FONDAZIONE BRUNO KESSLER

* AI

FUTURE BUILT ON KNOWLEDGE

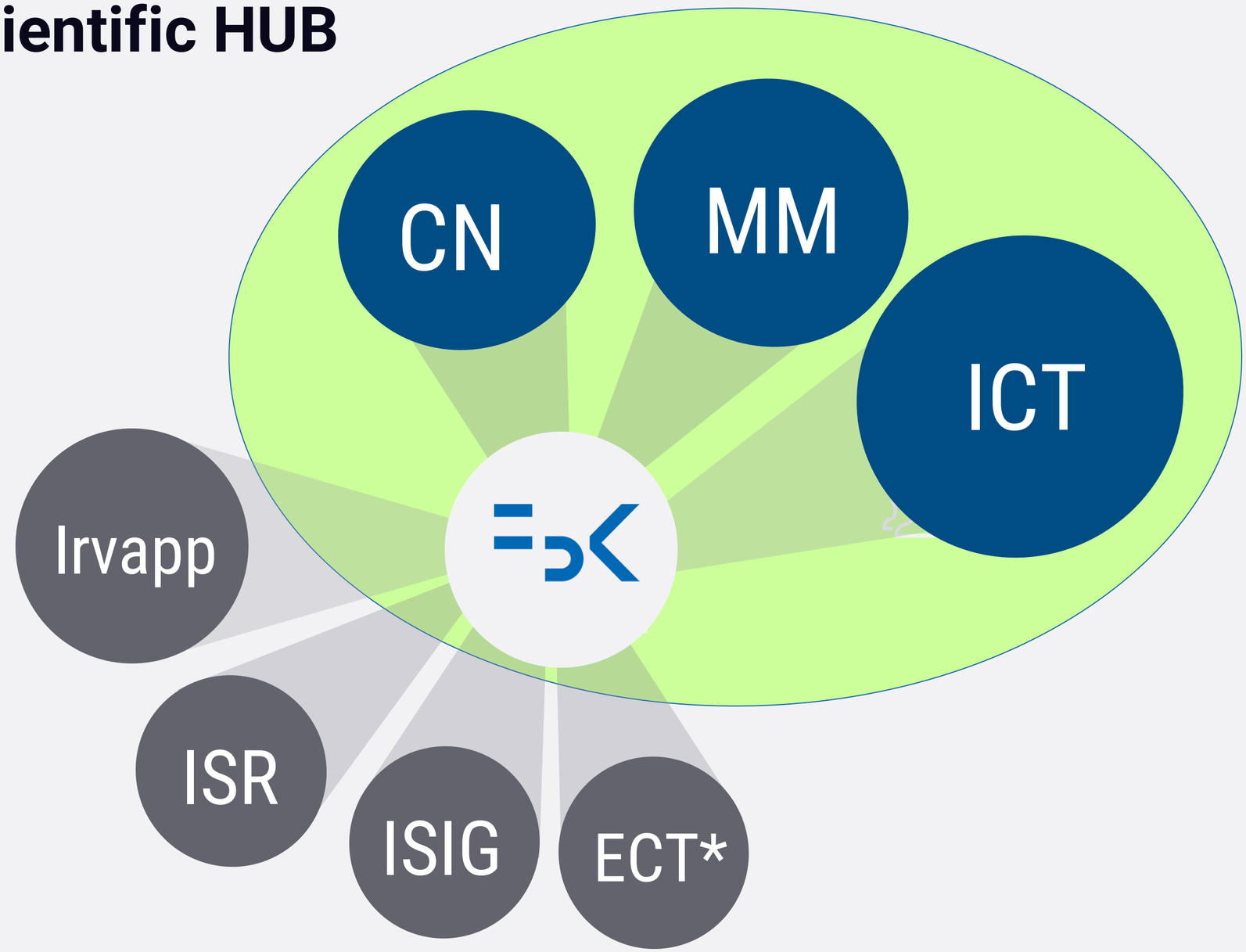
Scientific Hub Strategic Plan

2018 - 2027

*Future built on Artificial Intelligence

From Deep Competencies built in 30 years of Research to an Innovative Vision for the AI of the Future

Strategic Plan
Focus on Scientific HUB



The FOCUS of the Strategic Plan is on **FBK's scientific & technological research** managed by ICT, CMM and CREATE-NET centers.

* AI

The Plan is part of the FBK Master Plan that will be completed with the new Strategic Plan of the humanistic Hub (May 2018)

Strategic Plan
The goal of the Plan

To identify clear priorities fostering **the growth of FBK's reputation** in the scientific community with reference to **main worldwide challenges**

To promote the **transformation of research outputs** in social and economic value for citizens, companies and associations

To establish **strong alliances** with other scientific institutions through long-term common strategy

To **address the growth** and development of **internal competences** and the acquisition of new, highly qualified personnel dedicated to the attainment of long-term goals

Strategic Plan
Our philoshophy: FBK*AI

FBK built the future on a **new generation of Artificial Intelligence**, which does not replace humans at work, in their life but collaborate with them.

- FBK*AI for citizens, which makes the city more livable, enjoyable, and safe (Smart Cities & Communities)
- FBK*AI for humans who enjoy an healthy style of life (Health and Well Being)
- FBK*AI that lets machines and people work together, in a more productive, safe, pleasant, enjoyable factory (Industry 4.0/Meccatronica)
- FBK*AI for humans who respect the environment and its resources (Energy and Environment)
- FBK*AI that helps humans to discover the secrets of world and matter physics (Big Science)

Strategic Plan
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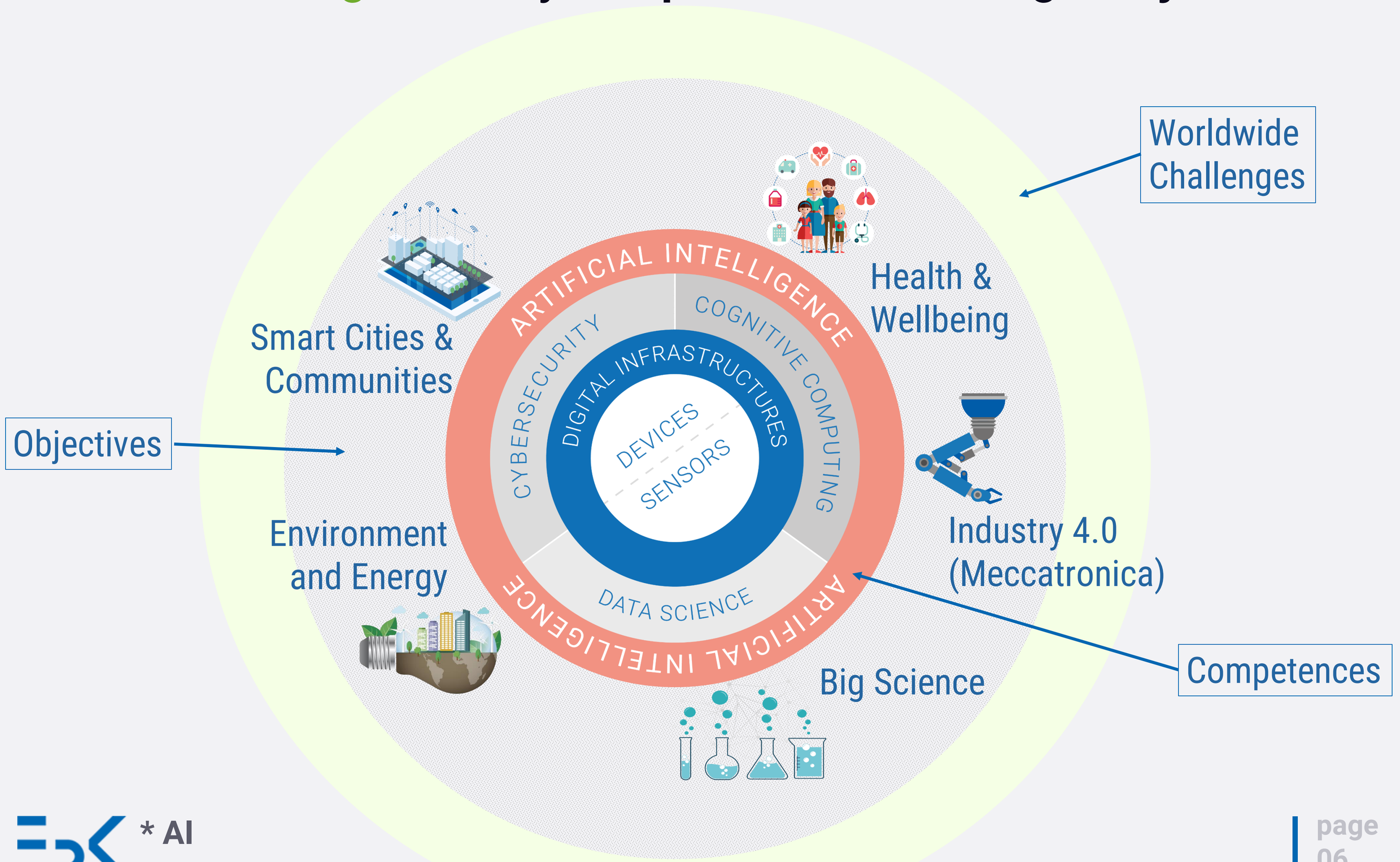
Vision
Artificial Intelligence: key competence for Strategic Objectives



Strategic objectives
Artificial Intelligence for Health & Wellbeing

our mission

Exploit the research/innovation results of FBK and Trentino Salute 4.0 to deploy patient-focused, technologyenabled, innovative services in healthcare organizations and systems (mainly, but not only, in APSS)

our vision

Empower each citizen as the manager of his/her health and as an active partner in the relationship with the healthcare providers through support of ICT platforms enriched by AI tools.

our values

For FBK: to exploit results of research into real world, meanwhile receiving feedback for new research activities.

- For citizens: to support for self-management of their health and improvement of their quality of life
- For healthcare organization: support for reforming/changing/improving existing model of care by delivering innovative and more efficient healthcare services based on new technologies (e.g. intelligent PHR platforms, mobile, cloud, wearable sensors, etc.)
- For local healthcare system: to become a reference site at National and International level for promoting and introducing innovative technology-driven digital healthcare services into clinical practice.
- For IT companies: to support the competitiveness of IT companies through technology and knowledge transfer.

Strategic objectives
Artificial Intelligence for Health & Wellbeing

Strategic program

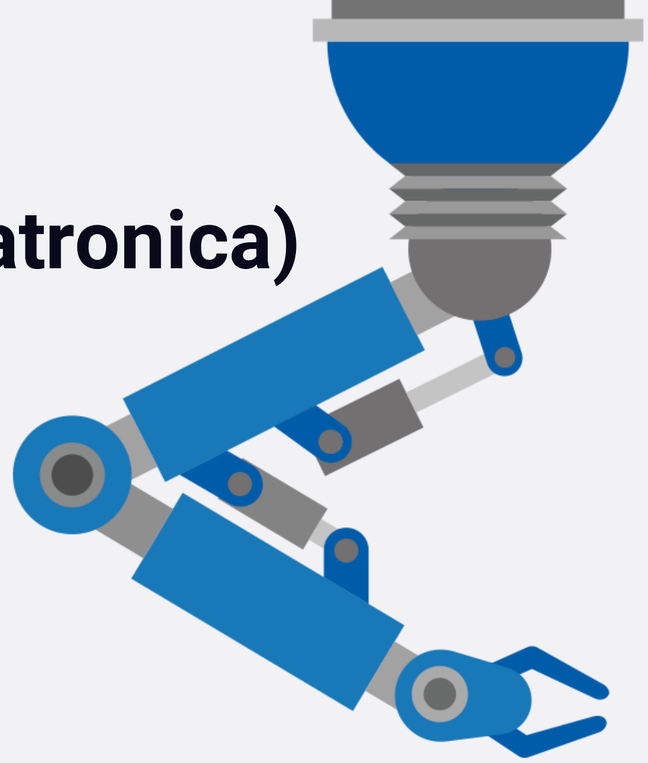
Focus on Development of Top Class Research in the following topics

- Continuous design, implementation and validation of a Personal Health Coach/Assistant Platform supporting citizens in adopting healthier lifestyles and chronic patients in self-management.
- Data Analytics on Healthcare Data from institutional healthcare repositories (e.g. FSE, TreC) for providing advanced intelligent services and predictive health risk assessments supporting decision support in the healthcare domain
- Implement cognitive functionalities built-in the IoT equipment deployed at home or in the clinics by processing data locally while preserving patient privacy and minimize data-flooding

Conduct R&D and Technology Transfer Activities by

- Deploying patient-focused, technology-enabled innovative healthcare services into clinical practice focusing on the Trentino Salute 4.0 initiative approach
- Promoting FBK technologies and vision on IT-supported healthcare management through new R&D National and International projects
- Reaching out to potential Industrial Collaborations and Partnerships.
- Increasing National and International visibility of the Group

Strategic objectives
Artificial Intelligence for Industry 4.0 (Meccatronica)



our mission

Exploit the research results of FBK and the alliances with companies to develop and exploit the platform.

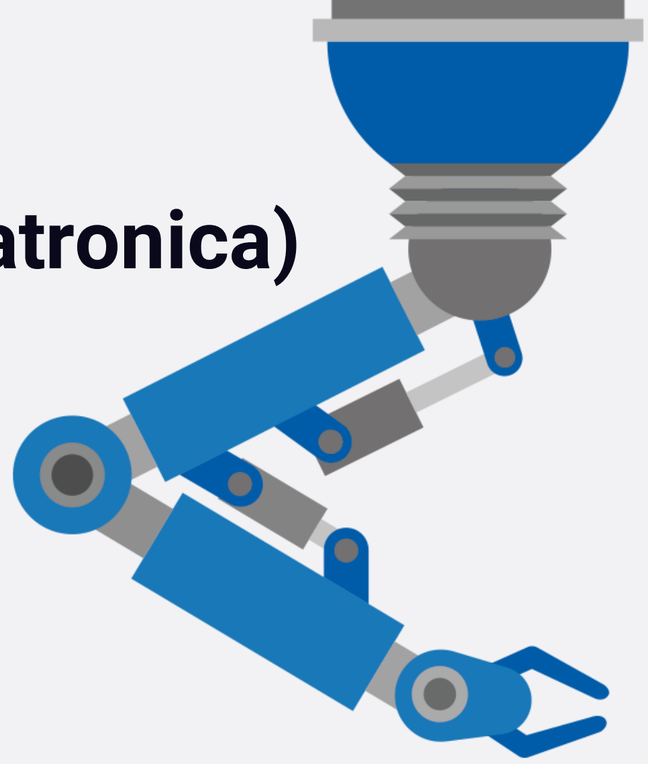
our vision

A full stack design / run-time platform for industrial applications.

our values

Inclusion of FBK’s research (both within the ICT center and other centers) Impact: develop technological assets enabling vertical complex applications Alliances (with companies): to transform knowledge in innovation.

Strategic objectives
Artificial Intelligence for Industry 4.0 (Meccatronica)



Strategic program

Model-based design

a technological platform supporting the design, deployment and certification of complex processes and systems

Smart Adaptive Operation

run time integrated solution for adaptive, self-learning decision making supported by simulation, planning, scheduling

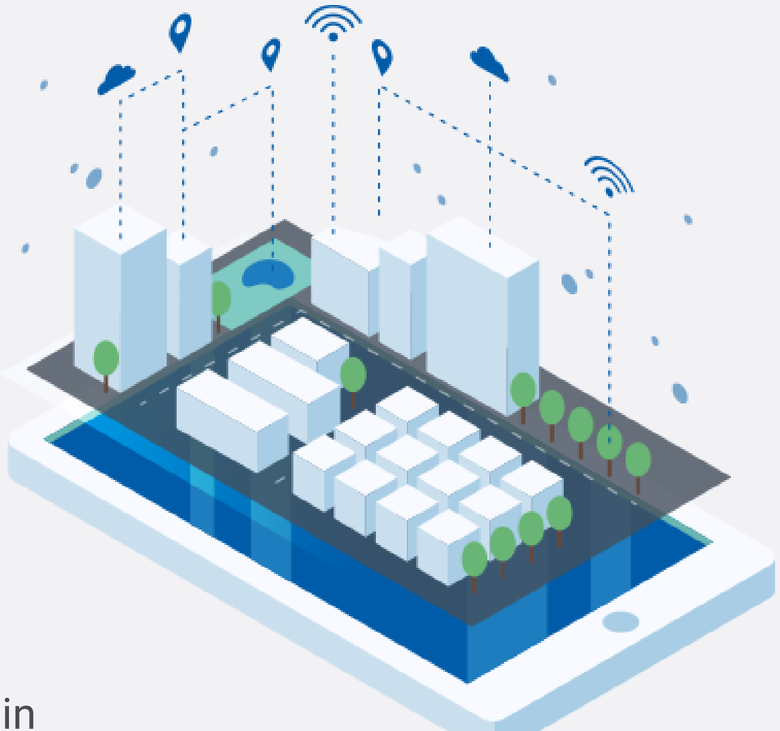
Autonomous Systems

design and development of deliberative, autonomous robotic applications for exploration and monitoring of extreme environments

Vertical Applications

complex industrial process operations with leading-edge research techniques (DSP, vision, …) leveraging on proximity (fog/edge) computing and IoT

Strategic objectives
Artificial Intelligence for Smart Cities and Communities



our mission

Develop and experiment a full stack methodological and technological platform for Smart Cities and Communities

our vision

ICT as key transformational technology to improve the quality of live in Smart Cities and Communities

our values

- Inclusion of FBK's research (both within the ICT center and other centers)
- Openness: open data, open source, open services, open hardware, open research, ...
- Joint open labs (with companies and with the territory) to transform knowledge in innovation

Strategic objectives
Artificial Intelligence for Smart Cities and Communities

Strategic program

Open Government
innovative approaches for more effective and transparent communication, better delivery of public services, and stronger participation and collaboration between citizens and public administration.

Mobility
more integrated and sustainable mobility through innovative ICT tools and active engagement of citizens.

Sustainability
increase awareness of citizens and public authorities, and better empower them, towards the adoption of sustainable lifestyles, habits and relations.

School
digital solutions to increase communication and cooperation among the community and improve efficiency of the educational system, both in a day-to-day and in a life-long perspective.

City Sensing
pervasive, diffuse and collaborative monitoring of the city, to help administrators and citizens understand the city and how it evolves.

Strategic objectives
Artificial Intelligence for Environment and Energy

our mission

- Development of methods capable of distributed, multi-parameter
- sensing for accrued efficiency monitoring
- Develop energy generation, storage and distribution equipment and methods for low environmental impact with high quality of life
- Action and partnerships at industrial and political levels, extended transfer to market.

our vision

- Contribute high-end instruments and methodologies for monitoring and managing the quality of the environment for quality of life
- Provide environmental security for hazard prevention
- Innovative energy solutions for balancing the ecological footprint

our values

- Key player in R&I at international level (based on know-how, methodologies, multi-disciplinary approach and prototyping capabilities).
- Key role in building future low-carbon energy scenarios.

Strategic objectives
Artificial Intelligence for Environment and Energy

Strategic program

Environmental monitoring

Integrating multi-parametric monitoring system for natural and urban environments.

Batteries and Storages

Development of innovative batteries for efficient storage solutions to support the large deployment of variable energy sources.

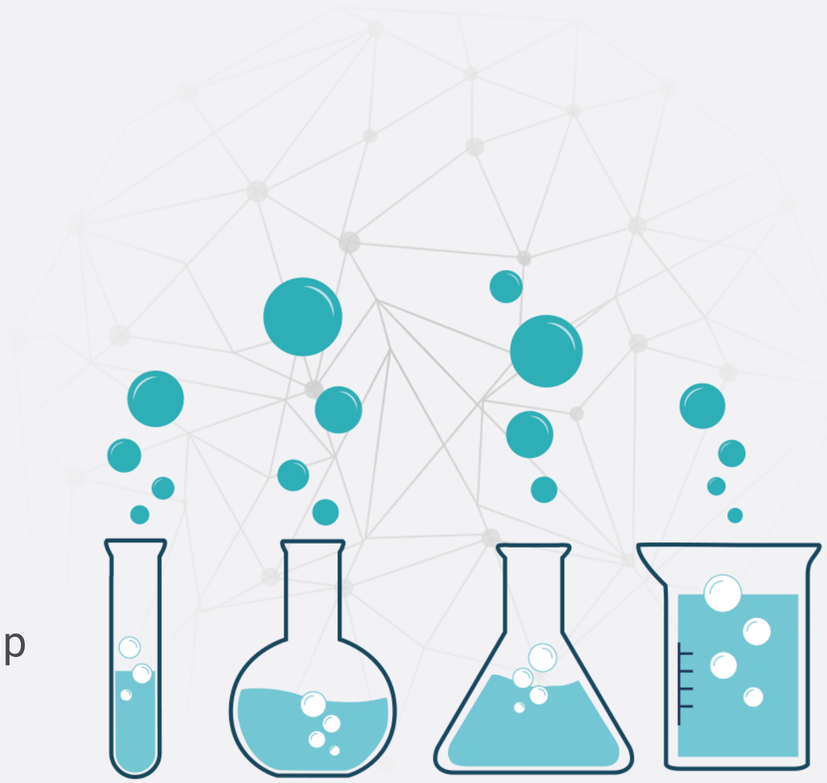
Solar Fuels and Solar Concentration

Breakthrough components for solar concentration plants (new materials and geometries and advanced manufacturing processes).

Flexible Energy Grids

In cities, for linking different grids and for flexible energy distribution.
Innovative energy integration schemes for smart and resilient communities and

Strategic objectives
Artificial Intelligence for Big Science



our mission

- Centrality to the international scientific scene: partnership with major scientific player's, presence in big science experiments
- High quality publications
- Attractiveness to highly esteemed collaborators and young scientists

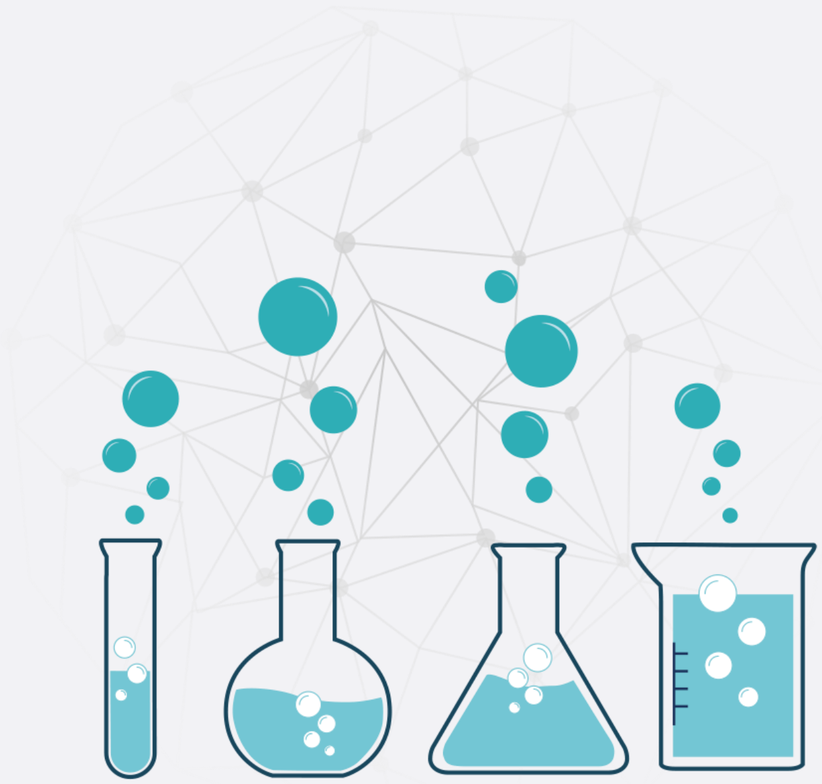
our vision

- Curiosity driven knowledge: Cultural and Scientific prestige
- Stimulus for continuous and possibly disruptive know-how

our values

- Wide range and expanding knowledge platforms
- Build novel interdisciplinary approaches (e.g. merging sensors with Deep Learning Data Analysis, heterogeneous manufacturing, introducing network functions in quantum based communications …).

Strategic objectives
Artificial Intelligence for Big Science



Strategic program

Superb instruments for superb science

Advancing science by advancing instruments for experiments in:

- Particle Physics and Astrophysics
- Nuclear physics
- Science in satellites
- High sensitivity experiments (Dark Matter, sterile neutrino, …)
- Quantum Physics and Technologies
- Synchrotron and x-ray chrystallography

Material science and nano-technologies

- Novel high-performance materials (e.g. graphene), functionalzing thin films, novel photonics materials, novel processes (integration), nano-materials, nano-electronics, biotechnologies.
- Quantum Science and Technology, a challenge to shape the future.

Competences
Specific Competences within Artificial Intelligence frame

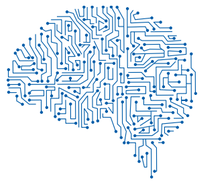
Devices

Sensors

Digital infrastructures

Cyber security

Data Science



Cognitive Computing

Competences
Devices

Strength

Solid know-how in designs for a variety of application.

Added value

Processing capabilities combined with design capabilities with third party technologies, full instrument or product development capability, advanced testing, analysis and debugging.

Challenges

the main sensor challenges (**low power, accrued performances, ease of deployment, local intelligence, 'fog readiness', …**) drive our strategy.

Areas

- Extreme sensitivity devices
- Quantum Technologies
- Devices at the nano-scale
- Biotech devices

Competences
Sensors

Strength

State-of-the-art technologies (CMOS line, MEMS, ASIC design, photonics, surface functionalization, ….) and research and innovation skills make our lab a leading reality in the sensor world.

Added value

Integrating technological platforms for enhancing the capabilities of the sensors (**heterogeneous manufacturing**) with novel functionalities: improvement on state-of-the-art implementing more-than-silicon solutions.

Challenges

Anticipating the future for devices: improve on silicon only performance, exploit new concepts (single quantum effects, nano-materials).

Areas

- Space applications
- X-ray analysis
- Gas sensors
- Detectors for high energy particles
- Silicon Drift Detectors for spectroscopy
- Single-photon detectors in full-custom and standard CMOS technologies
- Ultra-cold sensors
- Multispectral Imaging Camera (Visible, IR and THz)
- Ultra-low power imagers for Wireless Camera
- Photonic integrated circuits
- MEMS: Bio-MEMS, RF-MEMS

Competences
Digital Infrastructures

Vision

To develop the Next Generation Internet infrastructure: super-reactive, highly-robust and connecting anything/anywhere

Added value

to validate theoretical research with realistic experimentation in the field and rapid-prototyping

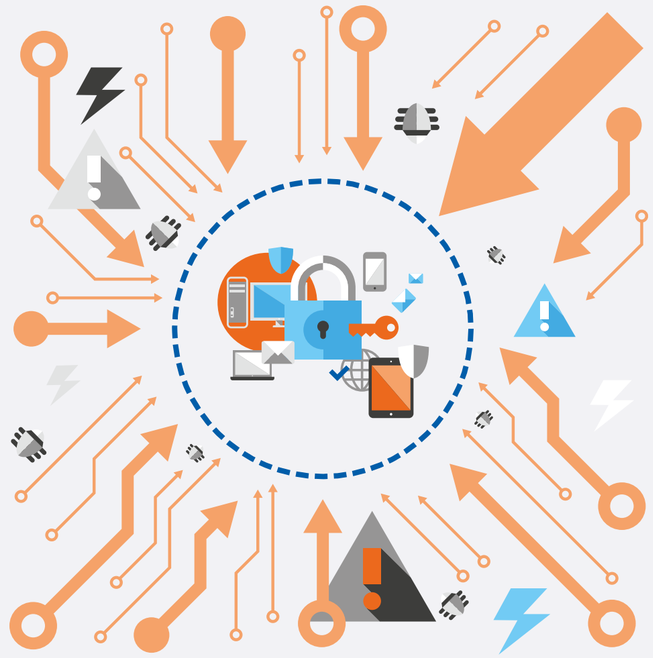
Challenges

To make the Next Generation Internet architecture (i) easily programmable to properly address Vertical sectors requirements (ii) self-adaptive to improve its robustness

Areas

- **5G** programmable/sliceable mobile & transport networks
- **Fog/edge computing** addressing real-time requirements < 1msec
- **Highly-decentralized IoT** leveraging on blockchain

Competences
Cybersecurity



Focus on

Combination of **security techniques** based on Formal Methods and **AI** for all phases of system development with **approaches from social science, economy, law** as well as practitioners, developers, and system administrators to consider roles played by humans (such as developers, users, or attackers)

Added value

Truly **disruptive cybersecurity solutions** capable of **mitigating threats** while improving **integration with humans** (usability, compliance with legal provisions, system engineering, …)

Challenges

Meeting security objectives requires a deep understanding of both the **human context** (e.g., how attackers discover and exploit flaws and vulnerabilities), **technological scenarios** (**AI**, web, mobile, cloud, IoT), and **use cases** (how and when data are accessed)

Areas

- **E-government**:
  authN/Z solutions, Penetration testing, GDPR, …
- **IoT**:
  risk assessment for insurance, design & enforcement of security policies, …
- **Metrics & Measures**:
  Quantitative approaches to security, Integrated macro / micro views for countering large scale attacks, ...

Competences
Data Science

Focus on

Generating new ideas that can change the world, from data, thorugh **AI** based (deep) learning techniques

Added value

Create opportunities in the real world from convergence of science, social and technical innovation

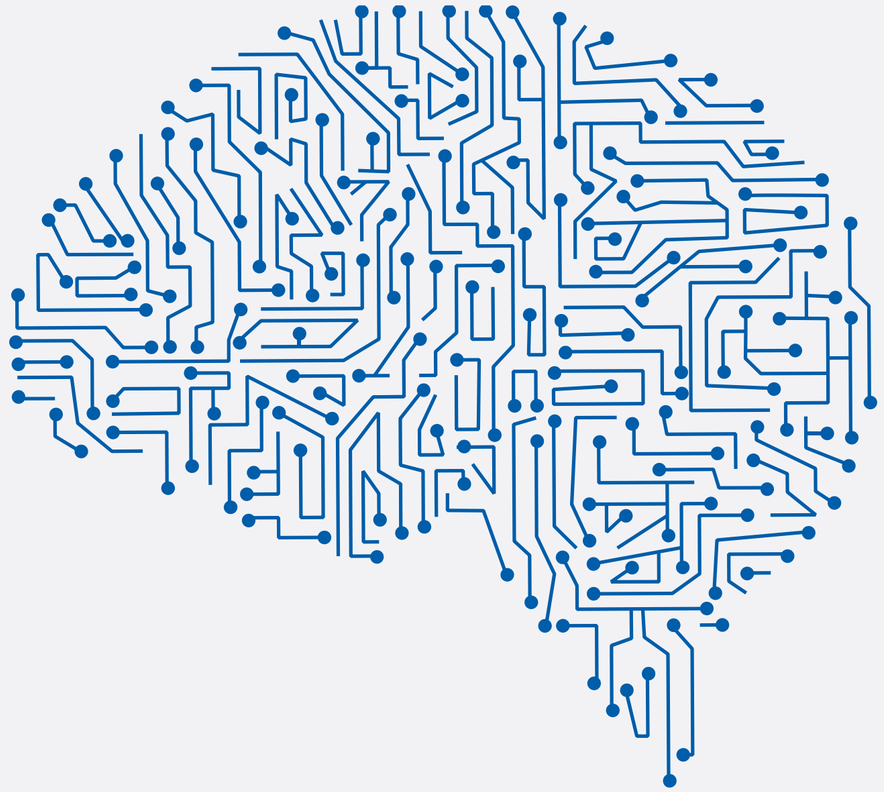
Challenges

Interacting with **AI** **Deep Learning** machines and **Complex Networks** to get value and discovery from big data

Areas

- **Precision Medicine** for biotech and medical research
- **Environment:** big data and AI for life and food
- **Development:** complex networks in action
- **Complex Data Analytics:** DL, CN, AI dashboards,

Competences
Cognitive Computing



Focus on

1. Understanding and realizing cognitive processes based on **AI** techniques
2. Constructing engineered systems that implement intelligent functions

Added value

Thirty years of experience of an internationally renowned center from the beginning devoted to artificial intelligence

Challenges

a) Integration of learning from data with knowledge-based research, both for fundamental advancements and original applications;

b) Integration of research areas to produce innovative artifacts

Areas

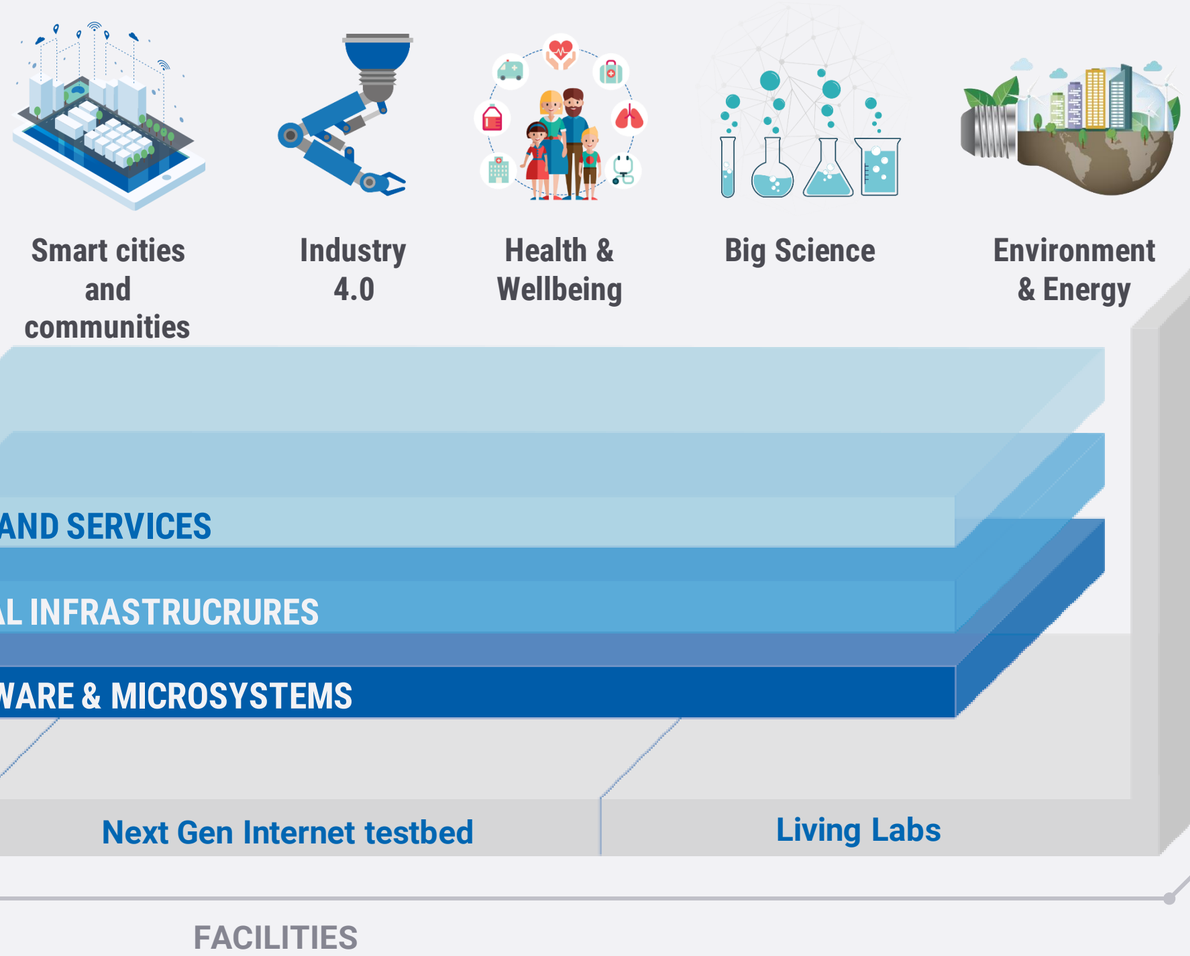
- Human interaction oriented AI (perception, communication, behavior)
- System oriented AI (planning, formal reasoning)
- Environment oriented AI (physical world, internet)

Strategic objectives / Competences
Integrated vision

- Developing **integrated platforms (horizontal axis)**
- Feedback from the whole **vertical chain**
- Dynamic exchange between **adjacent layers**

Tools based on
AI technology

- Cyber security
- Data Science
- Artificial Intelligence
- Sensors
- Devices
- Digital Infrastructures



Strategic objectives / Competences
Integrated vision

	Cyber Security	Data Science	Cognitive Computing	Digital Infrastructure	Devices	Sensors
Health & Wellbeing	▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▯	▮▯▯	▮▮▮
Industry 4.0 (Meccatronica)	▮▮▮	▮▮▮	▮▮▮	▮▮▮	▮▯▯	▮▮▮
Smart Cities and Communities	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▯▯	▮▮▮
Big Science	▯▯▯	▮▮▯	▮▮▯	▮▮▯	▮▮▮	▮▮▯
Environment & Energy	▯▯▯	▮▮▯	▮▮▯	▮▮▯	▮▯▯	▮▮▯

FBK positioning
Reference model

Step by step FBK is getting closer to **Fraunhofer Model**

Impact to market and society

- being a point of reference in innovation for local, national, and international companies
- being a key actor of the public-private ecosystem, enabling private business guided by public needs
- promoting strategic partnerships with private companies and public institutions
- promoting innovation and competitiveness of the industrial system and providing solutions to emerging needs in the public and private sectors
- being an internationally renowned center in research
- promoting the national economic and social development

Economical Sustainability

- high success rate in competitive research grants (e.g., FP9 calls)
- be a national point of reference for EU strategic initiatives (e.g., HPC, QT)
- increase the income from industrial projects

FBK positioning
Scientific Exellence

Top level publications:
- Journals with high impact factors and top level conferences
- High evaluation with “continuous VQR” (e.g. with a 4 years window)

High rates of citations indicating the scientific impact of research:
- Number of citations to (top level) papers
- Researchers h-index

Habilitations:
- Full Professor habilitations
- Associate Professor habilitations
- FBK - University co-funded double affiliations as full or associate professors

FBK positioning
Economical Sustainability

Increase the ability to self-fund research
and also apply lobbying tools to enter high-profile projects at European level (FP9 and more)

Increase links and contracts with private companies
on the medium-term research and development model

Exploit the IPR's economic and technological potential
by establishing collaborations with partners able to leverage its skills and gained experience in translating scientific results and findings into innovative products and services

Aim to open "new markets" (see China)
through alliances with organizations capable of opening the way for us

FBK positioning
Impact to market and society

- **Develop tools** that allow us to get to the marketplace rapidly. Market launching must be increasingly faster
- **Extend the value chain of the research activities** and, overall, the impact on society by deploying proper technology transfer and venturing management
- **Disseminate the innovations produced in its activities** in order to support the economic development of the local area, benefit the society and add value to and reward its researchers consistently
- **Foster the generation of intellectual property** and the protection of related rights arising from the results
- **Experiment with new models of long-term relationships with companies** and new models for creating start-ups and spin-offs
- **New models to enable private business guided by public needs** through alliances with both public and private key players

* AI

FBK positioning
Impact to the territory

Strategic Alliances with public institutions

- Health Care System with PaT (Trentino Salute 4.0)
- Mobility with Municipalities (Trento, Rovereto, Consorzio Comuni)
- Open Government & Sustainability with PaT, Municipalities
- School with Education Department of PaT

Territorial Labs

- Experimentation of **AI** technology for Health & Well Being for chronic patients and style of live
- Experimentation of innovative solutions for sustainable mobility and open government for citizens
- Experimentation of new services for students and teachers

Support to the territorial companies

- Co-innovation labs
- Specific projects to push innovation inside local companies

FBK positioning
Impact on new generations of scientists and professionals

Agreements and network

- Relations with the School System in Trentino (PaT, Schools, IPRASE)
- Collaboration agreements with national and international institutions (MIUR, Indire, CNR-ITD, Fondazione Giovanni Agnelli, Fondazione per la Scuola, ecc.)

Development of technical fluency and appropriate skills for individual and team work

- Application of new modalities of teaching and tutoring, together with top researchers
- Contribution to higher education curricula (training experiences, FBK tutors in projects within the schools, oriented towards learning-by-doing paths.
- Connection between geographically isolated places and actors of the school system, as well as serving as new communication channel among schools

School Camps and Labs

- WebValley - an Interdisciplinary Data Science School for High School
- [Pro]^{M}-Camp - an Industry 4.0 Challenge of Predictive Maintenance for High School Students (1st edition in 2018, 1 week in March, ~20 students)
- AI and Innovation Design LAB, a Data Science Lab run by students under FBK supervision (2018, FBK-Artigianelli)