FONDAZIONE BRUNO KESSLER

* AI

FUTURE BUILT ON KNOWLEDGE

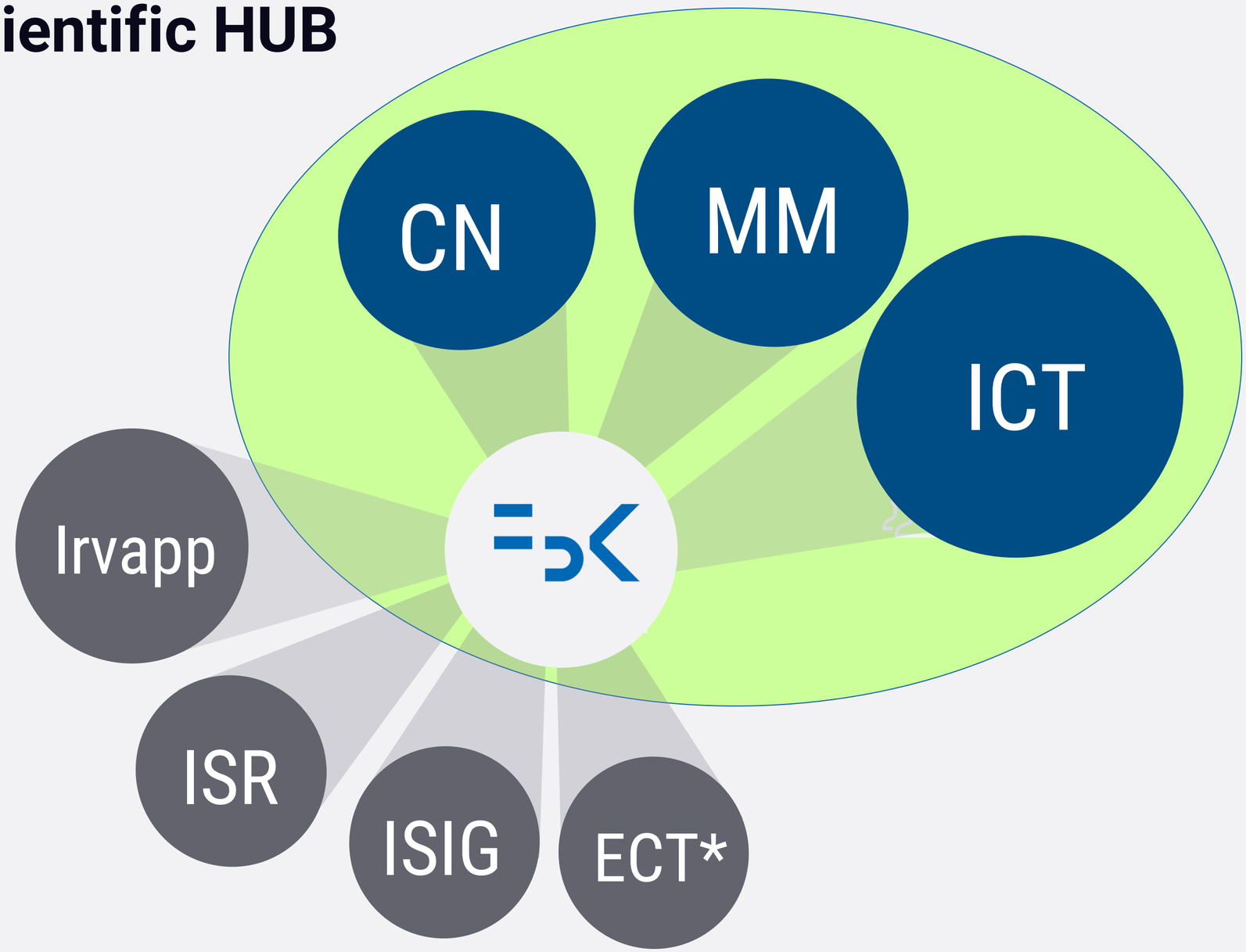
Scientific Hub Industrial Plan

2018 - 2020

*Future built on Artificial Intelligence

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

Industrial Plan
Focus on Scientific HUB



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

Industrial Plan
The goal of the Plan

- Identify specific applications for the lines of action of the Strategic Plan keeping the context and related conditions in mind
- Identify specific **tangible goals for the 2018-2020** period
- Strengthen the competences identified as important in the Strategic Plan
- Develop the tools needed for achieving goals and strengthening the competences identified in the Strategic Plan

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

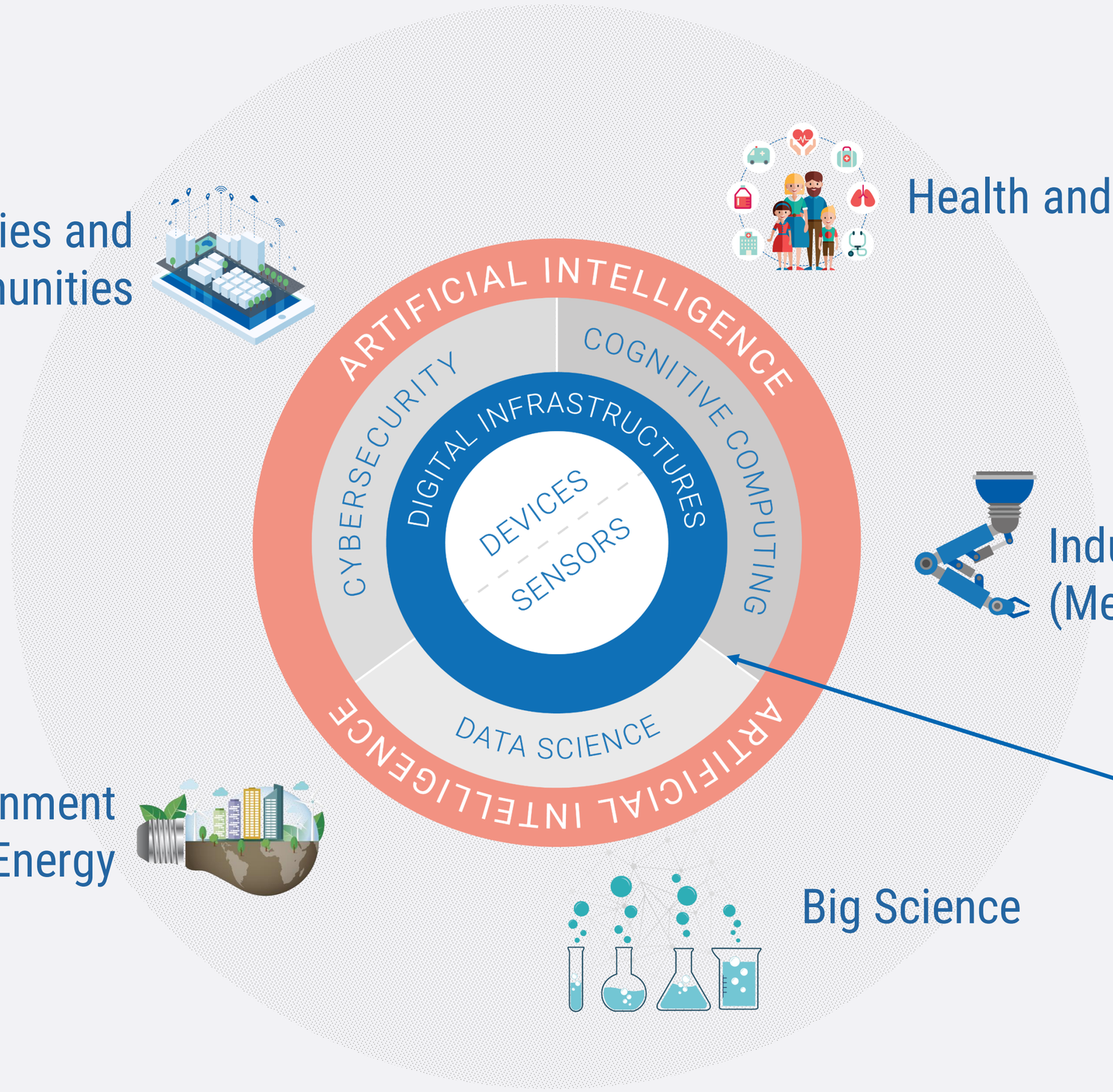
Industrial Plan
Our philoshophy: FBK*AI

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)

Industrial Plan
Index

Objectives
Artificial Intelligence main stream for 5 objectives



Objectives
Artificial Intelligence for Health & Wellbeing
Expected Results

I prescribe you an app

- ***in production***: system that allows doctors to prescribe apps for monitoring type I diabetics patients (***2018),*** extension to "personalized" monitoring of chronic patients - e.g., diabetes type I and II, BPCO, Asthma (***2020)***

Virtual Coaching

- ***development*** of an AI based system promoting healthy stiles of life and ***experimentation*** in a FBK, PAT, and INPS living lab with about 50 people ***(2018)***; ***in production*** in the whole territory ***(2020)***

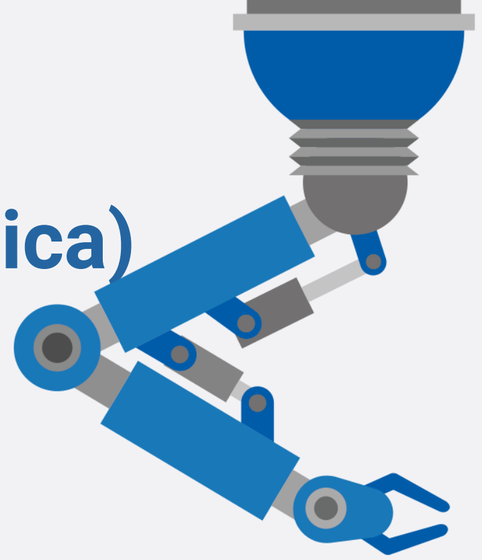
Medical Deep Learning

- ***study*** of the definition of the process to access people health data and ***development*** of predictive models for chronicle diseases ***(2018),)***; ***in production*** through the integration in the virtual coaching system ***(2020)***

Staff per year

Researchers	*38*
Innovators	*49*
PhD Students	*23*

Objectives
Artificial Intelligence for Industry 4.0 (Meccatronica)
Expected Results



Autonomous systems

- ***in production**:* design, validation, delivery of (safety & resilient) critical systems for industry 4.0 in the avionics, oil and gas, and railway sectors supported by industrial partners ***(2018)***; ***development and experimentation:*** advanced sensing for smart monitoring (e.g. quality control); adaptive control for smart online closed-loop control leveraging on fog computing and IoT infrastructure ***(2020)***

Predictive Maintenance

- ***development and experimentation**:* design and implementation of an integrated platform for big data analytics for diagnosis, prognosis, and predictive maintenance leveraging a decentralised (fog/edge) computing infrastructure ***(2018)***; ***in production*** integrated platform in realistic environments ***(2020)***

Towards Industry 5.0

- ***development:*** interdisciplinary approach for human-aware robotics in complex industrial environments ***(2018)***; ***experimentation:*** integration of techniques for automated planning and control for highly flexible production (e.g., chemical production) ***(2020)***

Staff per year

Researchers	*40*
Innovators	*42*
PhD Students	*31*

Objectives
Artificial Intelligence for Smart Cities and Communities
Expected Results

City Sensing

- ***in production****:* the Trento Smart City living lab (Vela district, > 100 citizens engaged); adoption by city managers for the analysis of city sustainability ***(2018)***; scale-up of adoption to city (and regional) level; wide coverage of city sustainability ***(2020)***

City Digital Companion

- ***in production****:* digital companion for urban sustainable mobility plan; adoption by PAs in Trentino for long-running campaigns (>6 months) engaging thousands of citizens ***(2018)***; game-based sustainable mobility adopted outside Trentino; co-creation platforms adopted by PA in innovation processes ***(2020)***

Digital Student Record

- ***in production:*** platform for collecting and managing personal data, killer application: work-linked training - ‘‘alternanza scuola lavoro’’ ***(2018)***; adoption in some high schools and companies; extension to the whole school system in Trentino; adoption in life-long learning scenarios – e.g. with employment office ***(2020)***

Staff per year

Researchers	*47*
Innovators	*55*
PhD Students	*34*

Objectives
Artificial Intelligence for Environment and Energy
Expected Results

Environmental monitoring

- ***Study, development***: Novel solutions to monitor the quality of indoor environment and residential life
- ***Study, development***: sensors and systems for the urban and natural environment resiliency of communities and city/land metabolism.

Solar Fuels and Solar Concentration

- ***Study***: Embedded Volumetric solar receiver – reactor for hydrogen production
- ***Study, development***: Novel solar thermal for industrial processes

Energy Storage and Carriers

- ***Experimentation, production***: Improved stacks of Redox Flow Battery (RFB) with high material and component integration
- ***development, experimentation***: Novel high temperature stacks for hydrogen production and fuel cells
- **Study**: initial study on metal – air cells

Flexible Energy Grids

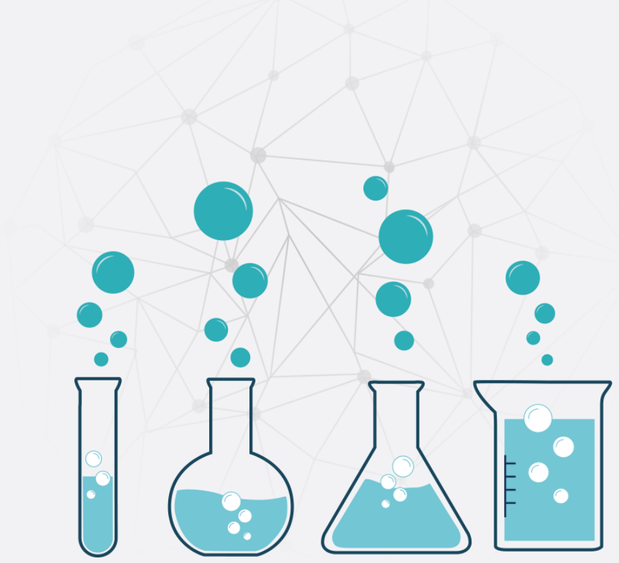
- ***study***: Models and scenarios to apply storage solutions
- ***study, development***: Distributed energy generation and nano-grids
- ***study, development***, ***experimentation***: Energy sharing in smart communities and cities, for wide penetration of Renewables.

Staff per year

Researchers	*21*
Innovators	*21*
PhD Students	*9*

Coordinator: CMM

Objectives
Artificial Intelligence for Big Science
Expected Results



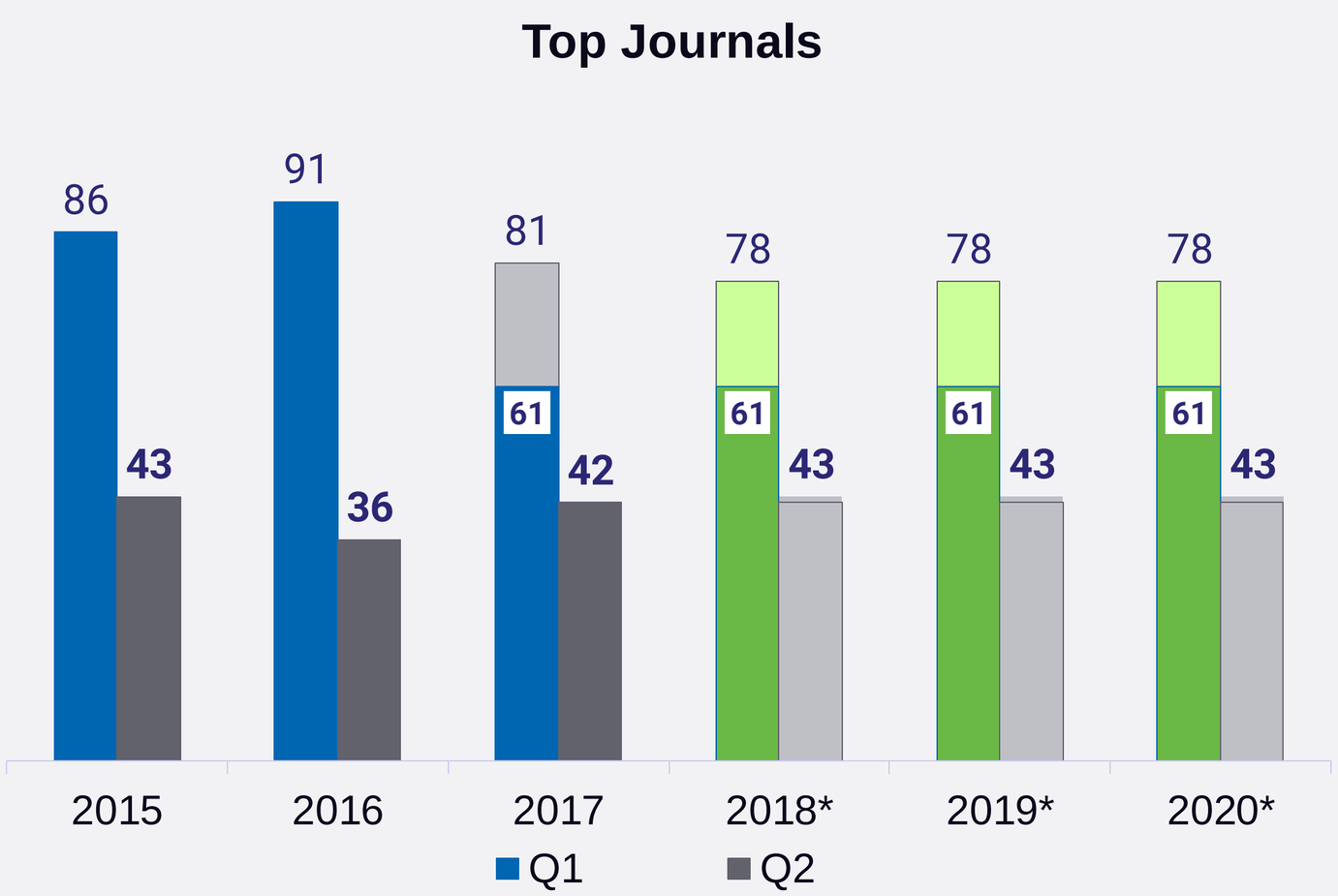
Instruments for future discoveries: human progress by knowledge

- ***Experimentation and production***: 3D (column) detectors for sensing in extreme hadron radiation environments.
- ***Development and experimentation***: novel rad-hard LGAD sensors for time-of-flight applications.
- ***Development, experimentation and production***: Novel high performance low mass pixel detectors for the hadron therapy applications for cancer.
- ***production***: Spectrometer for space science and economy. Design adaptation. Delivery for testing.
- ***study***: R&D for Quantum Technologies (single photon, entanglement).

Staff per year

Researchers	*16*
Innovators	*14*
PhD Students	*4*

Expected Scientific Results
Research Quality



- The research excellence in the above objectives will be reflected in the quality of publications (high IF journals, Q1 and Q2 levels).

- Same level of excellence defined by the average of the production of the last 5 years.

Expected Scientific Results
Research Quality

H-Index measures the scientific impact of a researcher, based on number of citations and number of publications. The National Habilitation recognizes a researcher the ability to be a (full or associate) professor.

H-index

Baseline (2017)

- **8** researchers with **h-index ≥ 40**
- **11** researchers with **30 ≤ h-index ≤ 39**
- **36** researchers with **20 ≤ h-index ≤ 29**
- **83** researchers with **h-index ≥ 15**

Forecast (2020)

- **25** researchers with **h-index ≥ 30**
- **95** researchers with **h-index ≥ 15**

Habilitations

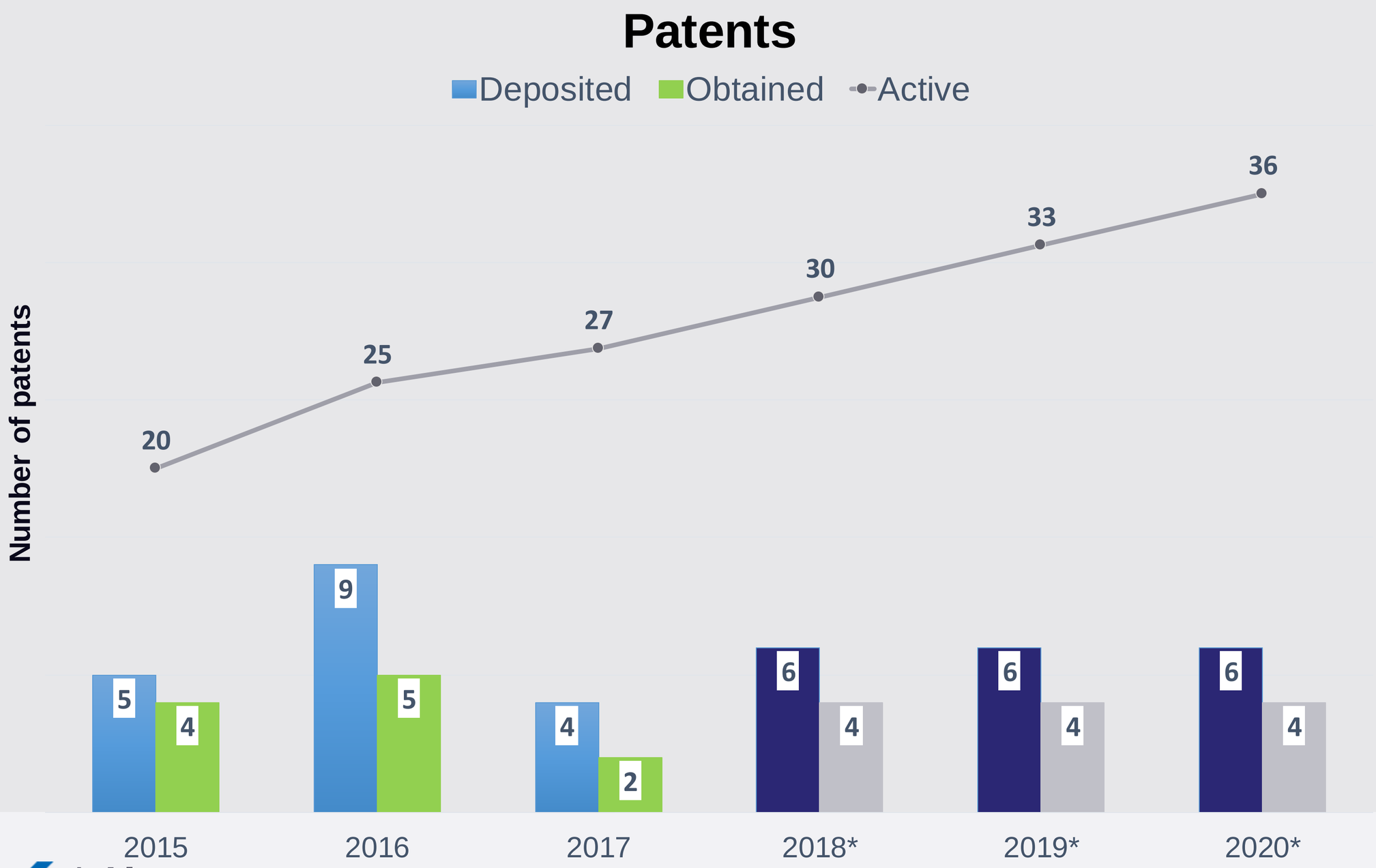
Baseline (2017)

- **12** researchers with habilitation as **full professors**
- **16** researchers with habilitations as **associate professors**

Forecast (2020)

- **≥ 15** researchers with habilitations as **full professors**
- **≥ 20** researchers with habilitations as **associate professors**

Expected Scientific Results
Patents



* AI

Revenues & Costs
Revenues (I)

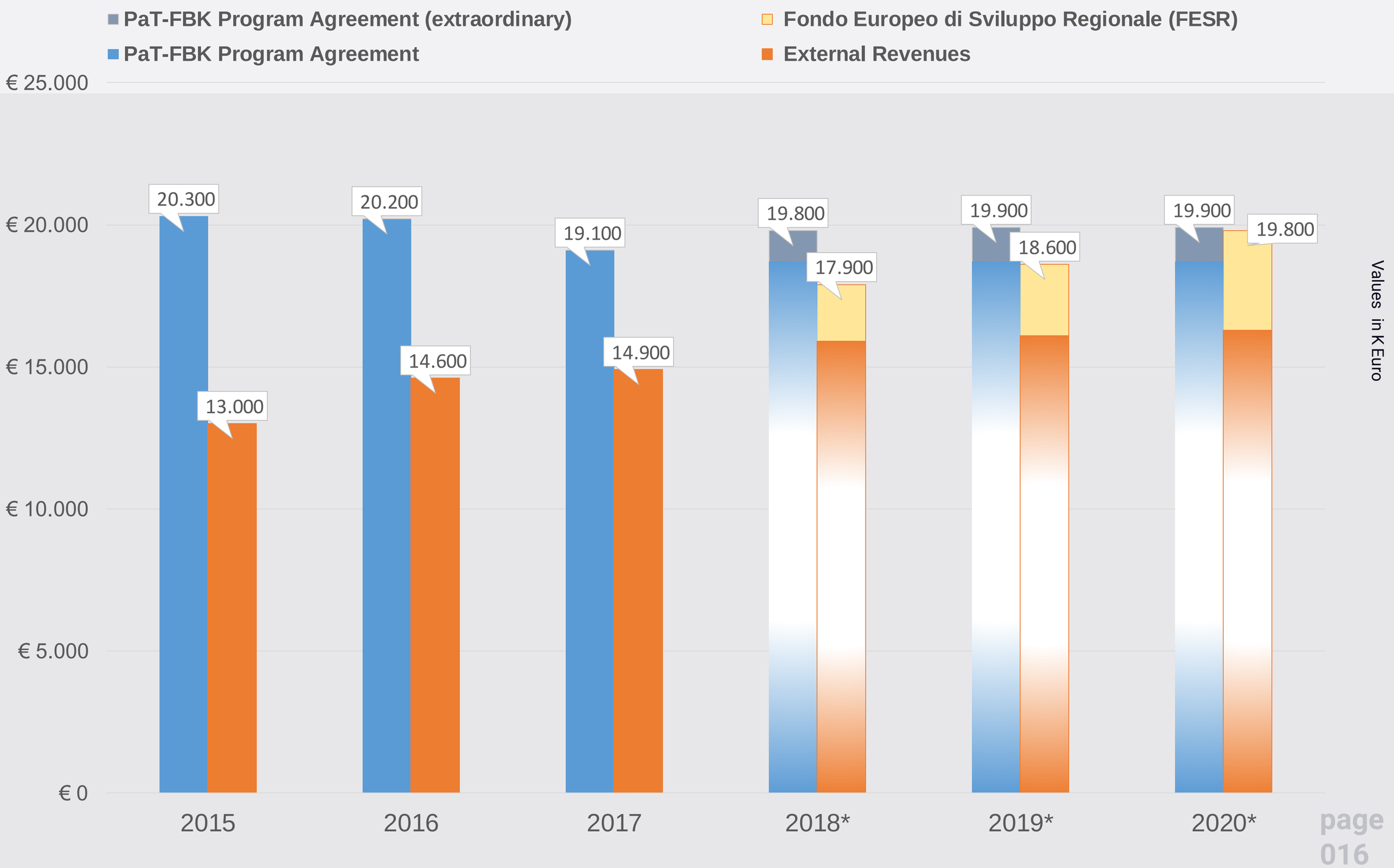
	2015	2016	2017	2018*	2019*	2020*
PaT-FBK Program Agreement	20.300	20.200	19.100	18.700	18.700	18.700
PaT-FBK Program Agreement (extraordinary)				1.100	1.200	1.200
External Revenues	13.000	14.600	14.900	15.900	16.100	16.300
Fondo Europeo di Sviluppo Regionale (FESR)	-	-	-	2.000	2.500	3.500
Total	**33.300**	**34.800**	**34.000**	**37.700**	**38.500**	**39.700**

Values in K Euro

The **FBK Incomes** are classified as followed:

- Funding from PaT (PaT-FBK agreement)
- External Revenues
  - From public agencies (H2020, ESA, etc..), National agencies (MIER, MISE, etc..)
  - From companies through commercial contracts
- Fondo Europeo di Sviluppo Regionale – FESR (dedicated to investments)

Revenues & Costs
Revenues (II)



Revenues & Costs
Structural Costs and Investments

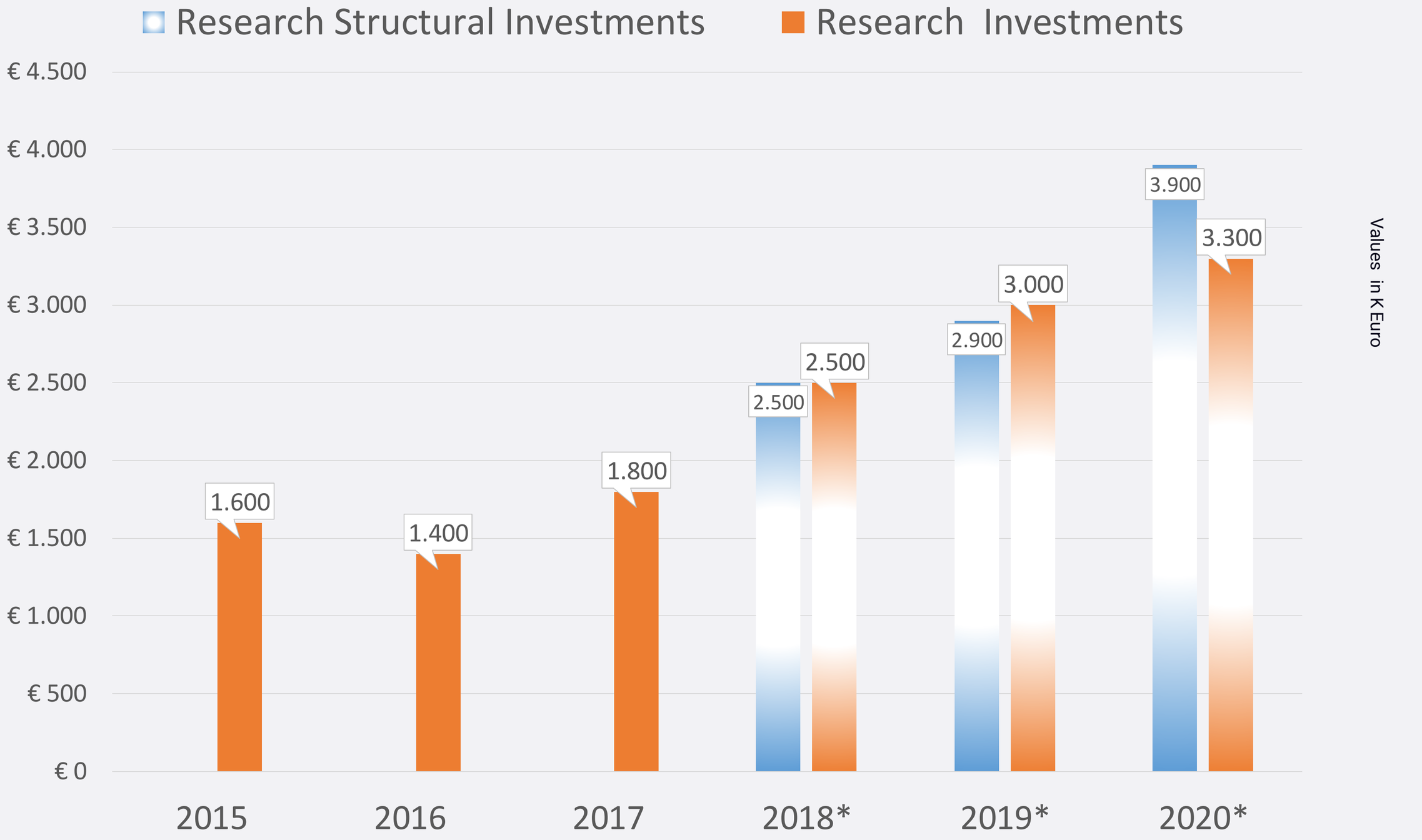
	2015	2016	2017	2018*	2019*	2020*
Personnel	18.300	19.200	20.500	21.600	21.600	21.600
Facility Management	7.300	7.300	5.800	5.500	5.400	5.300
Other costs (travels, internship, ..)	6.100	6.900	5.900	5.600	5.600	5.600
Research Structural Investments	0	0	0	2.500	2.900	3.900
Research Investments	1.600	1.400	1.800	2.500	3.000	3.300
Total	**33.300**	**34.800**	**34.000**	**37.700**	**38.500**	**39.700**

Values in K Euro

The **FBK Costs** are classified as followed:

- **Structural costs**
  - Personnel
  - Facility management
  - other costs
- **Investments**
  - Research Structural Investments related to scientific instruments
  - Research Investment are related to strategic initiatives as PhD, students, Proof of Concept Program, Flagship Projects, etc.

Revenues & Costs
Investments



* AI

Instruments for fund raising
Horizon 2020

Scouting of funding opportunities and international networking:

objectives

- Mainting numbers of EU projects in a high competitive scenario
- FBK Liaison function with EU stakeholders helps monitoring funding and project planning opportunities, scouting and possibilities of financing
- Promoting FBK at specific international events with the aim of creating an international network to access to funding programs

key aspects

- Communication and networking to create collaboration projects
- Scouting new funding opportunities and relationships at national, European and international level.

opportunities

- Creating a strong eco-system for access to European Community and international funding programs
- Developing synergies on research and innovation issues to identify new opportunities

Instruments for fund raising
EIT – Knowledge Innovation Communities (KIC)

European Institute of Innovation & Technology

EIT Climate

Bringing together a dynamic community to build a zero carbon economy and climate resilient societies

EIT Digital

Fostering digital technology innovation and entrepreneurial talent for economic growth and quality of life in Europe

EIT Inno-energy

Building a sustainable long-lasting operational framework to foster innovation and entrepreneurship in sustainable energy

EIT Raw Materials

Turning raw materials dependence into a strategic strength by boosting competitiveness via innovation and entrepreneurship

EIT Urban Mobility

Develop solutions for sustainable urban mobility through breakthrough innovations that lead to greener, more inclusive, safer and smarter transport systems.

EIT AVM

Strengthen high-value (or added-value) manufacturing industries to guarantee Europe's competitive position.

Instruments for fund raising
Co-Innovation Labs with companies

objective

Bridge the gap between research and innovation by sharing competences and personnel in specific common applications.

key aspects

- Common space to share people, competences, technologies
- Co-Funding, co-participation to proposals
- Training on the job

Instruments for fund raising
Knowledge Transfer

IPR creation and valorization with HIT (Hub Innovazione Trentino) support

objectives

Value creation from knowledge by making it applicable and available for economic or societal utilization

key aspects

- Scouting and screening of ideas and technologies by actively engaging FBK researchers
- Support to creation of intellectual property (IP)
- Assessment of economic and technological potential of IP rights and negotiation with potential partners
- Supporting spin out of technologies as new companies

opportunities

- Transform knowledge into new products and services for the society
- Stimulate entrepreneurship by creating spin-offs
- Contribute to the financial sustainability of FBK

Research Structural Investments
Key Enabling Technology Lab

Heterogeneous integration of different advanced technologies (silicon, NEMS and MEMS, functional coating, nano-electronics, bio-surfaces).

FBK is a KETs Technology Centre recognized by the EU.

Quantum Technologies

Novel chips for exploiting the potential of individual Quanta (Quantum Computing, Communications, Quantum Sensors): atom chips, quantum optics chips, entangled photon generators and sensors, quantum number generators.

Key role, as hardware provider, in the Q@TN joint lab.

Industry 4.0 (Meccatronica)

Collaboration with PRO-M for developing smart manufacturing solutions:

- Substitutional materials for improved performance (functional coatings).
- Additive manufacturing with embedded sensors for production control and production of smart parts.
- On demand sensor solutions.

Environment and health:

Multifunctional sensing for Environmental hazard (gas, toxins, radiation).

Lab-on-chip diagnostic tools.

Proposed investment:

New MEMS facility	**8.000 KE (18-20)**
Equipment Upgrades	**1.300 KE (18-20)**

Research Investment
Co-Labs & Double appointments

Research and Development Co-Labs

Joint labs with universities covering the whole spectrum from education to research and projects with companies.
Talent development through educational programs (Master, PhD etc.)
Research project collaborations between university and FBK
Research-based applications for companies' market needs

Proposed investment: 450 KE (18-20)

Double appointments

Research positions co-funded by FBK and Universities
Typical co-fund 50% FBK and University
Supported by a formal agreement that regulates the benefits for both institutions

Proposed investment: 550 KE (18-20)

Research Investment
FBK PhD program and Accredited PhD

The PhD Program is an excellence training program for PhD student carrying out their research at FBK based on the following pillars:

- Quality of the research
- Excellence certificate, best student award, diploma supplement
- International network of prestigious affiliated universities UCL, Imperial college, MIT
- Research oriented, in-the-lab training, within world-leader research teams

Joint PhD Schools

University involved

- **BOLOGNA**
- **GENOVA**
- **PADOVA**
- **FIRENZE**
- **TRENTO**
- **UDINE**

National agreement

University involved

- TRENTO
- BRESCIA
- SIENA
- FERRARA
- PAVIA

International agreement

- Imperial College **London**
- **UCL**
- **Massachusetts** Institute of Technology
- Queen Mary University of **London**
- **German** Research Center for Artificial Intelligence
- Université du **Luxembourg**
- TU **Wien**
- University of **Haifa**

Proposed investment **5.400 KE (18-20)**

Research Investment
Flagship projects/1

Research skills aim to create high impact outputs and new market opportunities with notable added value in significant economic domains.

Connected cars
CN + ICT

Design and experiment the safe & secure sustainable mobility of the future along the Munich-Bologna corridor leveraging on emerging technologies like 5G and IoT.

- Autonomous & connected cars
- Trucks platooning
- Advanced management of emergency
- Smart mobility

Proposed investment: 500 KE (18-20)

City Sensing @ Trento
ICT + CN

Deployment and experimentation of a novel approach to support citizens and administrators in understanding different phenomena in the city and the local territory, by exploiting and combining different info sources, including distributed sensors, open data, social network as well as official document and press.

- Mobility
- Security
- Social cohesion
- Environmental-awareness

Proposed investment: 330 KE (18-20)

Research Investment
Flagship projects/2

Quantum technology
CMM+ICT+CN

Implement the power of QT in sensors, photo-electronics chips, q-bits generation and secure communication.

- Quantum Science
- Quantum computing
- Future sensors
  Secure communication

Proposed investment:
360 KE (18-20)

Computational Human Behavior
ICT+IRVAPP

Development of a quantitative approach based on complexity science to support policy and decision-making processes, while accounting for the intervening social, cognitive and economic factors.

- Decision-making,
- Policy making and policy design,
- Behavioral sciences

Proposed investment:
260 KE (18-20)

CyberSecurity
ICT + CN

Development of methodologies and automatic tools for the design, security analysis and implementation best-practices of application and services based on the block-chain.

- Digital identity management
- Smart contracts
- Transaction management

Proposed investment:
220 KE (18-20)

EDK * AI

Research Investment
Proof of Concept Program

Proof of Concept (PoC)

objectives

- Reducing the technology risks connected with the results of FBK outstanding research
- Increasing scientific research value through consistent and timely demonstrations of related innovative results via consistent concepts testing
- Enabling the implementation of demonstrated innovative concepts into new technologies by attracting additional investments leading to market

key aspects

- FBK financing the call for PoC Propolas of projects for demonstrating the commercial potential of a new concept or technology in market applications
- Selection and Evaluation Committes identifying winning PoC and analysing results
- FBK owing foreground IP deriving from PoC execution
- HIT project managing PoC

opportunities

- Returning economic value to all stakeholders involved, directly and indirectly, in the value chain of scientific and technological research
- Fostering the technology transfer of research to real, market-usable innovative products or services
- Generating wider positive impact to society by solving problems with the use of new technologies

Research Investments
Summary

	2018	2019	2020	18-20
FESR	2.000	2.500	3.500	8.000
Equipment Upgrades	500	400	400	1.300
Research Structural Investments	**2.500**	**2.900**	**3.900**	**9.300**
Co-Innovation labs	100	150	200	450
Double Appointment	100	200	250	550
FBK PhD Program	1.700	1.800	1.900	5.400
Flagship projects	470	570	630	1.670
Proof of Concept	130	280	320	730
Research Investments	**2.500**	**3.000**	**3.300**	**8.800**

Values in K Euro

Other Research Investments
Human resources policies

Career opportunities
to maintain high quality performance of researchers and innovators by specific

Cost 270 KE/year

New tenure track
to increase the quality of the research

Cost 348 KE/year

Mobility Program
for researchers in order to improve the network

Cost 120KE/year

The annual costs related to the new human resources policies, are considered as part of the ‘‘personnel’’ costs reported in the ‘‘structural costs and investments’’ table

Monitoring and Evaluating Results
Approach & specific results from the 5 objectives

The monitoring and evaluation strategy is based on a set of periodical checks and controls regarding

i. the progress achieved by each specific objective of the Plan (biannual, yearly)
ii. the progress achieved in the scientific and technological domains (quarterly, biannual, yearly)
iii. the practical outcomes regarding local, national and EU communities, and the related economic and social systems, achieved by each specific objective (yearly)

Checks of the progress achieved in the five objectives refers to the following areas

i. Expected results
ii. Tools to reach them
iii. Costs and revenues

Monitoring and Evaluating Results
Scientific results

Evolution of FBK scientific network

Indicators

- amount of cooperation agreements and research projects carried out together with national and foreign universities, scientific research centres, scientific foundations, and the likes;
- position of FBK in the above network (i.e. number and proportion of research projects leaded by a FBK researcher).

Individual objectives' scientific results

Indicators

- overall and pro-capita number of papers published by the researchers of each objective in top international journals, classified according to their relative impact factor (Q1) and in top international conferences
- overall and pro-capita invitation to act as a main speaker, general and program chair, senior program committees in national and international scientific conferences by the researchers of each objective.

Individual researchers' scientific developments

Indicators

- level and variations over time of individual FBK researchers' H index (separately for each objective);
- results of individual FBK researchers' at ASN sessions (separately for each objective)
- individual or co-authored papers given at national or international conference (separately for researchers participating in each objective)