of significant public investment, contribution from corporate tech giants, and access to large sets of data

Over $4B by 2020
While little is being done on a national level, AI industry and research is led by academia and private industry in the US

Over $7B by 2030
Chinese efforts are mainly government led and have a strong research approach. China is determined to become world AI leader by 2030

Source: European Commission, Politico, Bloomberg
Corporations all around the world started incorporating AI technologies.

Both Italy and Germany are in the top 20 countries for number of artificial intelligence companies.

Germany has over 3 times the number of AI companies Italy has.

China has 7 times the number of AI companies Italy and Germany have combined, the US almost 14 times.
Italy and Germany: AI’s current state and development

Despite different level of investments, European Ecosystem is performing well in terms of research: Italy and Germany are active participants in this ecosystem.

Europe is the largest publisher of AI papers. In 2017, 28% of AI papers on Scopus were affiliated with European authors, followed by China (25%) and the U.S. (17%).

Italy and Germany perform above the average and Italian researchers have an impact on German research strategy.

- Two experts from Fondazione Bruno Kessler (FBK), one of the leading research centers for AI in Italy, are supporting German government in the evaluation committee for Artificial Intelligence research in Germany.
- During the 2018 AAAI (Association for the Advancement of Artificial Intelligence) conference China and U.S. submitted about 70% of papers. However, Italian and German papers received the highest acceptance rates, 41%, compared to the 21% of China and the 28% of U.S.
- European Research Council (ERC) is going to fund 222 researchers with 540 € million in 2019, to boost cutting edge research projects in AI. German researchers are the second most represented country with 15%, while Italy is the fourth, with more than 10% of the total.

Source: Elsevier, ERC
1. The importance of Innovation: a complex phenomenon
2. Italy and Germany: a macro-economic point of view
3. Italy and Germany: AI’s current state and development
4. Survey result analysis
5. Conclusions and key messages
Top performers worldwide and success factors

Today

In 10 years

The political and regulatory context is not yet perceived as conducive to the adoption of AI technologies

19% context ready vs 81% little prepared or not at all

20% context ready vs 80% little prepared or not at all

Public investment in R&D

Private investment in R&D

Availability of qualified people

Success factors

Top performer

1

2

3
98% of companies believe there will be a consolidation of AI technology.

98% of companies believe there will be a consolidation of AI technology.

The approach of companies in relation to the adoption of new technologies is mainly "wait-and-see" (47%) - They do not want to be the first in the sector to invest in technologies, but they try to adopt technological solutions in a gradual manner.
What are companies doing and how much are they investing

**What are companies doing?**

- **They have not yet begun to adopt AI**
- **Still in the preliminary study phase**
- **Already implemented some solutions**
- **They are an important centre of excellence**

**Among those who do NOT invest**

Average initial investment forecasted: *about 500k €*

**Among those who invest**

**In the last year**
- Less than 100k€: 47%
- From 100k€ to 1 M€: 19%
- From 1 M€ to 5 M€: 10%
- From 5 M€ to 10 M€: 7%
- 10 M€ or more: 17%

**In future, for 87% of both countries' companies, investments will increase, especially in 3 sectors**
- Industrial products
- Energy
- Technologies, Media & Telecommunications
...And in which technologies are they investing

What are companies doing?

- They have not yet begun to adopt AI
- Still in the preliminary study phase
- Already implemented some solutions
- They are an important centre of excellence

What are companies doing?

- Image processing (solutions to extract information from images)
- Autonomous Robot (able to move themselves or some of their parts without human intervention)
- Intelligent Data Processing (solutions for the analysis of structured and unstructured data)
- Image processing (solutions to extract information from images)
- Intelligent Data Processing (solutions for the analysis of structured and unstructured data)
- Virtual Assistant/Chatbot (software able to perform actions based on natural language commands)
- Intelligent Data Processing (solutions for the analysis of structured and unstructured data)
- Language Processing (solutions able to understand and create contents)
Challenges, risks and readiness of companies

3 main challenges for companies

- **Lack of expertise** in the company (e.g. developers, data scientists)
- **Integration problems** of AI into roles, functions and business processes
- **Data issues** (e.g. data privacy, access to quality sources, integration, training)

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried

Concern about AI-related risks (cybersecurity, ethical, legal)

- **61%** of companies are quite or very worried
- **80%** of companies are quite or very worried
Companies orientation towards employees

Following the development of AI’s initiatives, your company in the coming years is oriented to...

- **Introduce a small number of new talents, flanking/replacing them to the current ones**
  - 46%
  - 50%

- **Introduce a considerable number of new talents, supporting/replacing them to the current ones**
  - 21%
  - 30%

- **Maintain and train current employees**
  - 21%
  - 20%

- **Reduce current employees number**
  - 12%
  - 0%
1. The importance of Innovation: a complex phenomenon
2. Italy and Germany: a macro-economic point of view
3. Italy and Germany: AI’s current state and development
4. Survey result analysis
5. Conclusions and key messages
Conclusions and key messages

**Artificial Intelligence** will have a **strategic impact on** countries' **productivity**, becoming a fundamental factor for their economic development.

**Artificial Intelligence** is a technology that will be consolidated and will be **strategically important** for companies, indeed investments in AI will grow.

**Industrial context** has a direct **impact** on the **innovation capabilities** of a country and on the ability of its **companies** in adopting new technologies.

Both **lack of talents and political/regulatory context not ready** have an **impact** on the **perceptions** and **decisions of companies**.

**Italy** and **Germany** perform above the **average in the research field**, but they operate in a **fragmented context**.

Compared to major international player (China and US), there is a **lack of systemic approach and a shared European strategy** that increase the gap with big players.
Contacts

**Giovanni Gasperini**
Partner | Deloitte
335 7350619
ggasperini@deloitte.it

**Cristiano Camponeschi**
Partner | Deloitte - Officine Innovazione
348 4526682
ccamponeschi@deloitte.it

**Gabriele Secol**
Director | Deloitte - Officine Innovazione
335 7376981
gsecol@deloitte.it