Class
Industrial Policy in Emilia Romagna

IPS

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Industrial Development Policy of the Emilia-Romagna Region

RESILIENCE OF THE REGION TO SHOCKS

Structural changes involve more than just competition in markets: they involve industrial systems, that are embedded in regions, in specific institutional frameworks

Structural changes involve process or product innovation or upgrading, hence production re-organisation, hence changing division of labour

$\Leftrightarrow$ Changes in people (skills, working and social status) and in societies

What should be the objective(s) of industrial policy?

Firms or industry competitiveness?
Economic growth?
Industrial development?
Economic development?

⇒ Need for wider concept than growth

⇒ In practice, this means industrial policy is an "integrated" policy (must be comprehensive):

i.e. including instruments that ensure development of appropriate resources and competencies for industrial development

i.e. integrated with social and education policies: firms need human capital (appropriate skills) and social capital (partnerships of local producers, technological transfer U-I)

⇒ SOCIAL SUSTAINABILITY

Industries are complex systems, embedded not only in specific societies but also in specific environment

⇒Territorial planning, quality of living, environment for current and future generations is also key to ensure the development of the industrial system

⇒ integrated also means integration of environmental objectives

⇒ ENVIRONMENTAL SUSTAINABILITY

COMPETITIVENESS OF REGIONS?

Competitiveness concept leads to de-contextualised considerations (Bristow, 2010): determinants of competitiveness are the same for all regions, policy can be the same for all regions (called “one-size-fits-all” policies)

COMPETITIVENESS OF REGIONS?

Regional economists have shown that ‘place’ matters in determining how regions function, develop and evolve:

- socio-cultural characteristics are unique;
- History matters and determine specific path dependent processes

Major consequence:

- One-size-fits-all policies do not work
- Benchmarking policies and results in different regions may be useful but not to directly implement same instruments in different context: instruments have to be adapted to specific contexts.

(= true for any territory, region or nation)

CONCEPT OF RESILIENCE

= adaptation and adaptability

= used in literature on reaction to disasters and shocks

= comes from biological science, to define capacity of species to react to shocks

= appears useful in discussion of regional development and industrial policy

CONCEPT OF RESILIENCE

Has been increasingly used in regional studies to analyse the reaction of regions to external shocks.

What shocks? Financial crisis, natural catastrophes, war, coronavirus

Should industrial policy be aimed at resilience?

IF RESILIENCE IS ABOUT ADAPTATION AND ADAPTABILITY

IN TIME OF DEEP STRUCTURAL CHANGES (INDUSTRIAL REVOLUTION)

INDUSTRIAL POLICY SHOULD BE ABOUT RESILIENCE

Resilience

"the region's ability to experience positive economic success that is socially inclusive, works within environmental limits and can ride global economic punches" (Bristow, 2010, p. 1)

RESILIENCE = adaptation + adaptability

The ER region has shown both adaptation and adaptability:

Adaptability (LT): shift from industrial system essentially based on industrial districts in traditional sectors (industrial policy) to regional innovation system

Adaptation (ST): recovery after earthquake in May 2012

(other shocks: financial crisis, now coronavirus)

Regional resilience:

- Capacity of regions to reshape their socio-economic structure (Boschma)
- Regions as complex adaptive systems (Martin and Sunley; Bristow and Healy)
- Dynamic process
- Adaptation: capacity to maintain a specific development path (ST)
- Adaptability: capacity to embark into new development paths (LT)

Trade-off adaptation and adaptability

Grabher:

Adaptation requires increased specialisation, strong cohesion of the regional system

Adaptability requires diversification (related variety), redundancy and loose couplings

Loose couplings regard local social networks = networks that are open to novelty, to diversity

Factors for regional resilience

3 main categories of factors outlined in the literature:

1. Structure: specialisation (what sectors?), firm size, knowledge base, etc.
2. Agency: role of people, networks, social capital (capacity of people and organisations to relate, to exchange ideas; trust between people)
3. Governance: how and what policies and institutions are defined

Interplay of the three categories of factors in the case of adaptation and adaptability of a region:

The Emilia-Romagna region in Italy, 1980s to today

INDUSTRIAL POLICY IN THE EMILIA-ROMAGNA REGION: a long tradition

(Bianchi and Labory, 2011, 2014)

- 1980s: ER is model of flexible specialisation, with industrial districts in traditional sectors (Brusco, Sabel,…)
- 2000s: ER is model of regional innovation system, innovative region

HOW DID THIS CHANGE HAPPEN?

Role of **comprehensive industrial policy**: social policy, territorial policy, education and vocational training, as well as innovation policy

- 1980s: focus on social services (to firms and to families and workers); education (technical schools)
- End 1980s: already doubt about the capacity of the district model to face changing competitive environment
- 1990s: policy aimed at building regional innovation system

The ER region stands out as a case of late but rapid industrialisation.

The agricultural sector still prevailed in the region by the mid-20th century:

Percentage of active population in agriculture was 52 percent in 1951, against 32 per cent in Italy as a whole.

Most people employed in agriculture were sharecroppers or small farm-owners who had an experience of small farm entrepreneurship (Zamagni, 1997).

During the 1950-80 period ER went through a staggering process of industrialisation.

% pop in agriculture fell to 13% in 1981

% pop in industry increased to 38 % in 1981

➔ER became the region with highest per capita income in Italy in the 1980s

➔ Industrialisation came about in rural areas as well as in towns: food industry important in rural areas; some proto-industrial activities transformed into industrial ones, as in the case of Carpi where the process of osier shavings to make straw hats evolved into knitwear manufacturing

The leading sector of Emilian industrialisation was mechanical engineering, in Bologna, Modena, and Reggio Emilia.

After WWII, this know-how was used to meet a booming demand, as industries producing consumer goods required machinery for the manufacturing and packaging of their products.

➔ Orientation of mechanical engineering in ER towards the production of machines for different types of industry and agricultural activities, including luxury cars, which brands became famous worldwide (Ferrari, Maserati, and Lamborghini)

Industrial development was driven by a very high market demand and the possibility of undertaking production with limited capital.

Production was carried out by only two firms in the packaging industry of Bologna, during the period 1900 to 1950. The number of firms increased to almost 100 for the production of various machines, and to 200-300 supplying special parts and processes to the former, over the 1950 to 1970 period (Capecchi, 1990, 1997).

The distribution of the labour force among industries in ER was similar to that prevailing in the rest of Italy. What significantly differed was the size distribution of firms.

The proportion of the labour force employed in small firms was indeed higher in ER than in Italy as a whole.

The relationships amongst such firms evolved and gave rise to particular production systems called industrial districts (IDs).

Firms were frequently clustered in monocultural areas in which all firms had a very low degree of vertical integration and the production process was carried out through the collaboration of a number of firms.

In these areas, only a proportion of the small enterprises produced finished goods, while the others were their subcontractors.

Examples of IDs: knitwear and garment in Carpi, ceramic tiles in Sassuolo, mechanical engineering in Bologna, Modena and Reggio Emilia, biomedical products in Mirandola, food processing in Parma, machine tools in Piacenza, shoe manufacturing in Fusignano and San Mauro Pascoli (Brusco, 1982).

Industrial policy was focused on SMEs:

Particularly, real services to SMEs (support to SMEs in management, product development, internationalisation)

As well as infrastructure (transport, energy, communication)

And training to the labour force (particularly in technical schools, developing programmes jointly with firms)

ERVET development agency created in 1970 to support regional policies

The ER industrial structure has changed since 1990

Decline of low tech industries (textiles and garment; leather and footwear; wood and furniture; paper and printing)

Growing importance of the medium and high-tech industries, especially chemicals and mechanical engineering.

The regional industrial system remained diversified but with a more knowledge-intensive mix of sectors

Table 1. Employees in manufacturing in ER, by sector (%)

Sector	1981	2011
Food	16.1	11.6
Textiles and clothing Leather and footwear	28.7	15.5
Wood and furniture Paper and printing	14.6	4.6
Chemicals, petrol and rubber Non-metal minerals	7.1	18.7
Mechanical engineering	31.7	40.0
Other	1.8	9.6
Total	100	100

Today, ER is among the most dynamic EU regions.

Number of firms per inhabitant higher than in other Italian regions.

The regional economic system is increasingly focused on international markets and features a high rate of entrepreneurship, a strong manufacturing sector, a high level of innovation, and GDP per capita higher than the Italian and EU average (Bianchi & Labory, 2019).

ER accounts for 12 percent of intramural expenditure in R&D in Italy.

As a ratio to GDP, R&D expenditure in ER is substantially higher (1.8%) than in Italy as a whole (1.3) (2015)

Concerning patent applications to the European Patent Office (EPO) per million inhabitants, the region is above the EU28 average: 127.4 in ER, 62.2 in Italy and 112.7 the EU-28 average in 2011

(See https://www.regione.emilia-romagna.it/en/research-and-innovation)

1990: ER government dialogue with stakeholders and expresses concern that ID in traditional sectors might not continue being competitive in the new competitive context

Hence start policy to become regional innovation system

i.e. support to

- The development of new sectors
- Upgrading of existing sectors

Different measures taken, including

- Technological districts
- Creation of ASTER (1993) to favour technological transfer within the region
- Training of medium – high skills
- Progressively also links industry – universities are stressed

End 1999:

Industrial policy competence is transferred to regions

ER is one of the first to design and implement IP

Programming in 3-year plans

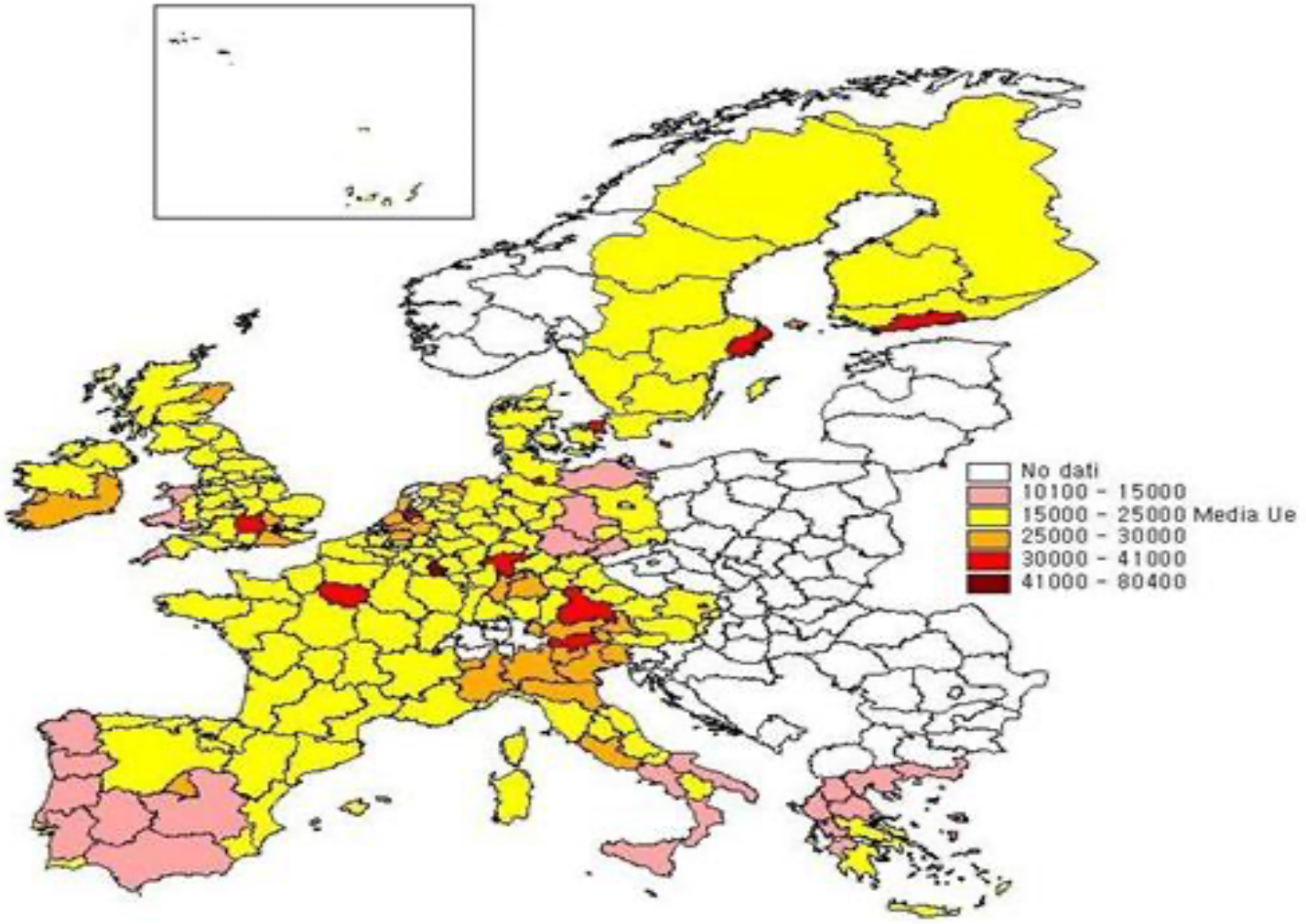
Focus on innovation and technology transfer

Policy also oriented towards larger firms (attraction of FDI under conditions that foreign firms embed in the region)

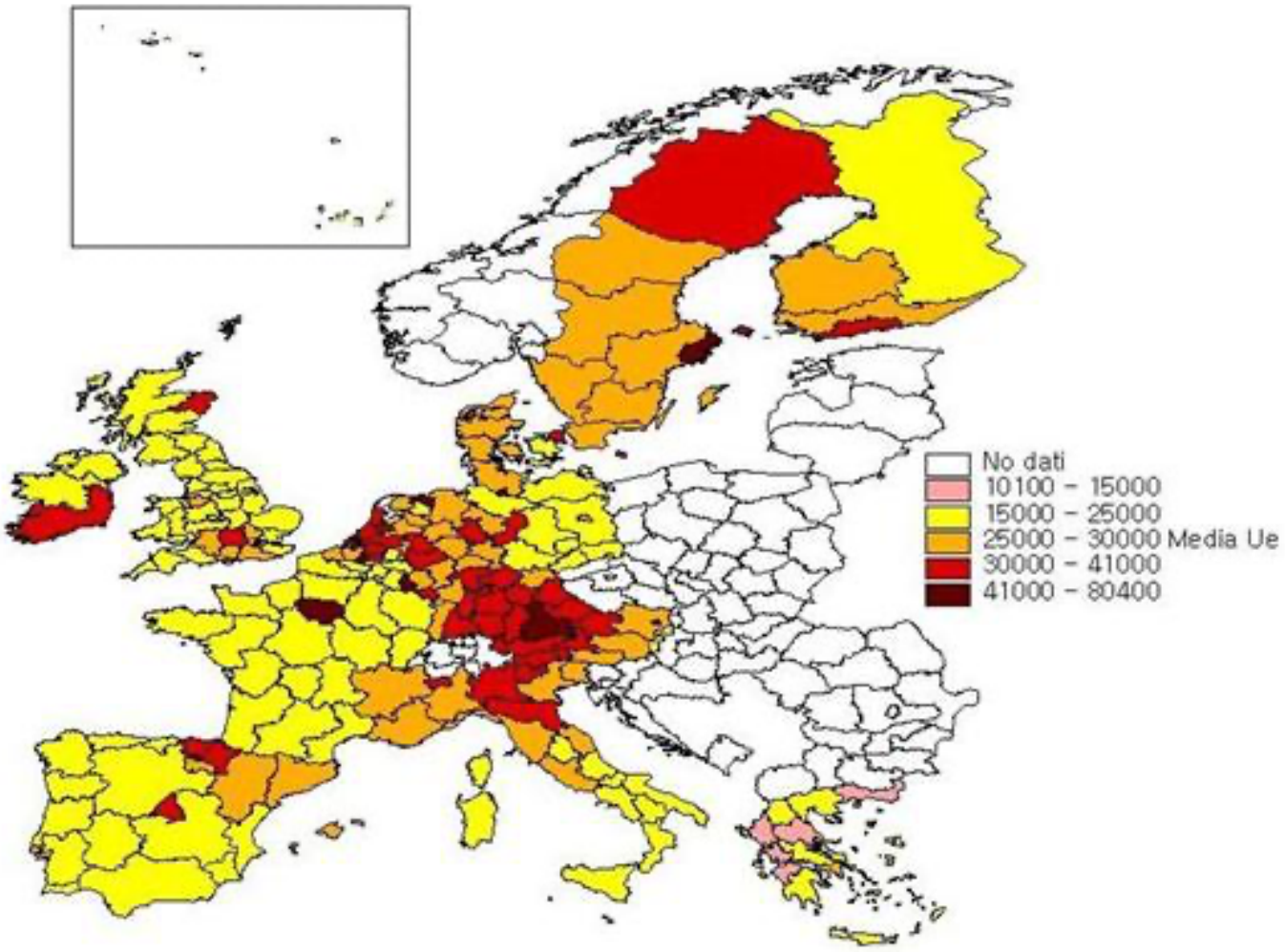
LONG-RUN STRUCTURAL CHANGES IN THE ER REGION

- Change in firm structure towards more medium firms and groups
- ROLE OF MECHANICAL ENGINEERING SECTOR IN UPGRADING OF ALL REGIONAL SECTORS (BIOMEDICAL, FOOD, CERAMICS, AUTOMOTIVE AND TRANSPORT EQUIPMENT, ETC.)

GDP per capita, 2000



GDP per capita, 2011



SECTOR SPECIALISATION
% of manufacturing, ER

	1981	1991	2010
Food industry	16.1	11.7	11.6
Textile and clothing	28.7	25.3	15.5
Leather and footwear			
Wood and furniture	14.6	11.1	4.6
Paper and printing			
Chemicals, petrol and rubber Non metal minerals	7.1	6.5	18.7
Mechanical engineering	31.7	38.8	40.0
Other	1.8	6.6	9.6
Total	100	100	100

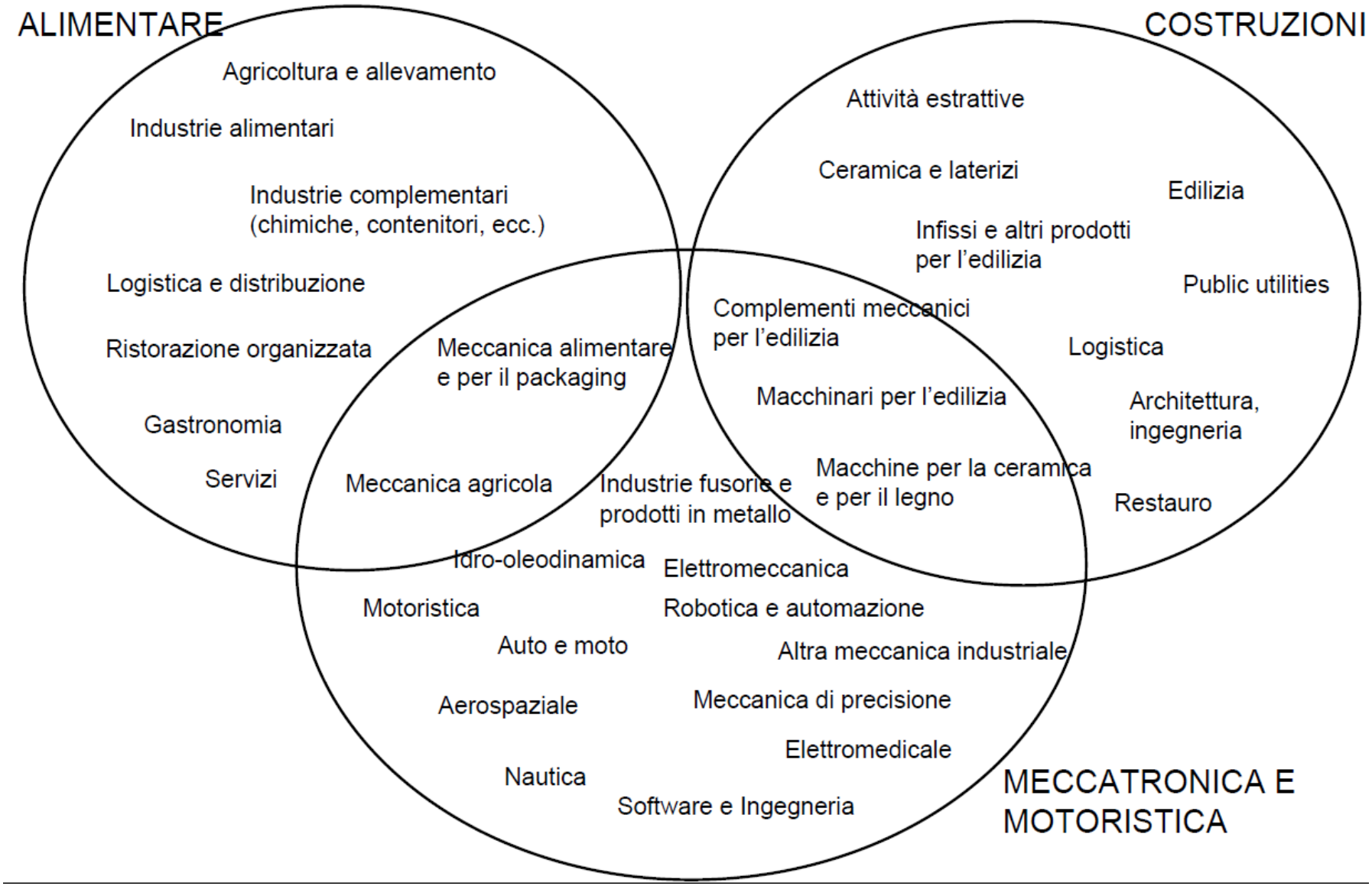
Related variety

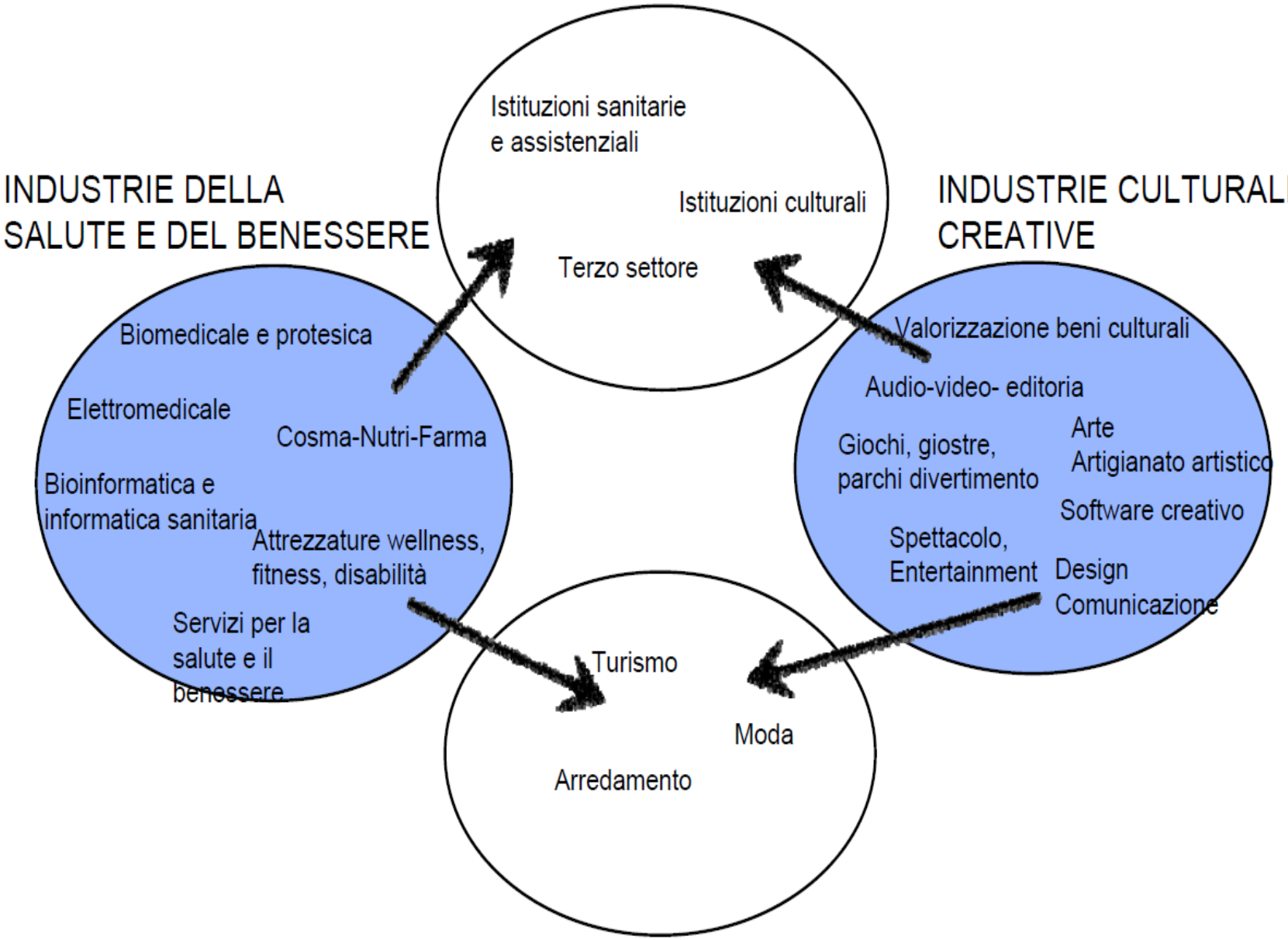
Identification of technological priorities of the region (2014-2020):

Based on industrial specialisation and research competencies: strategic sectors

1. Food industry
2. Building
3. Engineering and robotics
4. Health industry
5. Cultural and creative industries

Major specialisations in the region in 2014: VIEW AS SYSTEMS




INDUSTRIE DELLA SALUTE E DEL BENESSERE
Biomedicale e protesica
Elettromedicale
Cosma-Nutri-Farma
Bioinformatica e informatica sanitaria
Attrezzature wellness, fitness, disabilità
Servizi per la salute e il benessere
Istituzioni sanitarie e assistenziali
Istituzioni culturali
Terzo settore
INDUSTRIE CULTURALI E CREATIVE
Valorizzazione beni culturali
Audio-video- editoria
Arte
Artigianato artistico
Giochi, giostre, parchi divertimento
Software creativo
Spettacolo, Entertainment
Design
Comunicazione
Turismo
Moda
Arredamento

Multilevel governance

From the 1990s:

- No national industrial policy (especially late 90s to today)
- Industrial policy carried out at regional level using European structural and social funds

$\Rightarrow$ Industrial strategy and policy defined following strategic orientations of the EU (now smart growth, sustainability, social cohesion – see class on smart specialisation)

FACTORS OF RESILIENCE:

- STRUCTURE: related variety (mechanical engineering) + constant attention of policy-makers to favouring cross-synergies between sectors

- AGENCY: strong social cohesion maintained and strengthened by policy (favouring participation in the labour force, integration of immigrants, besides training and education)

- GOVERNANCE: dialogue with stakeholders; anticipation (pro-active); leadership

GOVERNANCE:

- Dialogue with stakeholders to define policy: regular conference including regional stakeholders (industry, worker representations, local governments) discussing challenges and defining policy (Conferenza per l'economia e il lavoro)

- anticipation: already end-80s worry about the competitiveness of industrial districts and therefore investigation about the opportunity to embark on alternative development paths (policy is pro-active)
- leadership: (risky) choice made to embark on innovative path

ANOTHER EXAMPLE:
MANAGING THE EMERGENCY: THE CASE OF THE RECONSTRUCTION OF THE EMILIA-ROMAGNA REGION AFTER THE EARTHQUAKES OF MAY 2012

Earthquakes

On 20 May 2012, eathquake of magnitude 5.9 degrees on the Richter scale; 29 May a second earthquake of magnitude 5.8

Big physical damages (few injuries)

THE EARTHQUAKE AFFECTS AN AREA OF THE REGION WHICH IS **THE INDUSTRIAL CORE**

⇒ IMMEDIATE MOBILISATION AT REGIONAL LEVEL:

⇒ MANAGE EMERGENCY AND FAVOUR RAPID RECONSTRUCTION TO PRESERVE THE INDUSTRIAL CENTRE

⇒ IMMEDIATE MEASURES SIMULTANEOUSLY TOWARDS INDUSTRIAL ACTIVITIES BUT ALSO TO AVOID SOCIAL FRAGMENTATION

⇒ INDUSTRY AND SCHOOLS AS PRIORITIES

5 months after the earthquake:

All pupils are at school

All the unusable schools have been rebuilt in prefabricated class A buildings

All damaged schools have been repaired by the municipalities

New high tech labs

Factories have restarted with increased capacities

No escape even of multinational firms

All local SMEs are involved in the process, avoiding the collapse of the local community, and strengthening social capital

Progressive Industrial Policy in the ER Region since the years 2000: adapting to the fourth industrial revolution

Now:

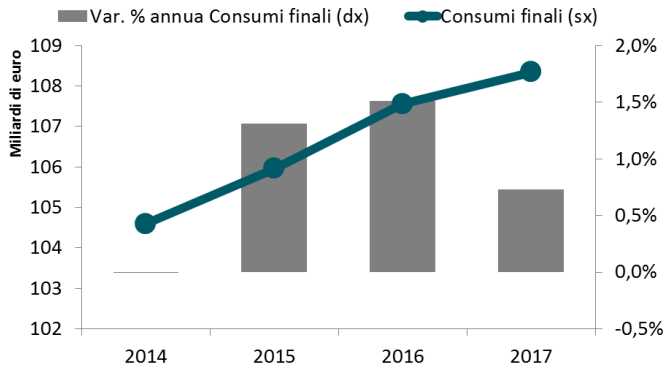
- Science – production integration (R&D projects involving firms and universities, New Master with firms and universities)
- Infrastructures for 4th industrial revolution: 4G and 5G, Bologna as European big data centre,…
- Support to technology adoption and to export for SMEs and their systems
- Building inclusive institutions: social sustainability (cohesion) viewed as key to regional development and growth (resilience)

STRUCTURAL CHANGES IN THE ER REGION

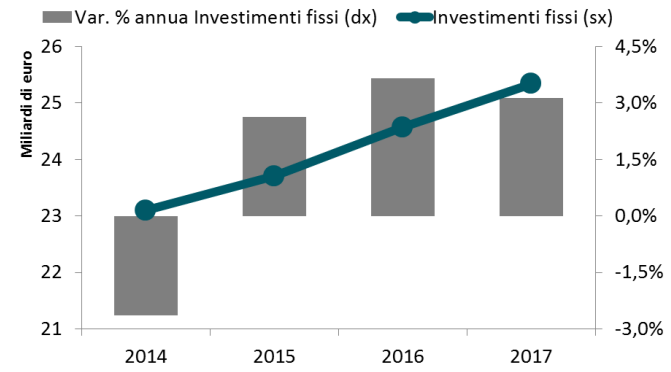
- Change in firm structure towards more medium firms and groups
- This phenomenon is not limited to ER, but regards other Italian regions
- Regional innovation system, industrial specialisations

Emilia-Romagna: GDP GROWTH

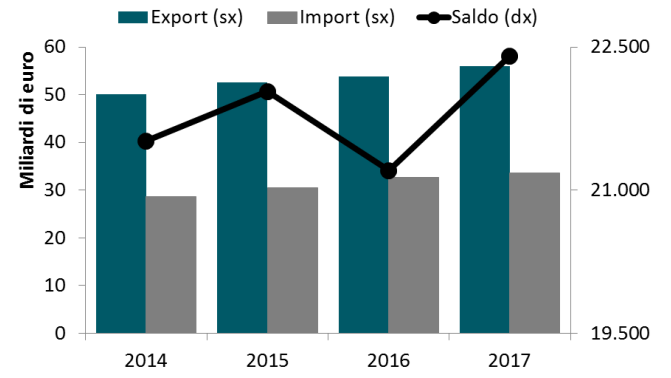
FINAL CONSO



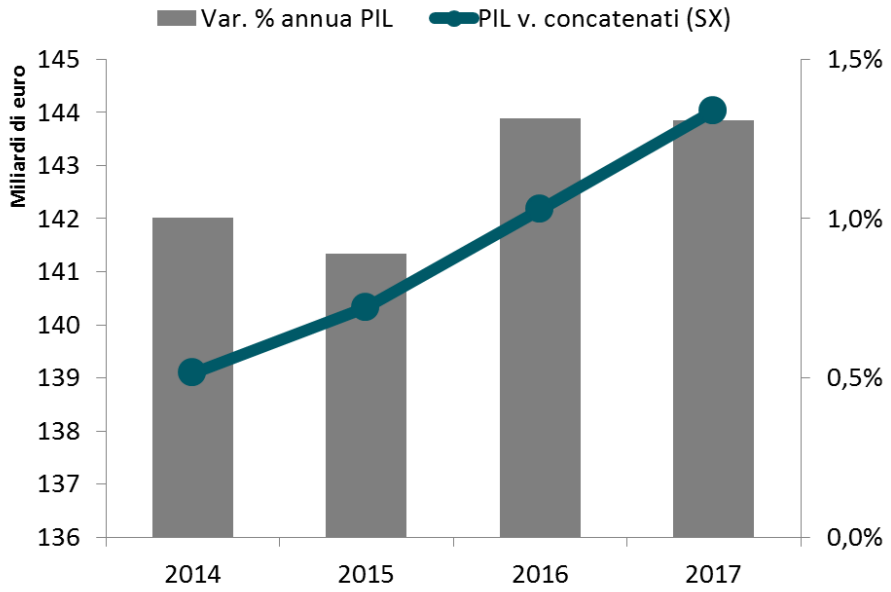
GROSS FIXED INV



TRADE BALANCE

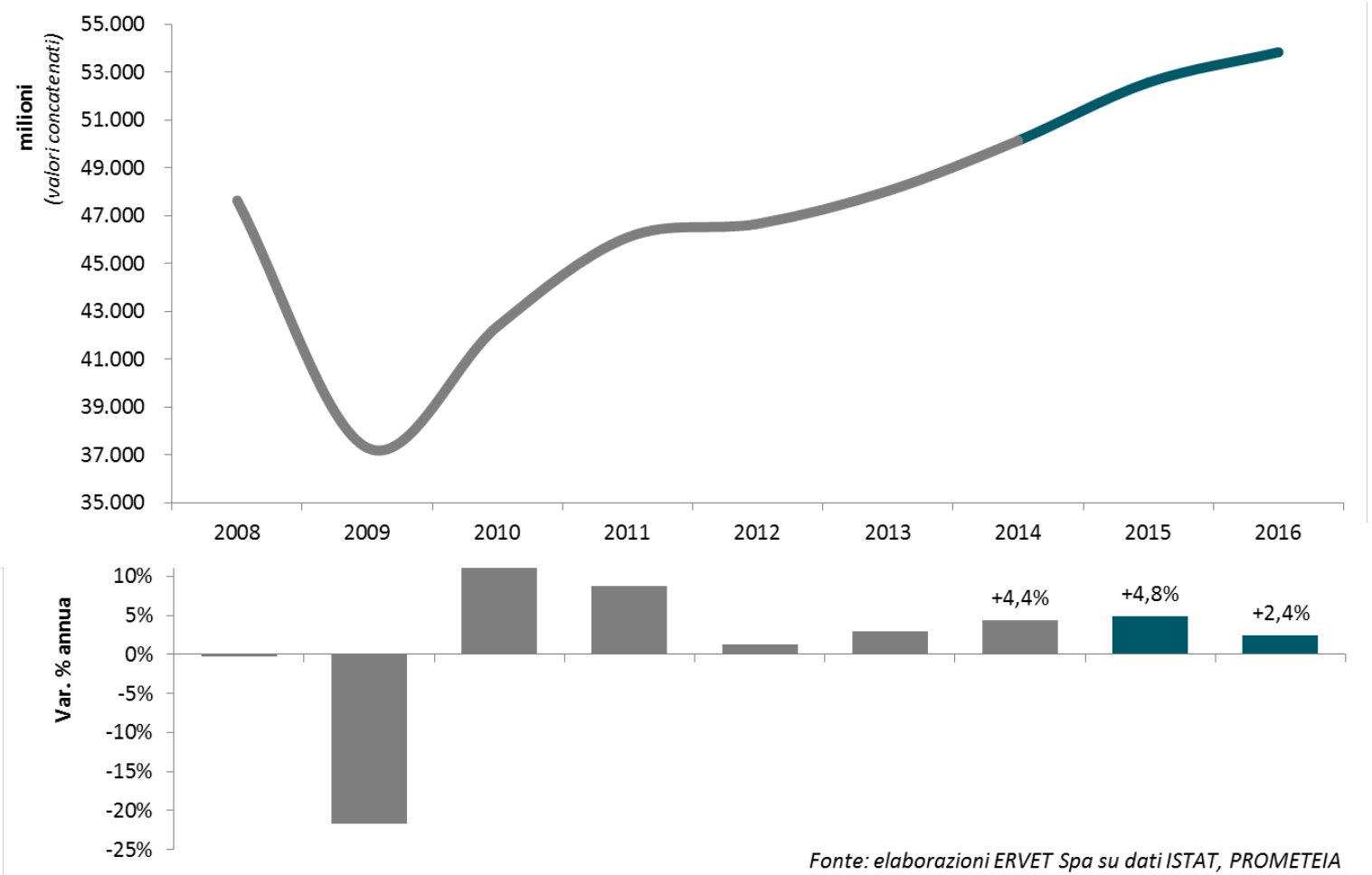


GDP



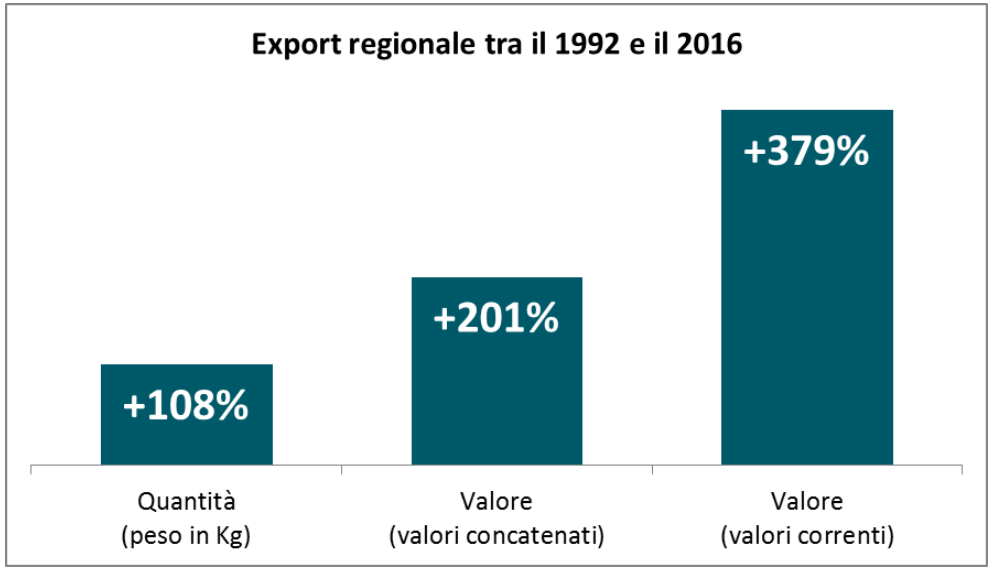
Fonte: elaborazione su dati PROMETEIA (Scenari Economie Locali, Aprile 2017)

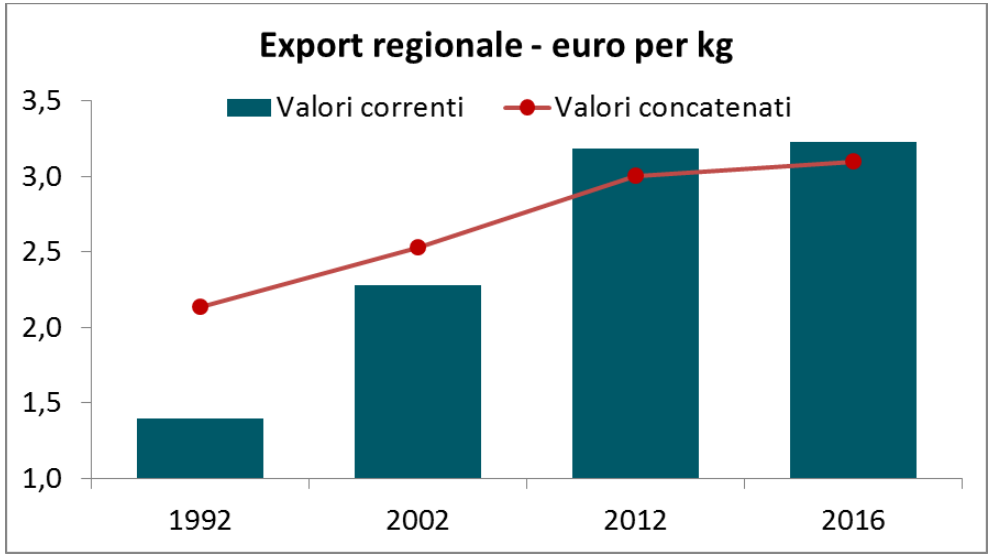
FOREIGN TRADE IS IMPORTANT DRIVER



Fonte: elaborazioni ERVET Spa su dati ISTAT, PROMETEIA

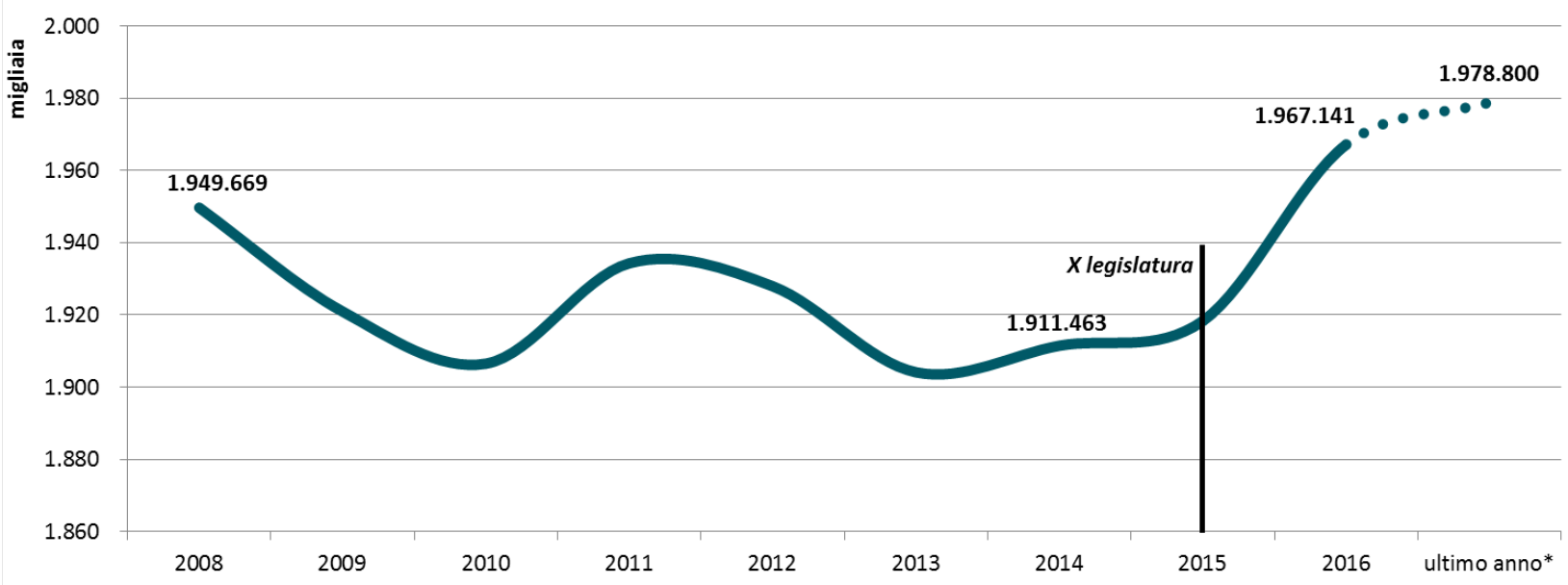
REGIONAL EXPORT IN THE LAST 25 YEARS





Fonte: elaborazioni ERVET Spa su dati ISTAT, Prometeia

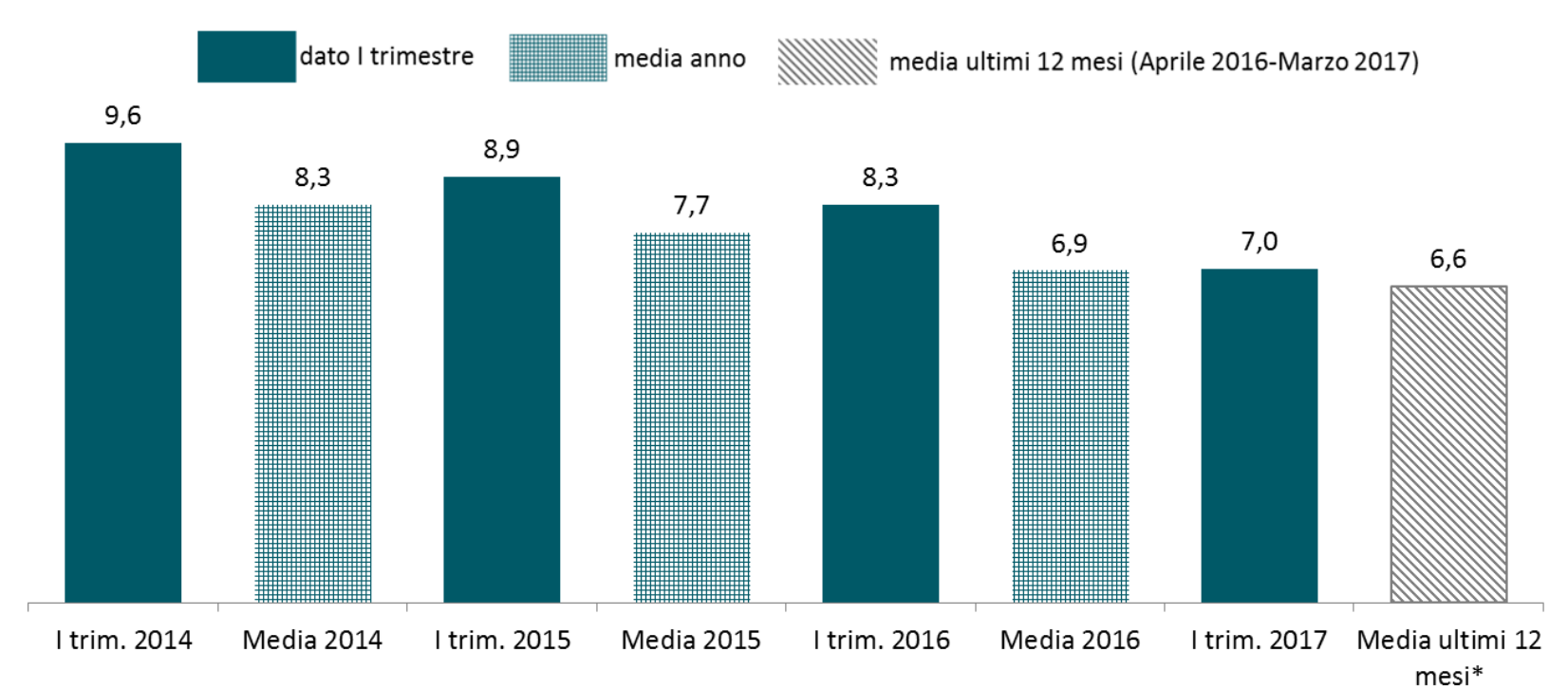
Regional employment grows, beyond pre-crisis levels (+2.9%)



* media Aprile 2016 - Marzo 2017

Fonte: elaborazioni ERVET Spa su dati ISTAT

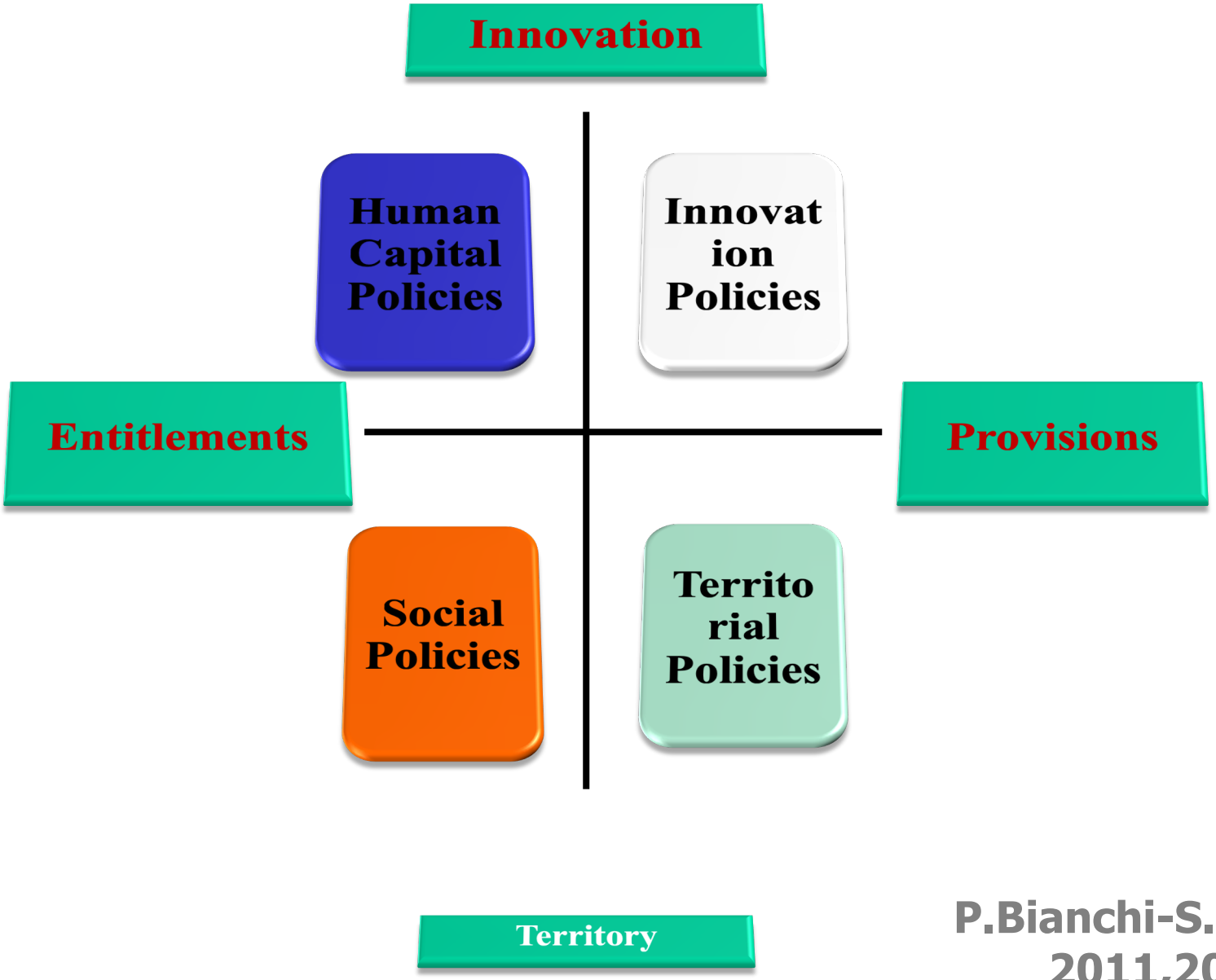
Regional unemployment reduces



Fonte: elaborazioni ERVET Spa su dati ISTAT

ER INDUSTRIAL POLICY

- **Reform of the education system**
- **Reconstruction after earthquake**
- **Patto per il Lavoro = comprehensive industrial policy**
- **Big data centre**
- **Automotive: human capital for industrial development**
- **Attraction of leaders and spinoffs**
- **International network: collaboration with Fraunhofer**



P.Bianchi-S.Labory, 2011,2016

Entitlements (Dahrendorf, 1988, 2008)

= rights = capabilities (A. Sen)

= socially defined means of access, to goods and to rights (right to vote, right to be educated, …)

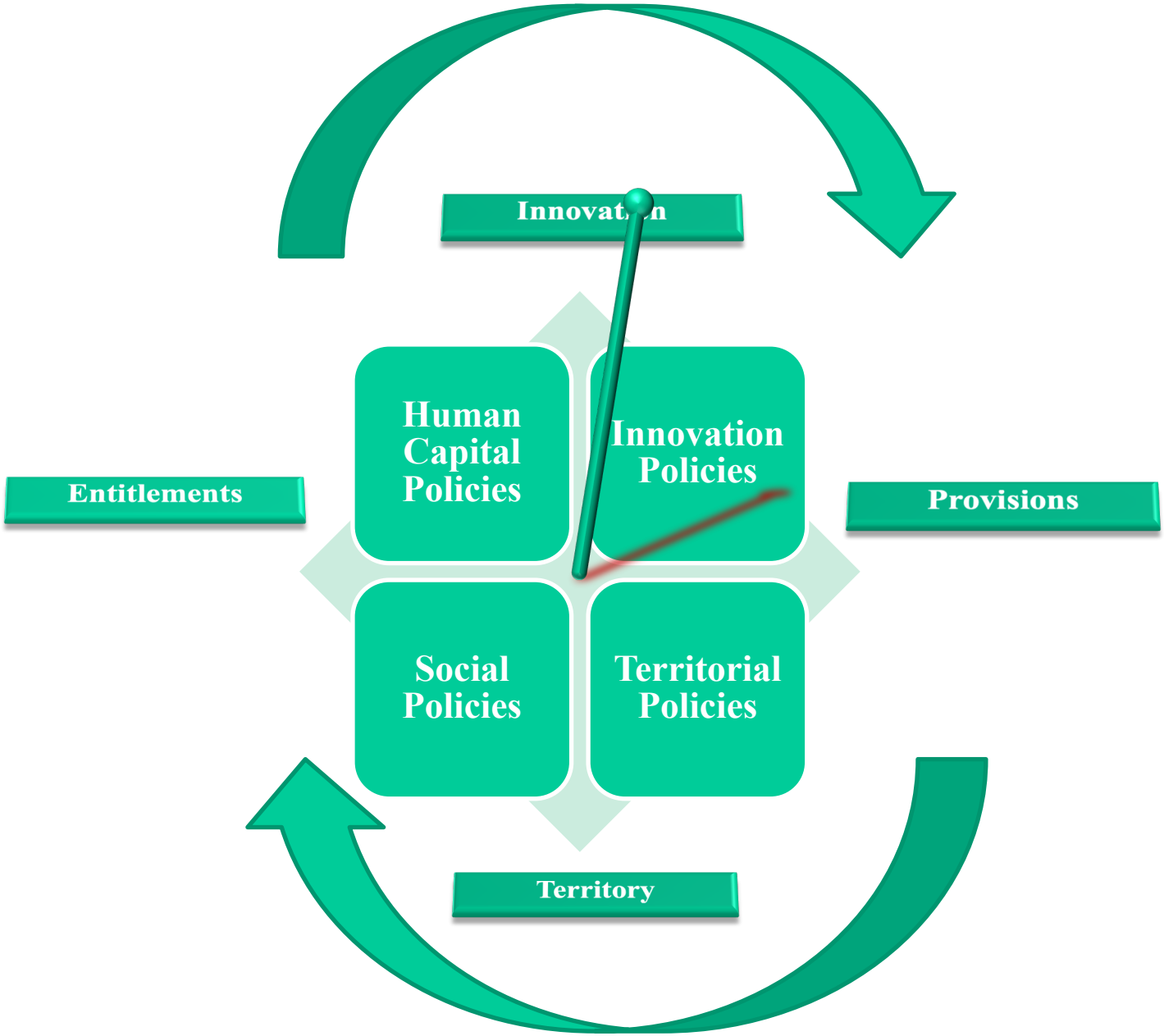
In the globalised world rights are threatened (work conditions, access to welfare, etc.)

However, no industrial development and economic growth is possible without entitlements

Example: developing countries

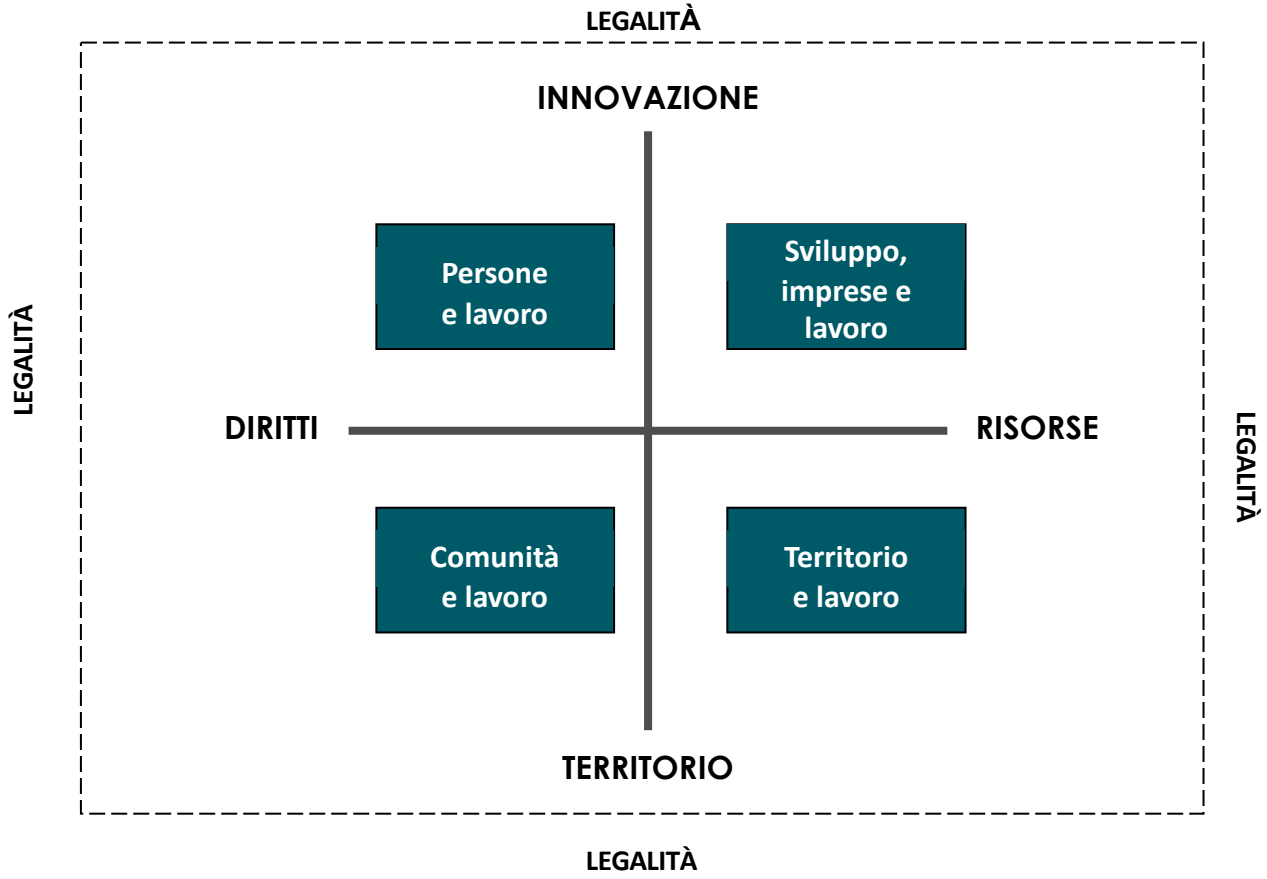
Dahrendorf (2008, p. 15): «Unless traditional entitlements structures are broken and elements of civil society created, macroeconomic growth means little for the many, however satisfactory the IMF may find the statistics»

⇔ SUSTAINABILITY


Innovation
Human Capital Policies
Innovation Policies
Entitlements
Provisions
Social Policies
Territorial Policies
Territory

Un nuovo sviluppo per una nuova coesione sociale

PATTO PER IL LAVORO



INDUSTRIAL POLICY FOR THE MANUFACTURING REVOLUTION:

I. Industrial revolution and transformations of GVCs
II. Implications on role of regions in industrial development
III. Four major policy elements
IV. IP in Emilia Romagna

I. Industrial Revolution and transformation of GVCs

Industrial policy called for by businesses when important structural changes are necessary

Last decades:

Boom of ICTs

Knowledge-based economy

Growing importance of intangible assets

Biotechnologies, nanotechnologies, new materials, robotics, …

⇔ Fourth industrial revolution

Fourth industrial revolution:

- New technological system (paradigm): many scientific discoveries and innovations in different fields, with large convergence
- New production system: manufacturing regime = mass customisation system
- From 1st to 4th industrial revolutions science and production have increasingly interacted: now real integration of science and production

⇒ Many new opportunities for developing new products and processes

Implications of transition in manufacturing regime:

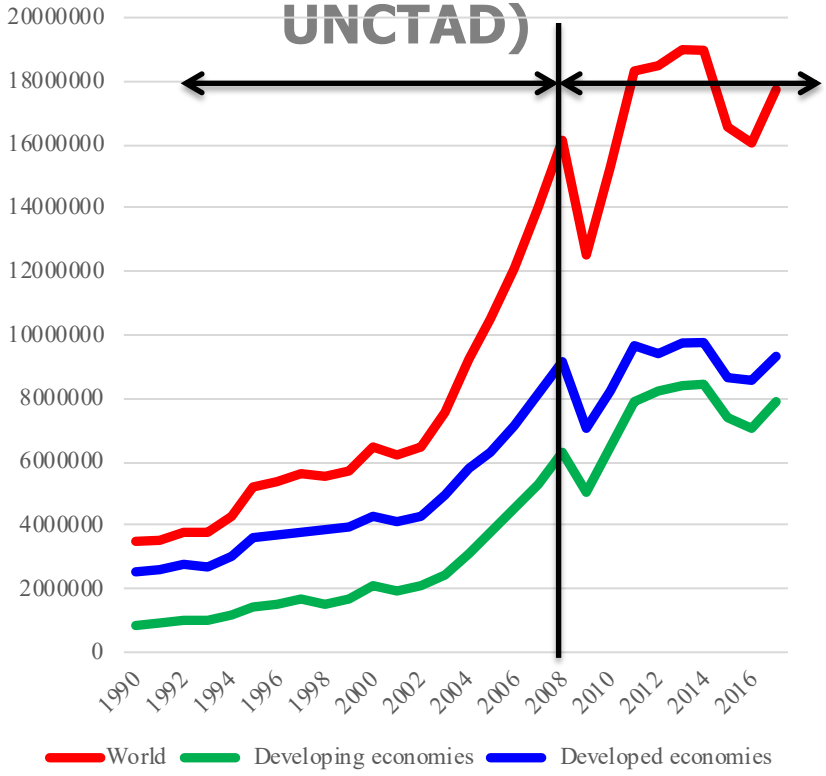
- Industries face big structural changes
- Economic structure changes
- Division of labour changes: new skills, new jobs ➔ effects on the society
- New products ➔ effects on the society (e.g. smartphones and platforms)

➔ Changes in culture

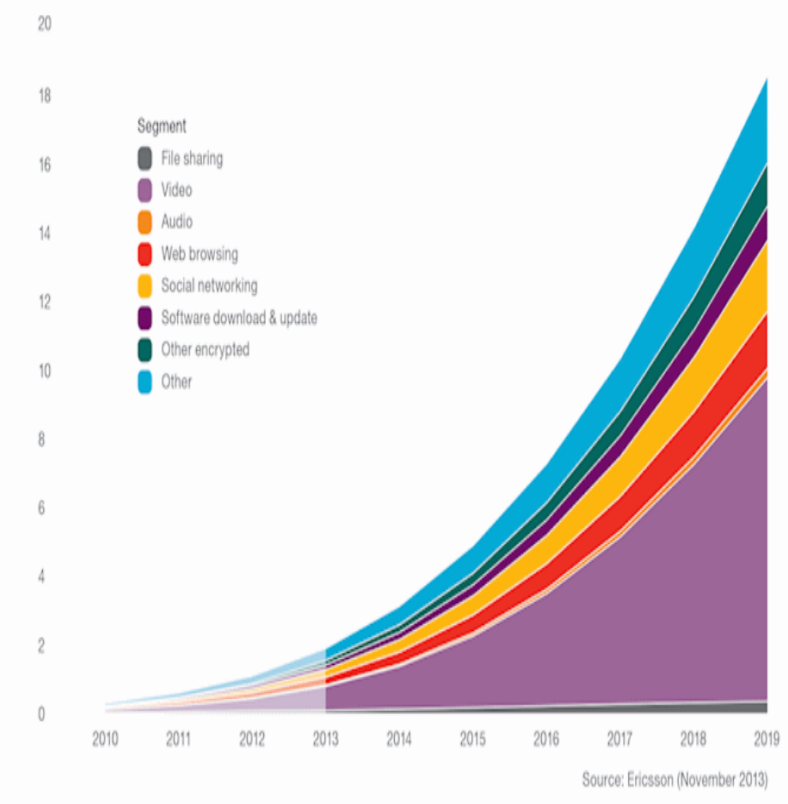
➔ COMPLEXITY

DIGITAL GLOBALISATION

Merchandise: Total Trade, current prices, US $ Mn (source UNCTAD)

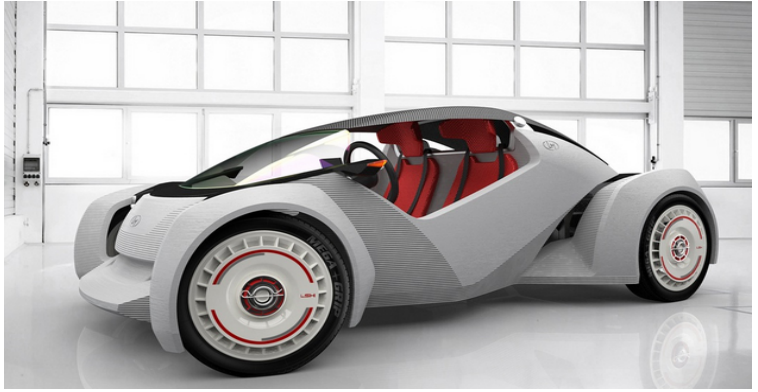


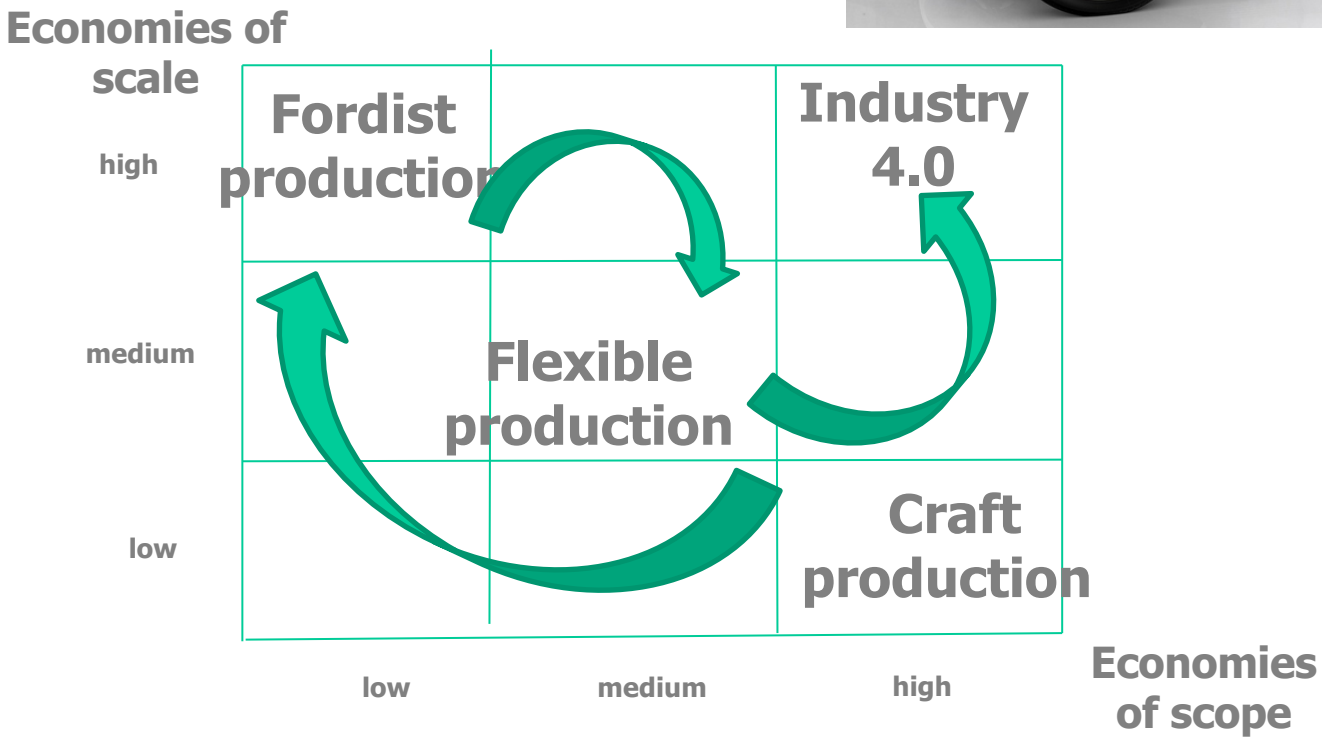
Data trafic, exabyte per month (source Ericsson)



DATA AS RAW MATERIAL OF THE NEW ERA

Transitions in Manufacturing Regimes





Structural changes required:

- Adoption of new technologies
- New products to meet new needs of consumers
- New consumption means (new markets with online platforms, new product experiences)

➔**Creativity and knowledge creation**

Industries can

Upgrade (increasing quality and variety)

Branch into new activities

Emerge from scratch (without pre-existing activities)

⇔ **GVC reshaping and emergence**

Innovation and creativity requires **redundancy** and interactions:

- Learning by trial and errors
- Various experimentations in parallel, not necessarily with precise aims
- Competition between alternatives
- **Interactions** between exps and alternatives

➔ Creating linkages

➔ To exploit complementarities

➔ TO ATTRACT AND RETAIN HIGH VALUE-ADDED PRODUCTION PHASES

⇔ **capacity for social interaction: social capital and facilitators**

II. Important role of regional industrial policy

- National industrial policy for the manufacturing revolution: e.g. Industrie 4.0 and strengthened role of Fraunhofer Institutes (like Manufacturing Institutes in the USA)
- Historical evidence: industrial revolutions risks generating uneven development (Pollard, 1981; Missaia, Robin and Phillips, 2018)

Fourth Industrial Revolution: new opportunities for all regions

- Hyper-connection implies easy access to knowledge and information
- Easy access also to consumers in distant markets
- New market intermediaries (platforms)

➔ Reshaping of GVCs and emergence of GVCs

➔ the conditions existing in territories determine their position in GVCs; regional industrial policy can influence their position by defining a strategy and implementing sets of instruments

III. What regional industrial policy for the fourth industrial revolution? 4 main elements

Must aim at creating and exploiting complementarities

- Between sectors, between research activities
- Within regions and between regions

⇔ regions as hubs of knowledge and capabilities

⇔ Regional industrial policy must be strategic: choice of strategic positioning in GVCs

(Bianchi and Labory, 2018, 2019)

Four Main elements

1. **Capabilities**
2. **Networking for building complementarities**
3. **Participative Governance**
4. **Policy Coherence**

1. Capabilities

⇔ to improve the knowledge base and competencies

Policy actions regard:

- Research and development: investment in R&D activities, R&D infrastructure (labs, …), as well as favouring knowledge transfer (U-I links)
- Skills: education, training, attraction of talents
- Infrastructure: communication, transport, … also big data

2. Networking for complementarities

Networking allows information and knowledge to be exchanged and collectively created

and also related to appropriate actors: e.g. links allow to identify and exploit complementarities – industrial application of research in university – industry links; new products or processes in links between firms

Networks must be built at all levels, and must overlap: industry – education institutions - infrastructure

3. Participative Governance

Complexity of structural changes

Complexity of the regional system

⇒ Involving all stakeholders in mapping of regional GVCs, definition and implementation of industrial policy

⇒ better access to information, better strategic choices by policy-making

⇒ mobilisation of the whole regional system towards the agreed aims of industrial policy

4. Policy Coherence

Two aspects:

1. Coherence between policy areas: industrial, innovation, education, social, infrastructure…

Best is joint definition and implementation of these policies

2. Coherence in the MLG: coherence of actions between the local, regional, national and supranational levels of policy-making

IV. Emilia Romagna: industrial policy for the fourth industrial revolution

Long tradition of industrial policy since the 1980s, favouring structural changes (Bianchi and Labory, 2011, 2018)

Current industrial policy: expressed in the

2015 Labour Pact

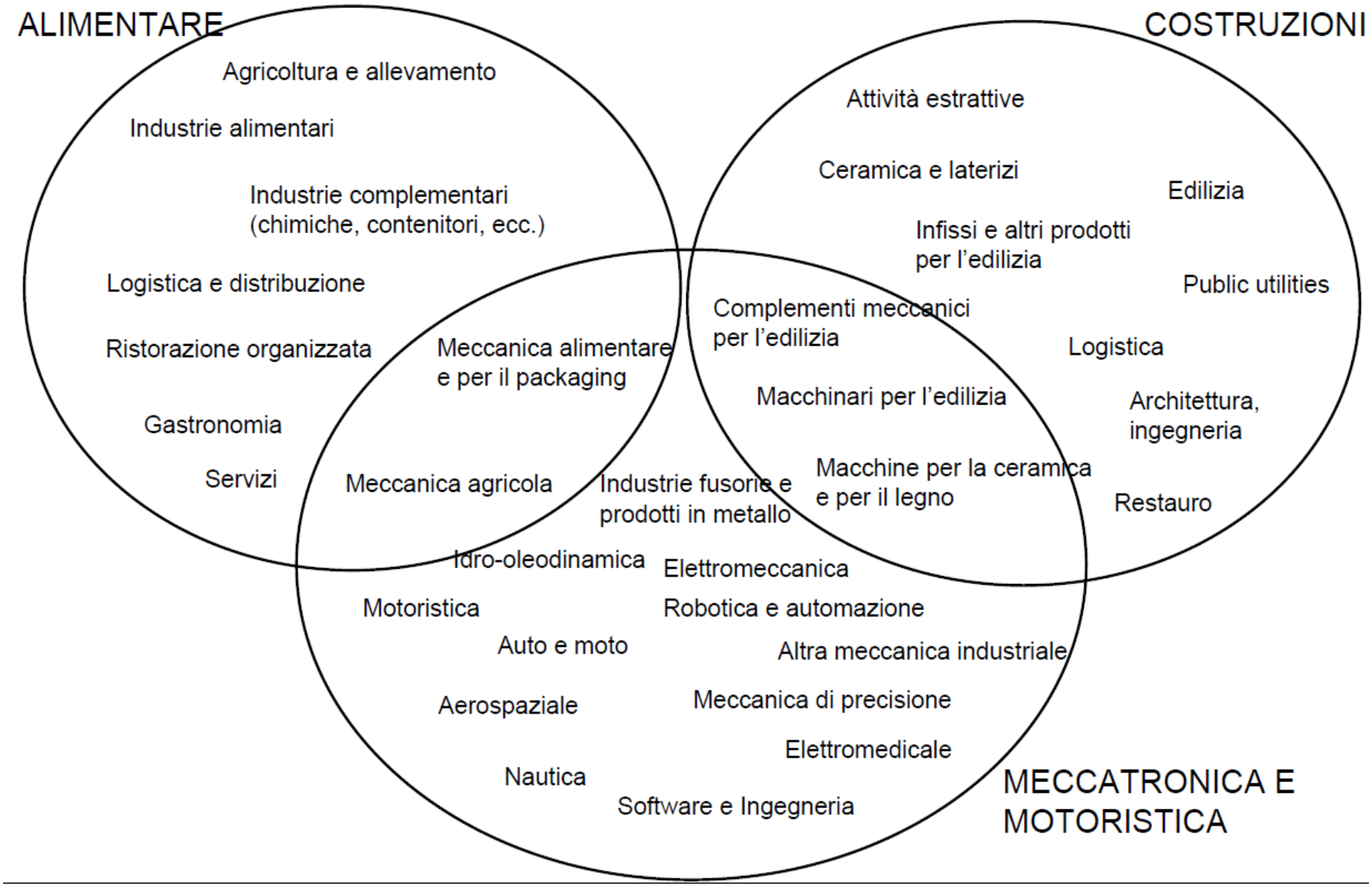
⇔ **Policy coherence (industrial and social)**

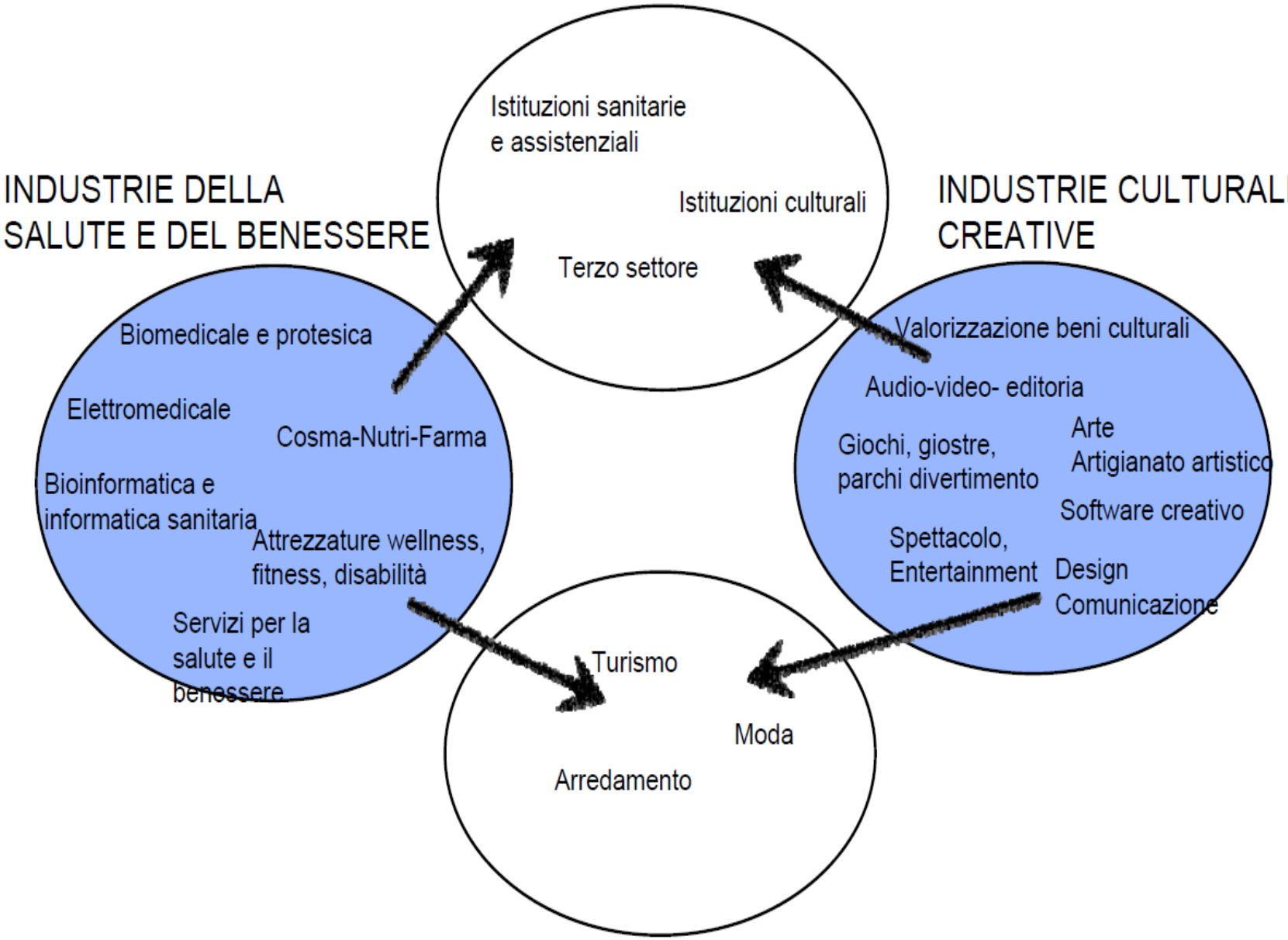
POLICY?

1. Mapping of regional GVCs and analysis of strengths and weaknesses to identify most strategic ones **involving stakeholders**
2. Favouring sharing of experiences, interactions, between firms AND research centres, education institutions, both public and private
3. Defining strategic objectives for each GVCs that are **shared between all stakeholders**
4. Implementation of instruments and actions to meet these objectives

⇔ **PARTICIPATIVE GOVERNANCE**

MAPPING OF REGIONAL GVCS AND COMPETENCIES




INDUSTRIE DELLA SALUTE E DEL BENESSERE
Biomedicale e protesica
Elettromedicale
Cosma-Nutri-Farma
Bioinformatica e informatica sanitaria
Attrezzature wellness, fitness, disabilità
Servizi per la salute e il benessere
Istituzioni sanitarie e assistenziali
Istituzioni culturali
Terzo settore
INDUSTRIE CULTURALI E CREATIVE
Valorizzazione beni culturali
Audio-video- editoria
Arte
Artigianato artistico
Giochi, giostre, parchi divertimento
Software creativo
Spettacolo, Entertainment
Design
Comunicazione
Turismo
Moda
Arredamento

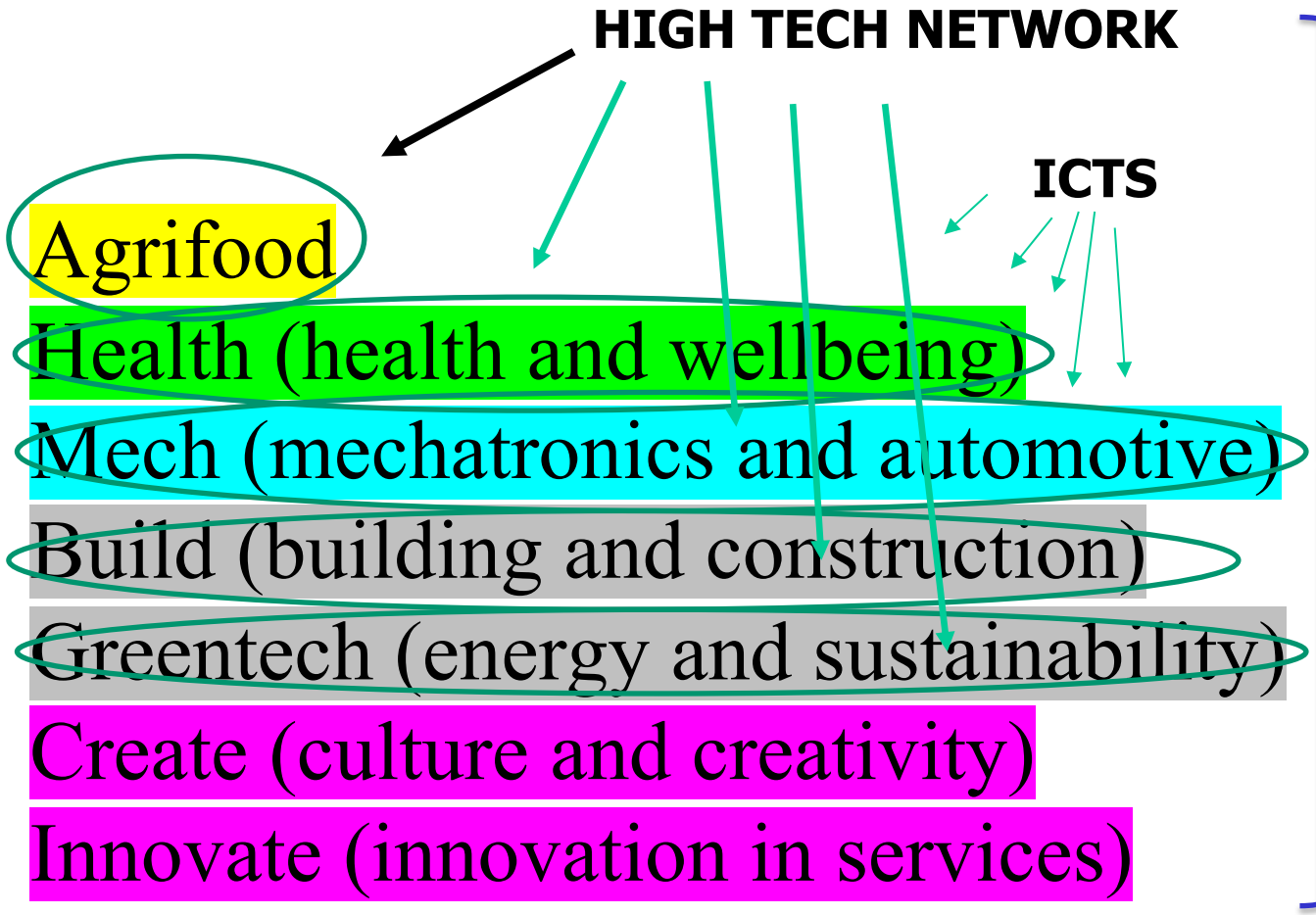
5 BROAD SECTORS COMPRISING 27 GVCs

⇔ Clust.ER = regional clusters, defined as communities of public and private stakeholders (research centres, firms and education institutions) which meet to support the competitiveness of productive systems

⇔ focused on industrial application of research

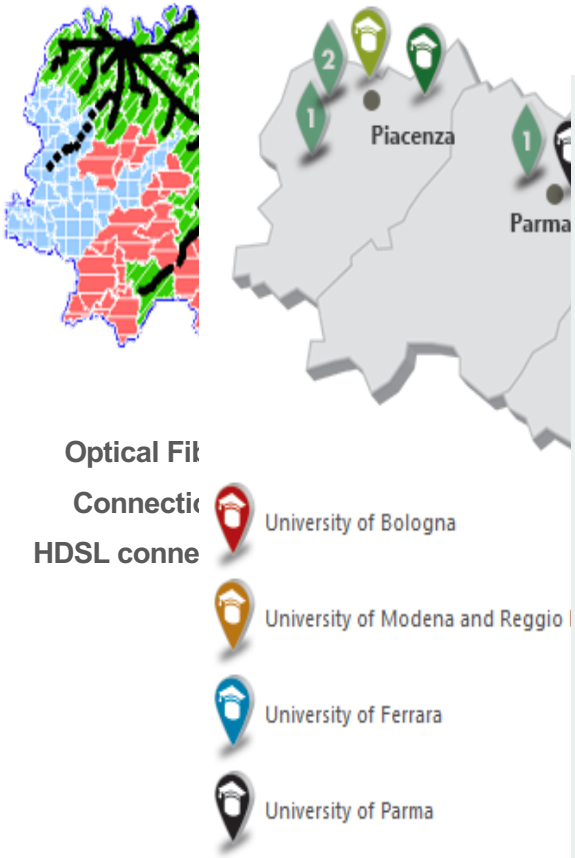
Idea that firm competitiveness increasingly depends on the ability of the regional system to be innovative and attractive

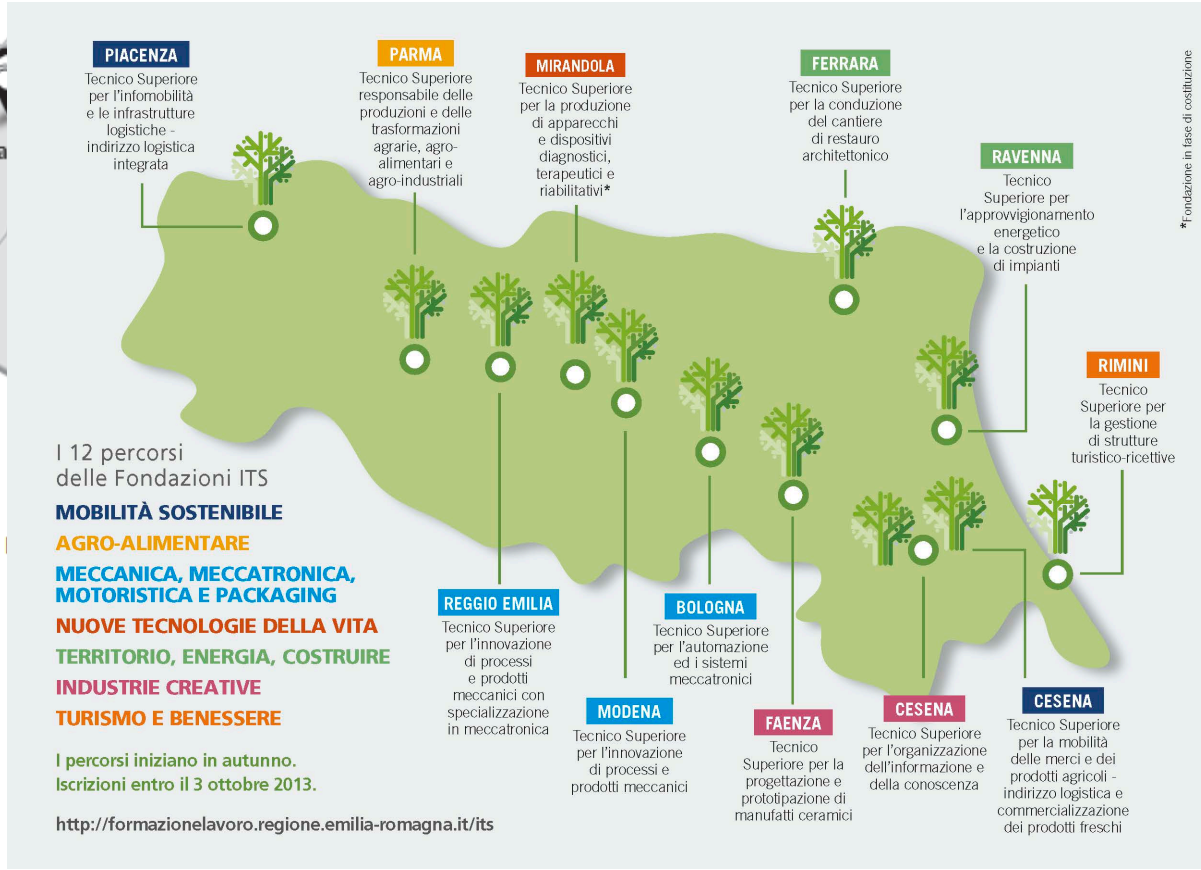
7 CLUSTERS COMPRISING 27 GVCs



FIVE PRIORITY SECTORS OF SMART SPECIALISATIO STRATEGY

NETWORKING FOR COMPLEMENTARITY + DEVELOPMENT OF CAPABILITIES





Overlapping networks: e.g. Polytechnics with research and production, especially for industrial applications of research

CAPABILITIES: SKILLS, RESEARCH CAPACITY, INFRASTRUCTURE FOR THE REGIONAL GVCs

1791 RESEARCHERS INVOLVED

230 FOREIGN RESEARCHERS HOSTED

94 INTERNATIONAL EVENTS

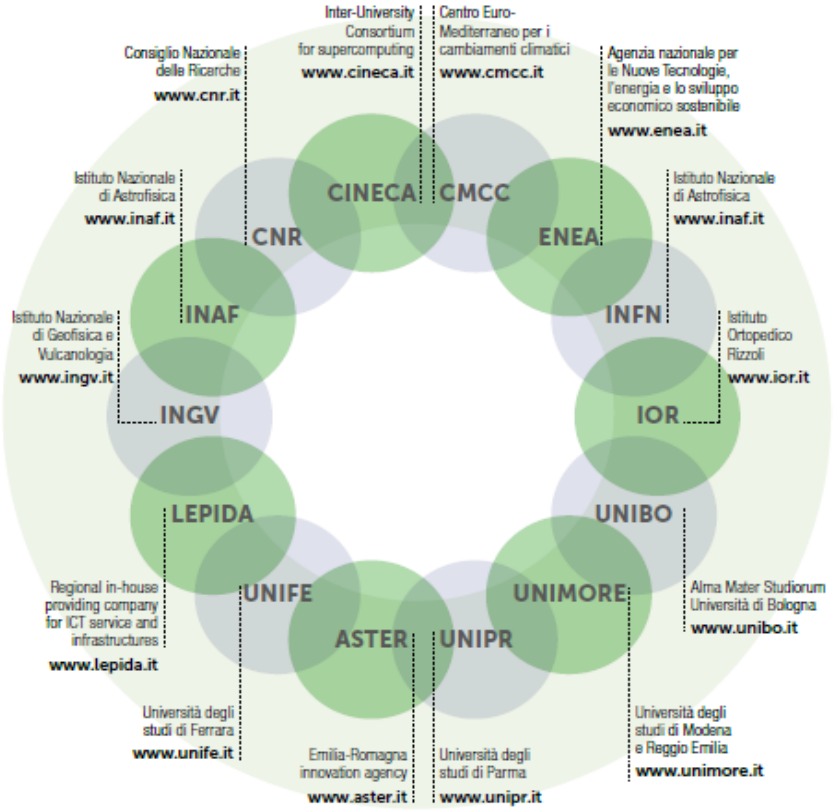
60 HIGHER EDUCATION INITIATIVES INCLUDING

- PhD courses
- Laurea magistrale
- Master
- Summer schools

S3 and Big data infrastructure

- ENERGY & ENVIRONMENT
- MECHANICS MATERIALS
- AGRIFOOD
- CONSTRUCTIO
- ICT & DESIGN
- LIFE SCIENCE

Interconnecting science and production organisations



Second region in Italy for number of start-ups

NETWORKING INNOVATIVE START-UPS

551 innovative start-ups in Emilia-Romagna (2015)

- **Italia Start-Up Visa - The Italian government supports the creation of innovative companies with a Start-Up Visa (for foreign entrepreneurs) and the Start-Up Law (for innovative companies)**

- **Emilia-Romagna Start-Up - The regional focal point for the creation of innovative enterprises**

- **Make-ER – the digital manufacturing network of Emilia-Romagna - The first Italian regional network for digital manufacturing, including Fab-Labs and other organisations that provide alternative work organisation**

COHERENCE BETWEEN ALL REGIONAL PROGRAMMES AND ACTIONS

EDUCATION AND TRAINING (Multiannual plan for highly qualified labour in industrial research and innovation; Technical Institutes; MUNER, etc.)

SOCIAL SERVICES (empowerment; resilience of communities); SOCIAL CAPITAL

BUSINESS SERVICES (firm creation, internationalisation, networking)

RESEARCH (Regional High Tech Network, Technopoles, network of regional universities, U-I links, focus on application of research)

INFRASTRUCTURE: BIG DATA

Strategic positioning of the region: after check of competencies in the region, decision to make the region a **hub for big data storage and analytics in Italy and in Europe** (4 universities, CINECA – national consortium of supercomputing, CNAF – National computing centre of the Italian nuclear physics research centre)

Bologna as European centre for Big Data on medium-term weather forecast (ECMWF)

All research facilities on big data have been relocated near the European Centre, together with the National Excellence Centre for Research and Innovation on Industry 4.0, sponsored by the National Ministry of Industrial Development

⇔ **BIG DATA TECHNOPOLE**

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⇔ **BIG DATA TECHNOPOLE**

THE ER REGION (BOLOGNA) HAS BECOME A EUROPEAN HUB OF BIG DATA CAPACITY IN RECENT YEARS

Long history of supercomputing development in Bologna:

- **1961: supercomputing centre of CNEN (now ENEA) localised in Bologna**
- **CINECA (consortium of universities of North-East Italy) created in 1969, localised in Bologna with acquisition of most powerful computer of the time (CDC 7600)**
- **In 2010 the supercomputer FERMI of CINECA is among the top 10 most powerful computers in the world**

THE ER REGION (BOLOGNA) HAS BECOME A EUROPEAN HUB OF BIG DATA CAPACITY IN RECENT YEARS

From 2010: dialogue with regional stakeholders

- **Universities**
- **Businesses**
- **Worker representatives and other organisations**

Leading to highlight existing capacity in big data + strategic importance of big data in the future

=> Regional stakeholders mandated the regional government to potentiate this capacity


ECMWF

1) THE REGION HAS DEVELOPED A NETWORK OF TECHNOPOLES, BASED ON 6 UNIVERSITIES AND 11 CAMPUS, GATHERED IN A COORDINATING ENTITY, THE «REGION-UNIVERSITY CONFERENCE»

ER HIGH-TECH NETWORK:

10 Technopoles

88 laboratories/centres of industrial research

600 full time young researchers

1200 part-time researchers

800 High Tech Start ups

2) NETWORK OF HIGH-SKILL TRAINING SCHOOLS CREATED IN COLLABORATION WITH THE UNIVERSITIES

INT. SCHOOL ON ADVANCED EDUCATION PRACTICES

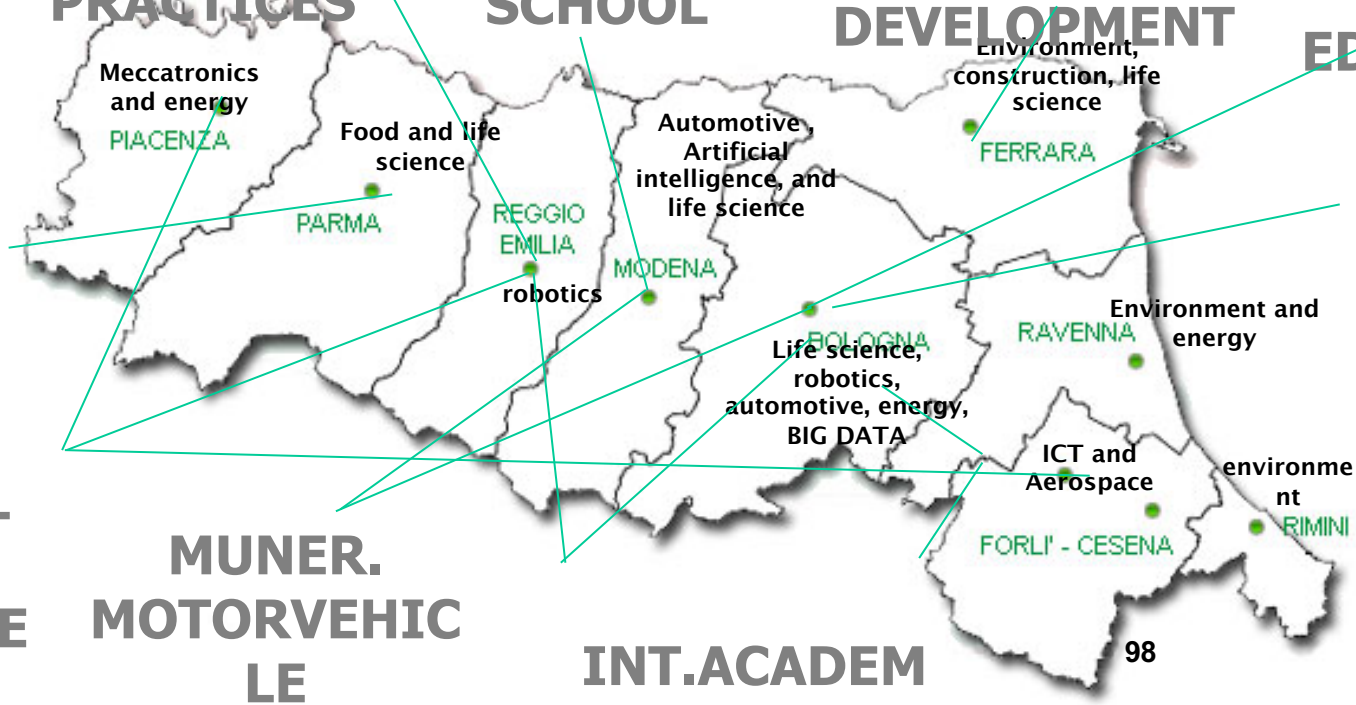
ARTIFICIAL INTELLIGENCE HIGH SCHOOL

INTERNATIONAL SCHOOL OF PUBLIC POLICIES FOR DEVELOPMENT

INT.SCHOOL ON MUSIC EDUCATION

BIG DATA HIGH SCHOOL

FOODPROCESSING AND NUTRITION HIGH SCHOOL



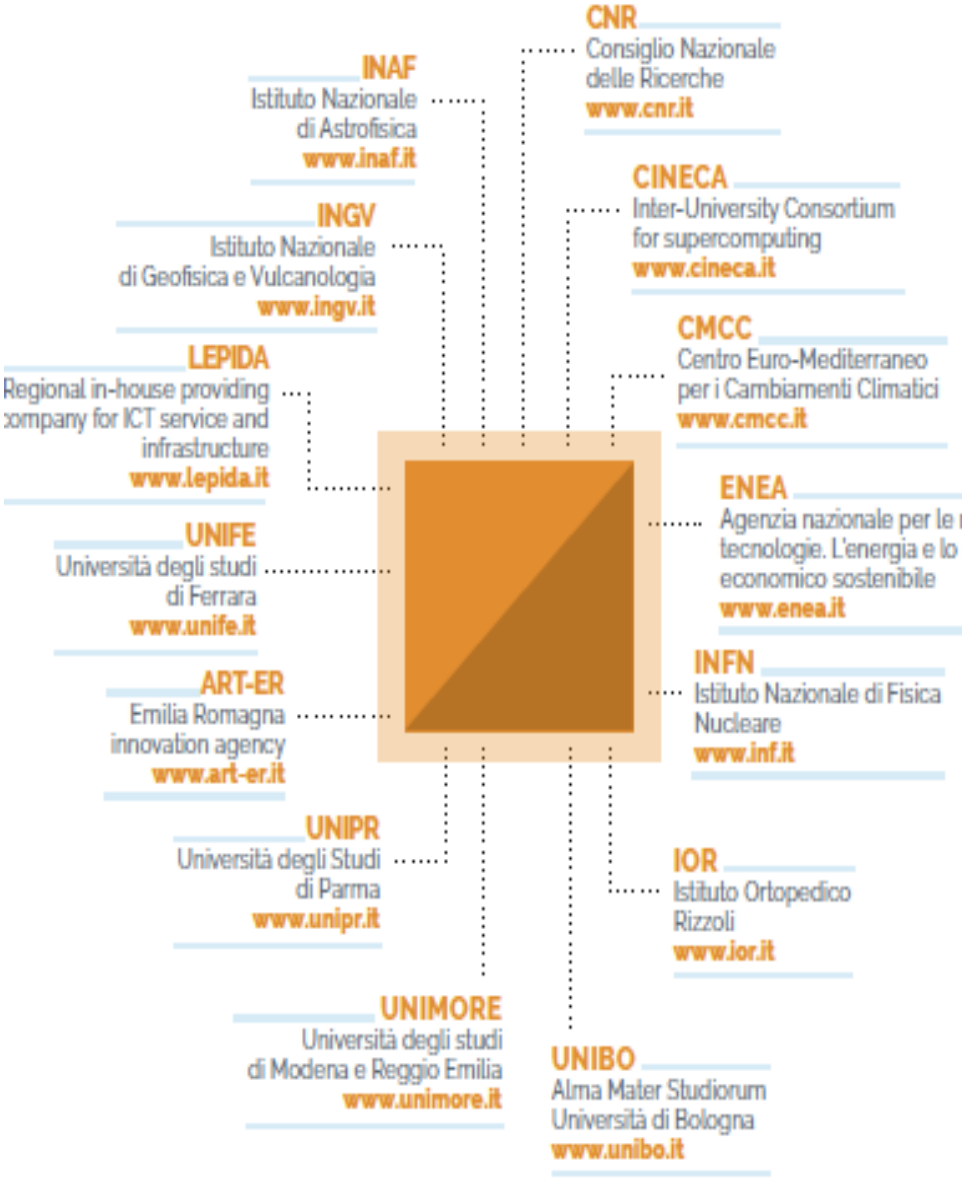
ADVANCED INDUSTRIAL ROBOTICS SCHOOL

MUNER. MOTORVEHICLE UNIVERSITY EMILIA ROMAGNA

INT.ACADEMY ON RELIGIOUS STUDIES

INT.SCHOOL ON ENVIRONMENT

3) IN ORDER TO PROMOTE THE BIG DATA ASSOCIATION - BDA



Supercomputing resources for public research in Italy managed by association members

>90%

H2020, FP7 or CEF projects[1]

140

Total Cost of the projects

> 2,1 BLN€

Funding received from EC

160 MLN€

THE Bologna BD HUB is also a reference for research projects involving INDUSTRY

•**FENIX**: Digital infrastructure federation between CINECA (Italy), Barcellona SuperComputing Centre (BSC) Spain, Commissariat à l'énergie atomique (CEA) France, ETH Zuerich's Swiss National Supercomputing Centre (CSCS) Switzerland, Jülich Supercomputing Centre (JSC), Germany.

•**MaX European centre of Excellence:** supports developers and end users of advanced applications in the field of materials, and works at the frontiers of the current and future High Performance Computing (HPC) and big data

•**CINECA & Eni** partnership for development of new applications for seismic analysis, reservoirs simulation and technology watch for emerging domain such as AI and Quantum computing. Eni is the second largest Oil & Gas Company in Europe.

•**CINECA & UnipolSAI Group** partnership for R&D based on big data analytics and AI in the domains of risk management, asset liability, fraud. UnipoSAI Group is the third largest insurance company in Europe.

•**Drug design and open lab** between CINECA, Alfawasserman, Dompè Pharmaceutical, Chiesi pharmaceutical.

5) EUROPEAN CONTEST FOR THE TRANSFER OF THE EUROPEAN AGENCY FOR WEATHER FORECASTS FROM READINGS: BOLOGNA APPLICATION

ECMWF is the intergovernmental agency created in 1975 by 20 Member States for the development of computing systems for weather forecasts. Bologna won the contest and will be the new location of the agency. The new data centre in Bologna will have computing power 10 times more powerful than the preceding ones.

ECMWF

EUROPEAN CENTRE FOR MEDIUM RANGE WEATHER FORECASTS

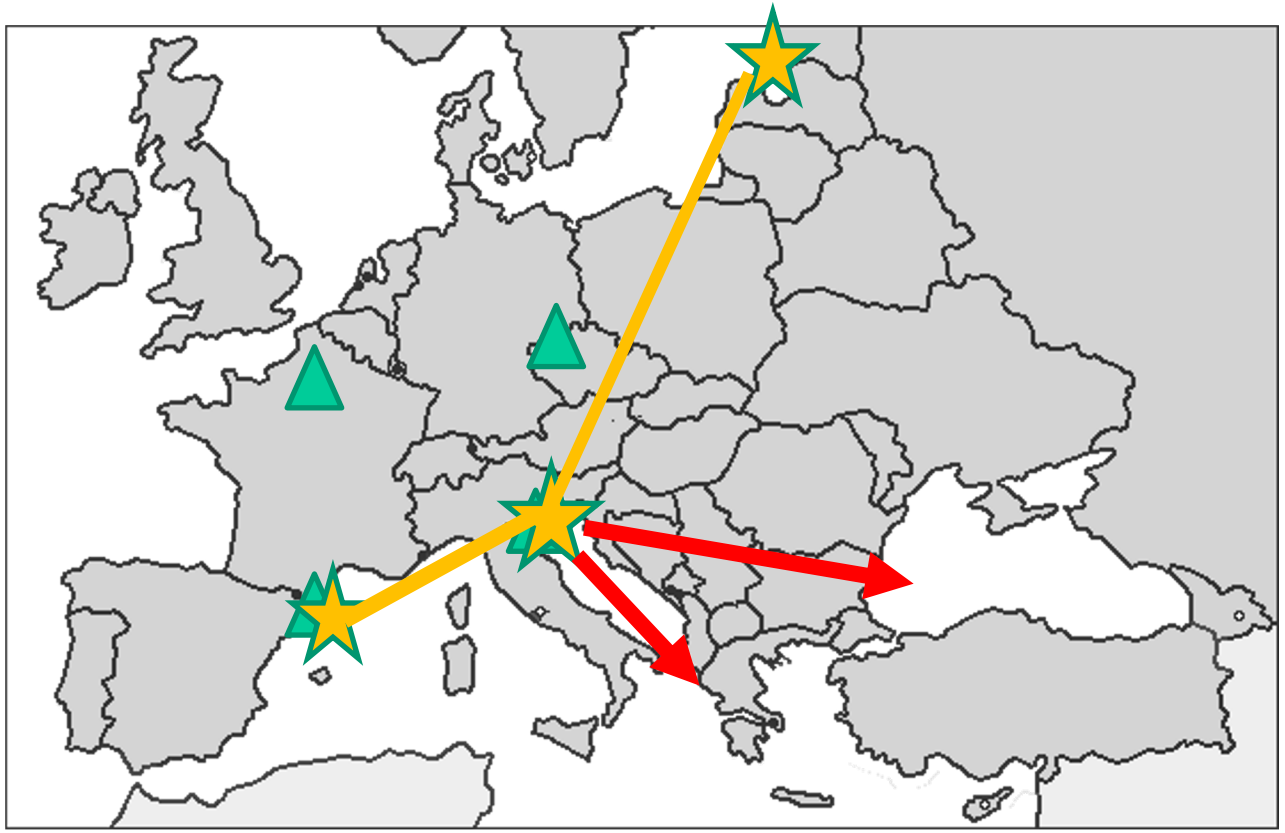
6) EUROPEAN CONTEST FOR THE LOCALISATION OF THE EUROPEAN SUPERCOMPUTER EURO HPC LEONARDO: BOLOGNA WON AGAIN

The Joint Undertaking Euro-HPC chooses Bologna as the location of the speediest of the three pre-exascale European computers, with 270 petaflops.

50% of its power will be available to the universities, research institutes and firms of the hosting country, 50% to the other countries of the

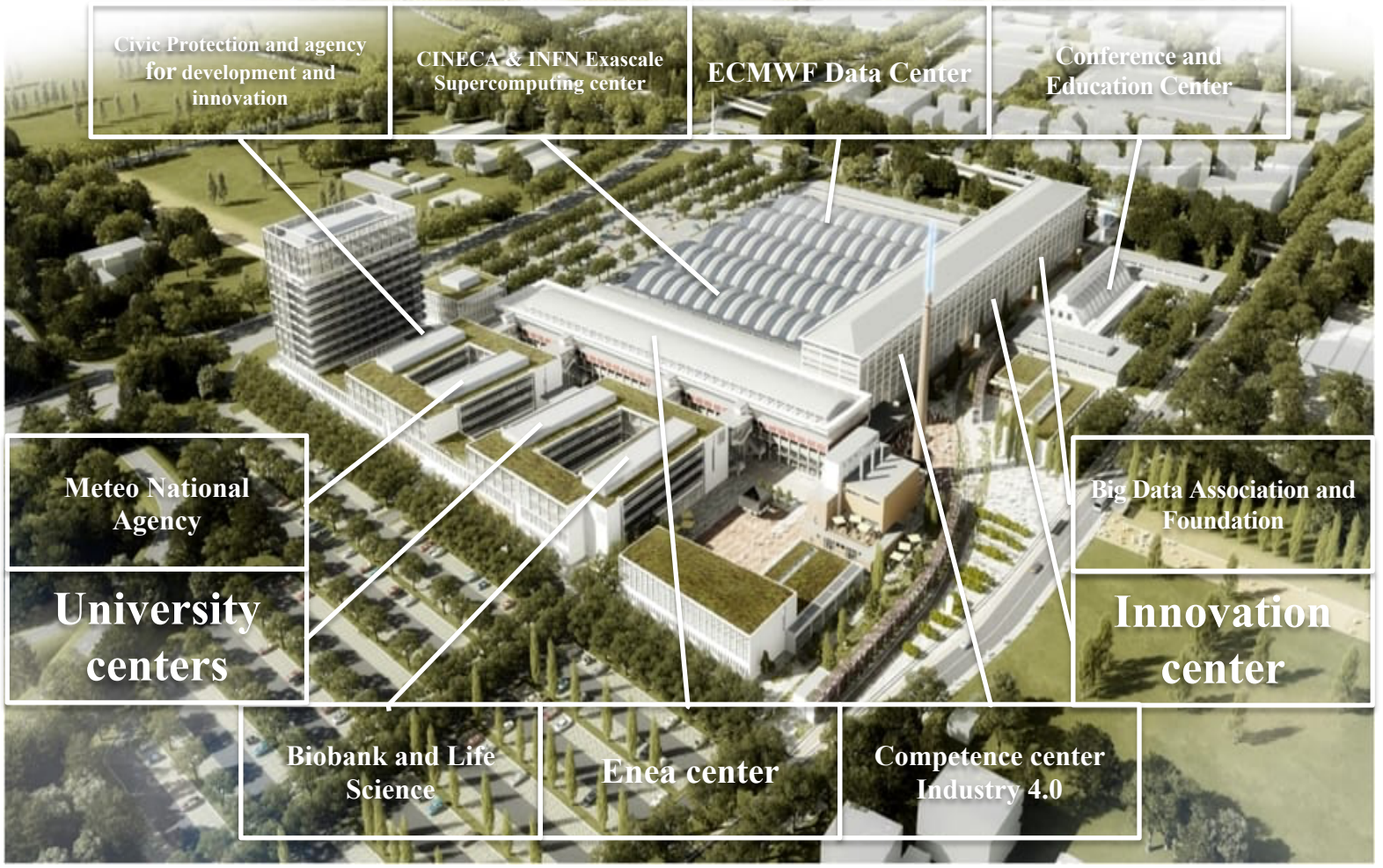
EuroHPC
Joint Undertaking

PRACE – PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE – IS THE NETWORK OF EUROPEAN SUPER-COMPUTERS, with 4 poles: Barcelona, Bologna, Julich, Paris



EUROHPC is the European network of supercomputers that is being created, with 3 poles in Barcelona, Helsinki and Bologna. Bologna has the most powerful HPC, so that it is really the European hub of

7) Bologna big data Technopole: A European, National and Regional investment for Big Data and AI



Industry is also involved in the Bologna Big Data Hub

bi-rex
Big Data Innovation & Research Excellence

IoTwins

MISTRAL
Meteo Italian Supercomputing Portal

Highlander

bi-rex
Big Data Innovation & Research Excellence

Big data & AI for manufacturing production

- **University of Bologna**, **Ferrara**, **Modena Reggio-Emilia** e **Parma**, **Catholic University of Sacro Cuore**, **CNR and INFN**, **Istituto Ortopedico Rizzoli**, **ASTER**, **Bologna Business School**, **CINECA** , **Fondazione Golinelli**.

  45 companies: Sacmi, Bonfiglioli Riduttori, FerraraBio, IMA, Philip Morris Manufacturing & Technology Bologna, SAMP, Aetna Group, Consorzio Nazionale Servizi, Modis Consulting, Poggipolini, Rekeep, UPMC Italy, CAMST, Conad, Ducati Motor Holding, Eni, Gruppo Hera, Link Italia, Marposs, Rem Tec, Alascom Services, Circle Touch, CRIF, Eurocoating, Filippetti, Marposs Italia, Nanosurfaces Industries, Service, Altair Engineering, Intesa SanPaolo, Manz Italy, Parametric Technology Italia, Siemens, TIM, Datariver, IBM Italia, DVP Vacuum Technology, Eascon Engineering, Energy Group, Etna Biotech, Fancy Pixel, Juno Design, Kaitek, Nextema, Nier Ingegneria.

1	BONFIGLIOLI RIDUTTORI SPA	IT
2	BARCELONA SUPERCOMPUTING CENTER	ES
3	ESI GROUP	FR
4	FRAUNHOFER E.V.	DE
5	TECHNISCHE UNIVERSITAT BERLIN	DE
6	FUTBOL CLUB BARCELONA ASOCIACION	ES
7	MARPOSS SPA	IT
8	UNIVERSITA DI BOLOGNA	IT
9	INFN	IT
10	CINECA	IT
11	ART-ER	IT
12	WAVESTONE LUXEMBOURG SA	LU
13	ETXE-TAR, S.A.	ES
14	KK-ELECTRONICS A/S	DK
15	BEWARRANT	BE
16	E. N. SUPERIEURE D'ARTS ET METIERS	FR
17	GCL INTERNATIONAL SARL	LU
18	SIEMENS OESTERREICH	AT
19	SIEMENS	DE
20	TTTECH COMPUTERTECHNIK AG	AT
21	THALES SAS	FR
22	C. T. INDUSTRIES MECANIQUES	FR
23	FILL GESELLSCHAFT MBH	AT

IoTwins

BD & AI for predictive maintenance

EU H2020-ICT-2018-2020

Distributed Digital Twins for industrial SMEs: a big-data platform

Funded € 17 Millions

Budget € 20 Millions

Prime contractor Bonfiglioli Riduttori SpA

Muner: Motorvehicle University of Emilia Romagna

- The Regional Government promoted an association among the 4 universities and the motorvehicle companies working in ER
- Universities: Bologna, Ferrara, Modena and Reggio Emilia, Parma
- Businesses: Ferrari, Alfa Romeo, Maserati, Lamborghini, Ducati, Dallara, Toro Rosso, Pagani, Marelli, Coxa

Automotive international university

- UNIBO, UNIMORE, UNIPR, UNIFE
- FERRARI, MASERATI, ALFA ROMEO, LAMBORGHINI, DUCATI, DALLARA, MARELLI, TORO ROSSO

- LAUREA MAGISTRALE IN AUTOMOTIVE ENGINEERING 86 PERCORSI9
- LAUREA MAGISTRALE IN COMPUMOTIVE

INTERNATIONAL FOUNDATION

BIG DATA AND ARTIFICIAL INTELLIGENCE

FOR HUMAN DEVELOPMENT

LR. 7/2019 Emilia Romagna

to try out new ideas and push boundaries in research, education, and entrepreneurship for a new sustainable development

THE REGIONAL SYSTEM IS **NOT ISOLATED**:

INDUSTRIAL POLICY POTENTIATES CAPABILITIES AND NETWORKING NOT ONLY WITHIN THE REGION

BUT ALSO **OUTSIDE THE REGION**

INITIATIVE OF INDUSTRIAL POLICY: REGIONAL LEVEL

BASE = DIALOGUE WITH STAKEHOLDERS HIGHLIGHTING COMPETITIVE STRENGTHS OF THE REGION THAT SHOULD BE POTENTIATED

REGIONAL POLICY-MAKERS THEN INTERACTED WITH HIGHER (NATIONAL AND EUROPEAN) AND LOWER (LOCAL) LEVELS IN ORDER TO

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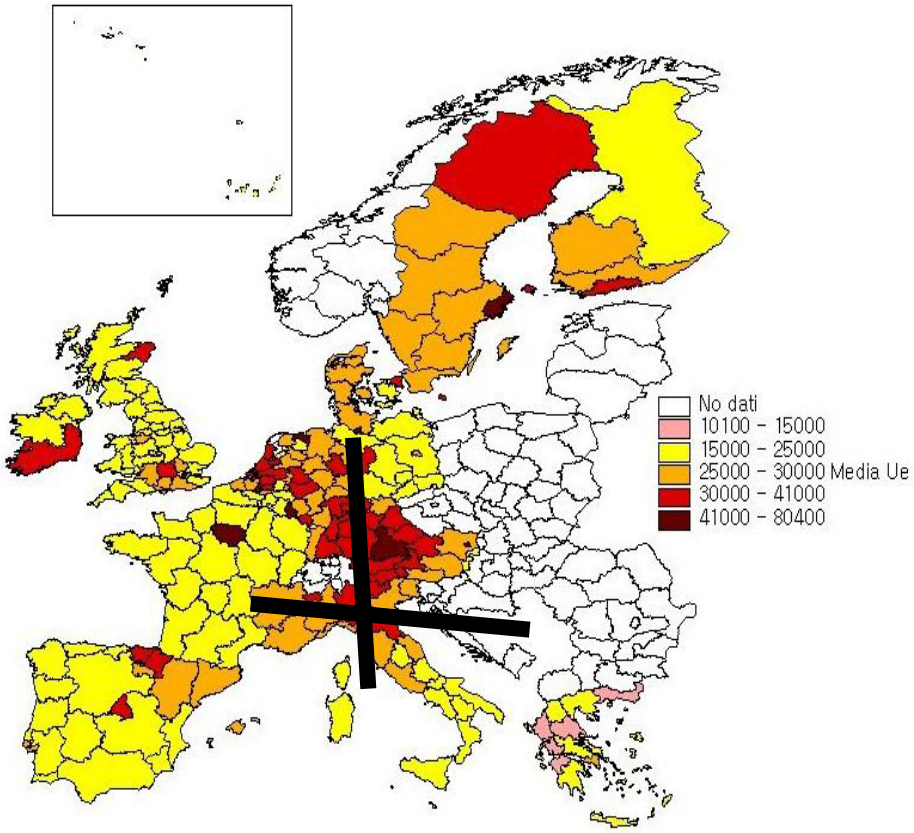
BUT ALSO OUTSIDE THE REGION



Economic geography: taking advantage of being in the industrial core of the EU

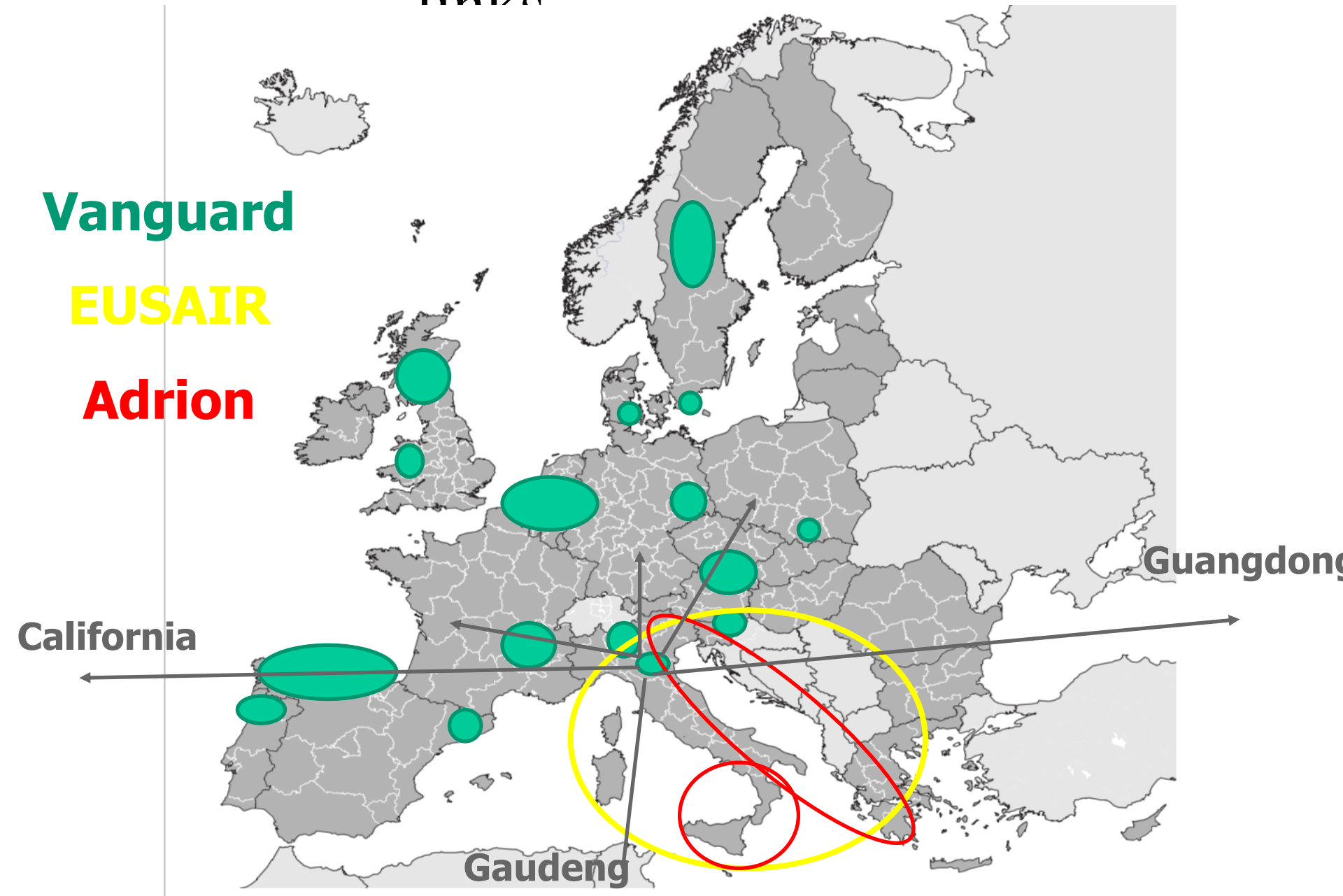
Extra-regional links of ER

- **Prospection** to set up national network of big data research and capacity
- **Partner regions**: Hessen (Wiesbaden – Frankfurt, D), Aquitaine (F), Wilkopolska (PL) in Europe; California (US), Guangdong (China), Gauteng (South Africa)
- **Vanguard:** association of advanced regions focused on industrial application of innovations
- **Interreg**: Adrion, Italy – Croatia, Italy – Greece, Italy-France (Alps), …
- Macroregion: **EUSAIR**
- **National lab** on innovation and research policy (dialogue with other Italian regions)

⇔ search for complementarity not left to private initiative only

⇔ Facilitator: strong role of ASTER

ER External links



CONCLUSIONS

Regional industrial policy for GVC reshaping and emergence characterised by:

- Definition of a vision of industrial development, choice of development trajectory
- 4 elements to orientate industrial development towards the chosen path
    1. develop capabilities
    2. networking both within and outside the region to exploit complementarities
    3. Participative governance: involvement of stakeholders in the policy process
    4. Policy coherence, between policy levels and between policy areas

MULTILEVEL GOVERNANCE FRAMEWORK

- Coherence and complementarity between policy levels is fundamental;
- Italy: no strategy at national level → a region like ER manages to implement policy thanks to policy enterpreneurship
- But more synergies between regions could be exploited (e.g. Big data and Tuscany)
- Particular problematic for less developed regions (South of Italy)