

# SEMINARIO-TALLER ITINERANTE INTERNACIONAL TRANSFERENCIA DE CONOCIMIENTO UNIVERSIDAD EMPRESA (TCUE)

Universidad Federico Santa María

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Gerencia de Capacidades Tecnológicas CORFO  
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Gobierno  
de Chile



# Outline

1. Engineering 2030 program
2. Competencies for transforming the digital industry

# NATIONAL AND INTERNATIONAL CONTEXT

## - NATIONAL CONTEXT:

Economy strongly oriented to exports

Lack of economic diversification

Lack of private innovation (companies)

Outdated Engineering schools

**Innovation and entrepreneurship as a driver**

# Agenda of Productivity, Innovation and Growth; in order to go from an natural resources-based economy to an more knowledge-based economy



1. **Strategic selection policy**
2. Fostering innovation in SMEs
3. Institutional Strengthening
4. Enhancing innovation and entrepreneurial ecosystem
5. Innovation for inclusive growth
6. **Strengthening human capital and mission oriented science & technology**

# INTERNATIONAL CONTEXT: engineering tendencies



## Change factors

- Demand for better technological solutions
- Access to new, specialized, and multidisciplinary content
- Use of IT in all phases of the productive process



## Evolution process in the practice of engineering

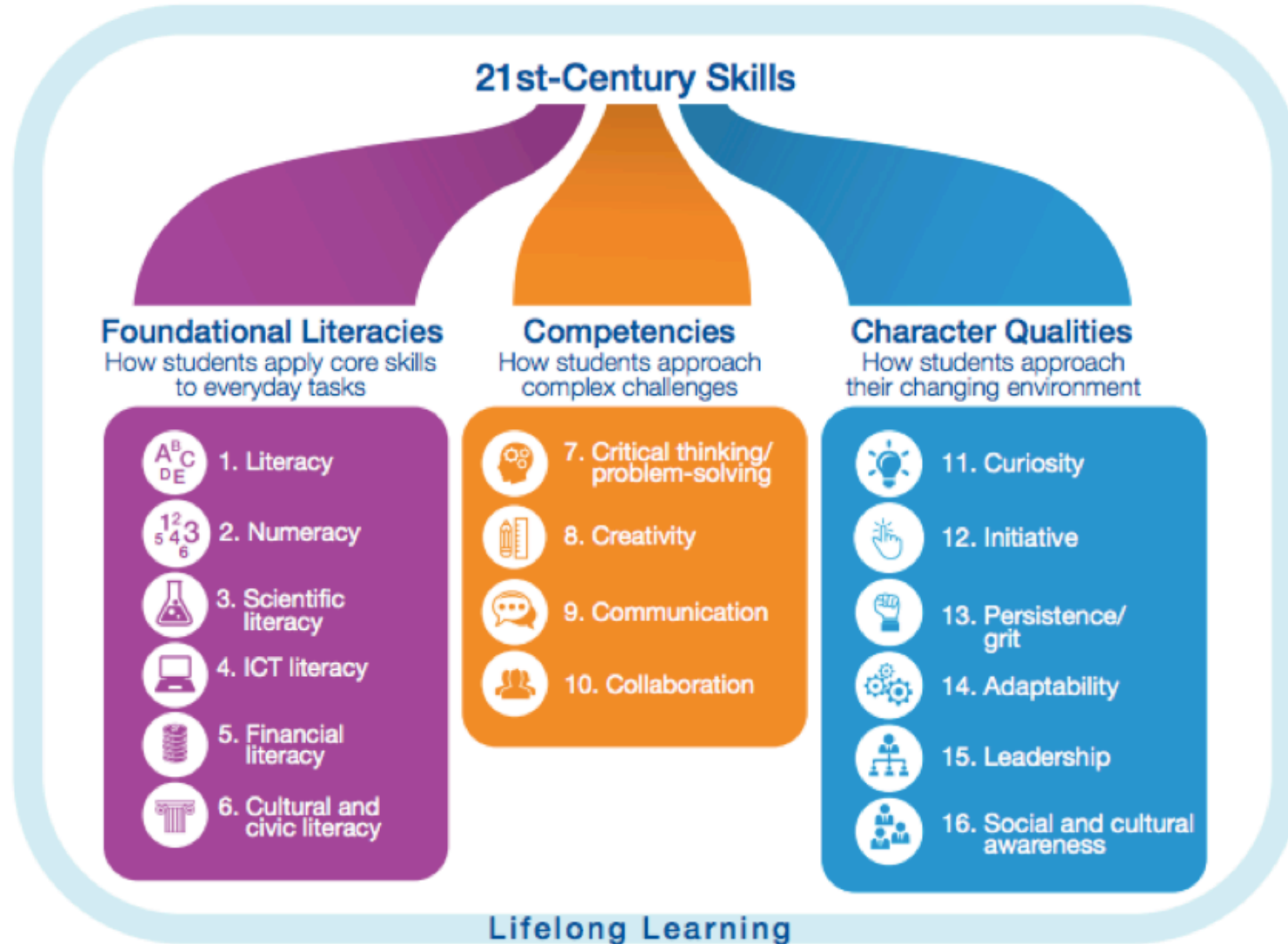
- Increased scientific and technologic content
- Increased demand for higher quality and efficiency in engineering
- Accelerated product development and services globalization



## Number of Engineers

- Evidence of engineers shortage in developed countries (1 million engineers by 2020-USA)
- Efforts to counter the relative lost of interest in studying engineering
- Numerous STEM initiatives (USA, OCDE)

# NEW SKILLS for the XXI CENTURY



Source: New Vision for Education Unlocking the Potential of Technology, World Economic Forum, 2015.

# WE MUST INFLUENCE THE LABOUR MARKET



## *A Skilled Workforce for Strong, Sustainable and Balanced Growth (OIT, 2010)*

The experience from countries that have successfully linked the development of competences with growing productivity, employment and development, have addressed a policy with 3 objectives:

1. To meet the current demand for competences by adjusting the offer
2. To help workers and enterprises to adapt themselves to the change
3. To create and support competences for the demands of future job markets

**Specially relevant in periods with vertiginous technological changes**

## 2. ENGINEERING 2030

### DIAGNOSTICS

**Educational programs are not responding to the needs of the industry**

- Weak Company demand for Innovation
- Limited incentives to the incorporation of graduate students in Industry

**Research culture focused on scientific productivity with very limited applied approach and economic relevance**

- Limited specialized human resources
- Graduate programs focused only on science

**Lack of commercialization and tech transfer strategies in the Universities**



## DIAGNOSTICS (2)

- **Problem solving in the industry requires multidisciplinary teams**
- **There are no professional PhDs to work on Innovation and Technology Transfer in Chile. In Europe and North America this type of formation is regular**
- **Lack of internationalization in the academia, commercialization of technologies from universities and student mobility**

# PROGRAM NEW ENGINEERING FOR 2030



**Stage I**  
**International**  
**Benchmarking and**  
**Strategic Plan**

**2013-2014**

**24 Universities**



**Stage II**  
**Implementation of Strategic**  
**Plans**

**2015-2020**

**17 Universities**  
**Monitoring with international panel**  
**Coordinated with MINEDUC**



**Stage III**  
**Follow up and Consolidation**

**2020-2030**

## **Main goal**

**Transform their educational programs under international standards in the fields of applied R&D, technology transfer, innovation and entrepreneurship, lifting them into a World Class category.**

# ENGINEERING 2030 PROGRAM

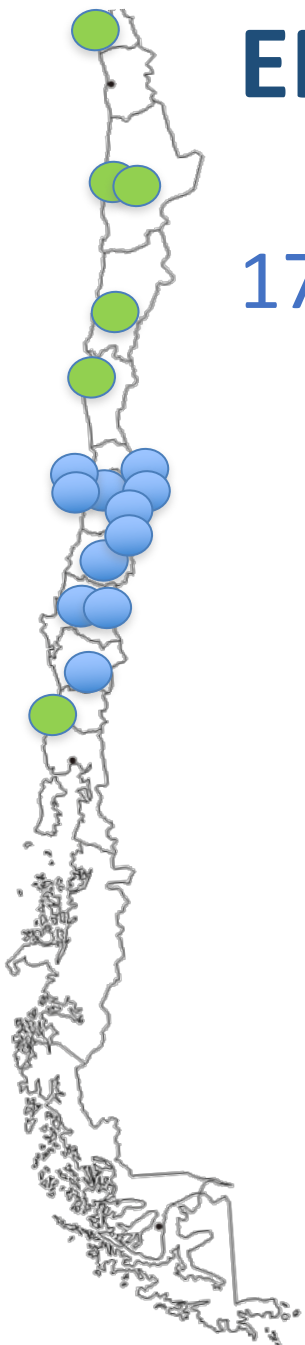
17 Universities participating

- 7 Projects in Implementation phase (phase 2)
- 3 Projects in Design phase



**56.175 students / 75% Civil Eng. (\*)**

(\*) from universities with over 1000 students in all civil engineer programs



# ENGINEERING 2030: STRATEGIC COMPONENTS

HARMONIZATION OF UNDERGRADUATE CURRICULUM AND  
FOCUS ON GRADUATE TECHNOLOGY PROGRAMS

FOCUS ON APPLIED R&D AND LINKS WITH INDUSTRY

ENTREPRENEURSHIP AND TECHNOLOGY COMMERCIALIZATION

INTERNATIONAL PARTNERSHIPS/MOBILITY

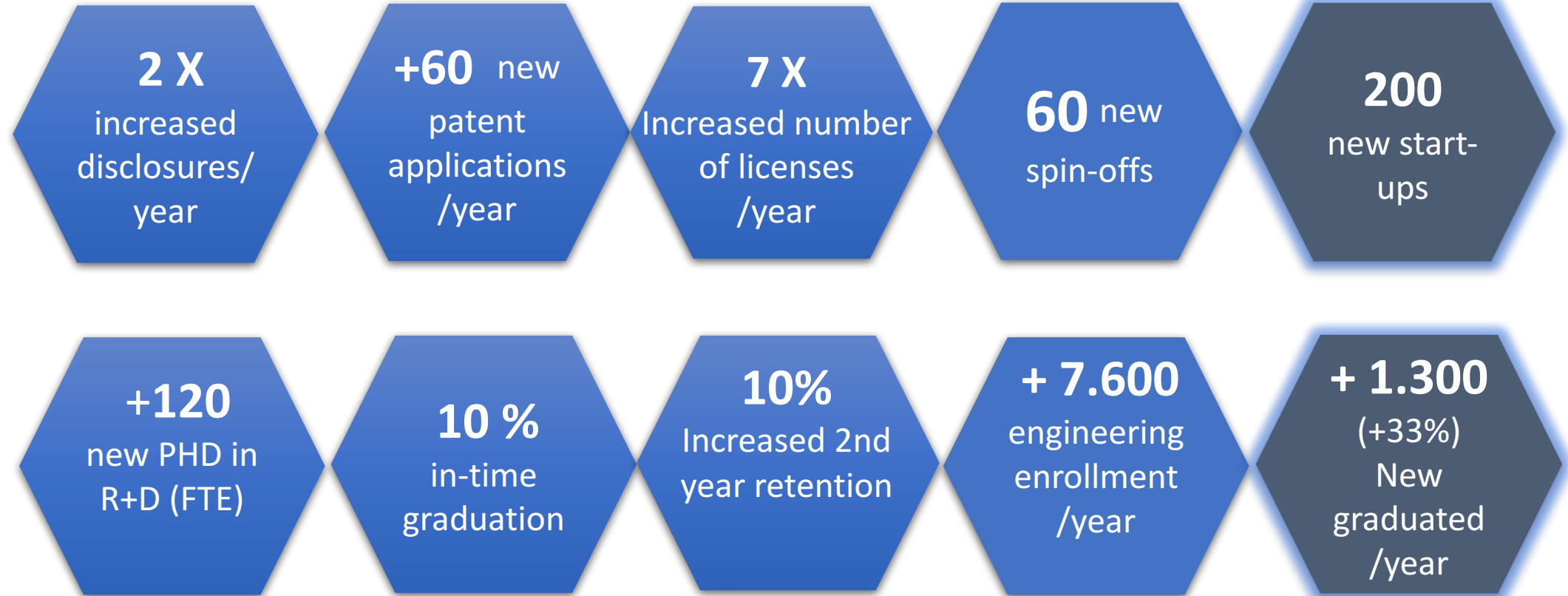
HUMAN CAPITAL / CHANGE MANAGEMENT

+ PROJECT GOVERNANCE AND SYNERGIES (in consortium projects)

World Class  
Engineering  
School



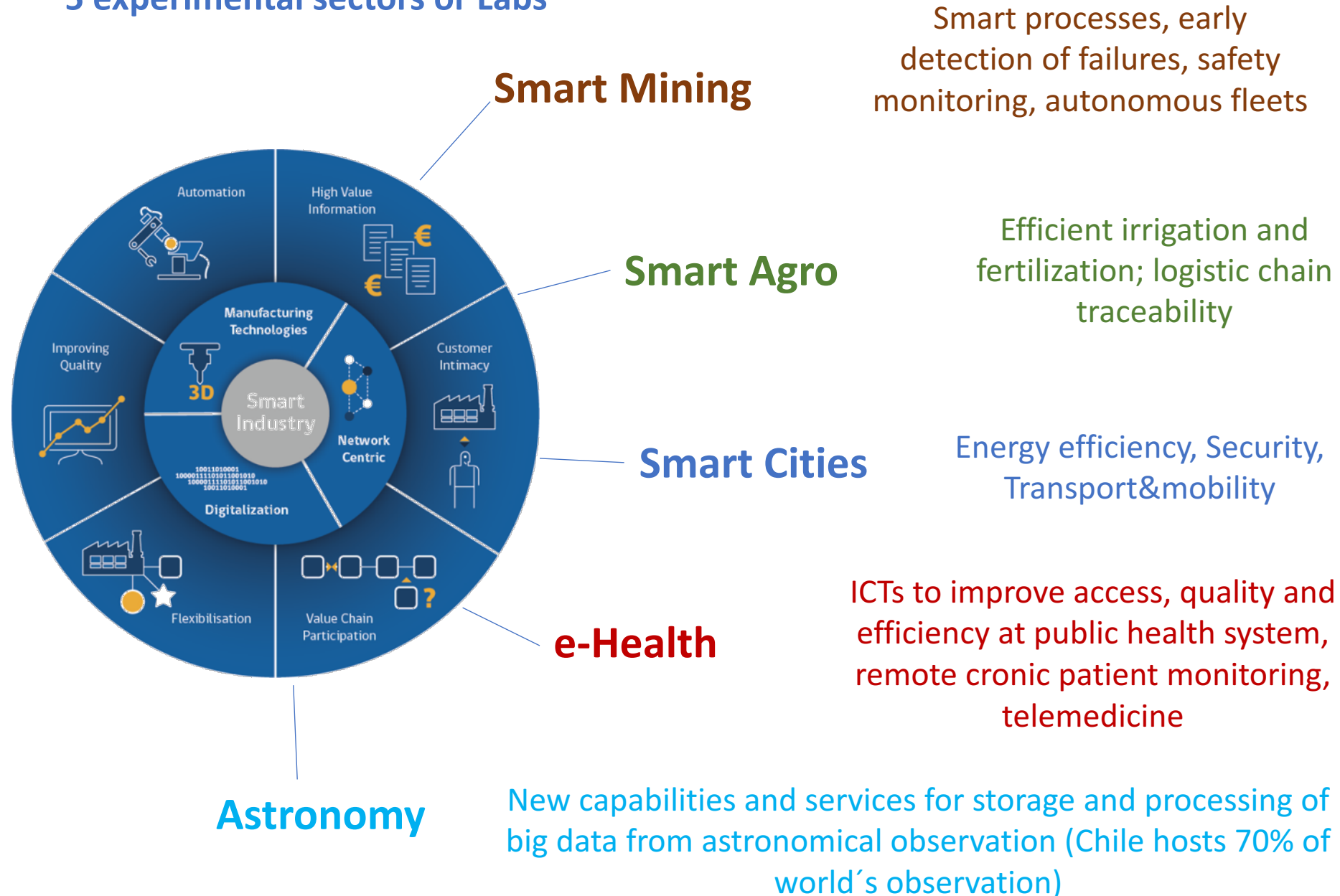
# ADDED GOALS for R&D+i+e and ENGINEER TRAINING



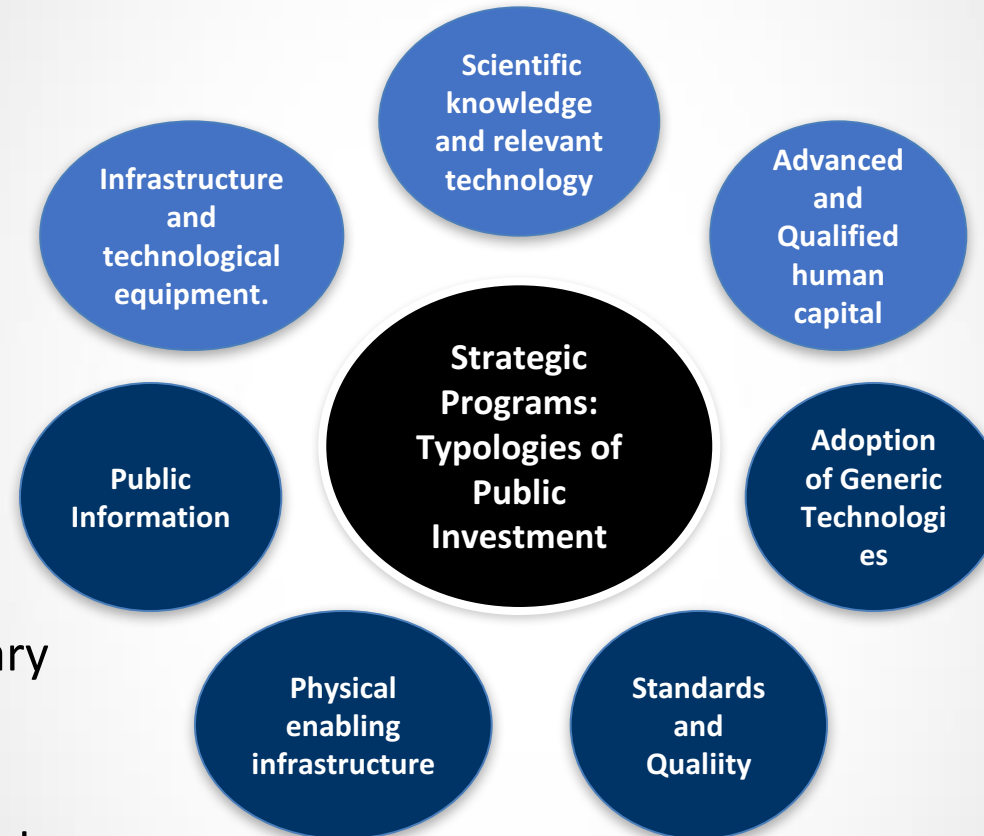
**Goals by 2020**

# NATIONAL SMART INDUSTRY PROGRAM: emerging industries

5 experimental sectors or Labs



## Closing Competitive Gaps and Solving Coordination Failures Through Public Goods, R&D Innovation and TT initiatives



How is the necessary public investment articulated and identified to promote innovation and private investment?

“Chile Transform” program works with 7 sectors of the economy, that have the highest potential and define roadmaps for medium and long term.

## NATIONAL SMART SPECIALIZATION STRATEGIC PROGRAMS



**SMART INDUSTRIES  
SOLAR INDUSTRY/WATER  
NATIONAL LOGISTIC  
ADVANCED MANUFACTURING  
BIOTECHNOLOGIES APPLIED TO NATURAL RESOURCES**





- **State/Industry University Cooperative Research Centres Programme**  
[National Science Foundation, USA](#)  
Cooperación industria-universidad en investigación aplicada incorporando intereses del estado.
- **Engineering Research Centres Programme**  
[National Science Foundation](#)  
Asociación de gobierno, industria y universidad para fortalecer la competitividad de las empresas en mercados internacionales.



- **Catapult Programme**  
[InnovateUK](#)  
Red de centros líderes en el mundo para aumentar la capacidad de innovación en industrias relevantes de UK. (asociación industria – academia, principalmente liderado por empresas tractoras)
- **Collaborative Research and Development Programmes**  
[Technology Strategy Board - UK](#)  
Asociación de industriales y academia para trabajar en desafíos de desarrollo tecnológico de ingeniería y tecnología en sectores estratégicos.



- **VINN Excellence Centres**  
[VINNOVA, Suecia](#)  
Cooperación industria-universidad en donde las empresas participan activamente para obtener beneficios a largo plazo.
- **Berzelii Centres**  
[VINNOVA](#)  
Asociación de industria y academia para creación de nuevos productos y servicios.



- **Cooperative Research Centres Programme**  
[Commonwealth Government, Australia](#)  
Asociación entre industria y academia para mejorar el crecimiento comercial y económico de las empresas, impulsados principalmente por las empresas.



- **Centres for Research-Based Innovation (SFI)**  
[Research Council, Noruega](#)  
Apoyo a la investigación a largo plazo orientada a la industria, asociación entre industria y academia para el desarrollo tecnológico y creación de nuevos productos y servicios.



- **Strategic Centres for Science, Technology and Innovation (SHOK)**  
[TEKES, Finlandia](#)  
Alianzas público-privadas para agilizar procesos de innovación en la industria y crear innovaciones radicales.



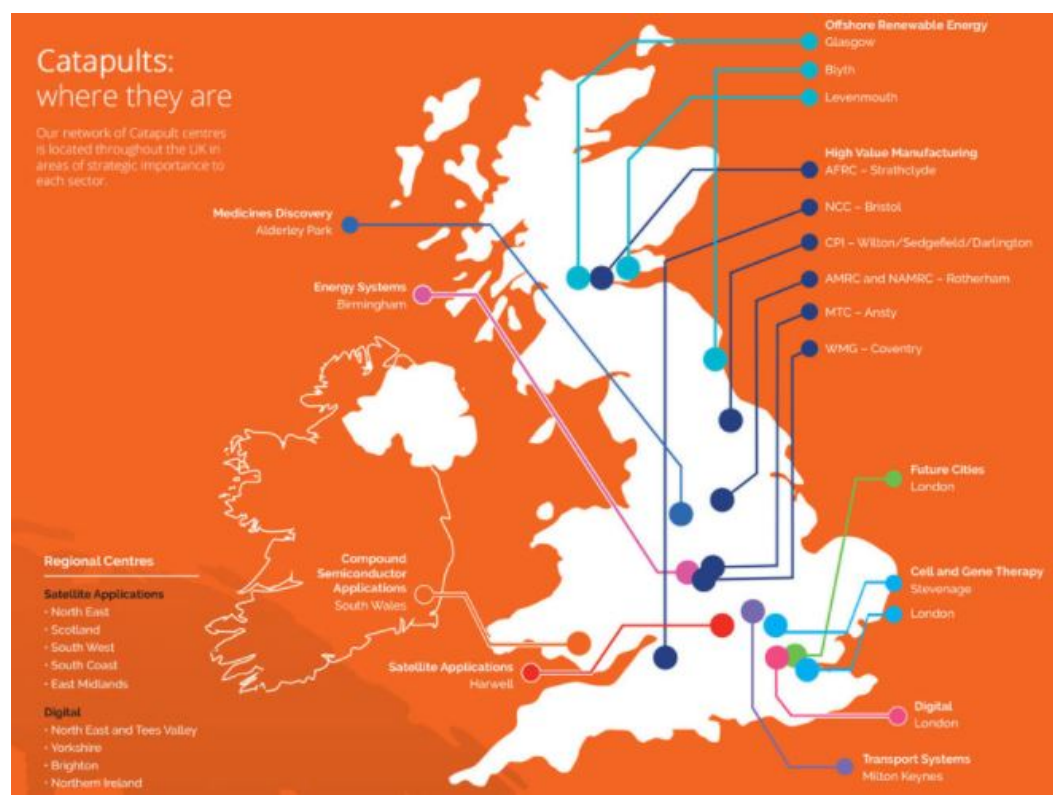
# CATAPULT

## Innovate UK

Technology Strategy Board

### Catapults: where they are

Our network of Catapult centres is located throughout the UK in areas of strategic importance to each sector.



DELIVERED  
**636**  
ACADEMIC  
COLLABORATIONS



*"To innovate, we need open centres where academia and business can get together and drive forward great ideas into manufactured products. And that's what the Catapults are delivering for us."*

**Juergen Maier**  
CHIEF EXECUTIVE, SIEMENS UK

OPERATING  
**£850m**  
OF OPEN ACCESS  
RESEARCH &  
DEMONSTRATION  
FACILITIES for the benefit  
of UK industry and academia



DELIVERED  
**2473**  
INDUSTRY COLLABORATIONS



*"We wouldn't have been able to set up our own facility, we would have needed to invest tens of millions to access these kinds of technologies.... there are other centres but they are all abroad."*

**Richard Price,**  
PRAGMATIC PRINTING

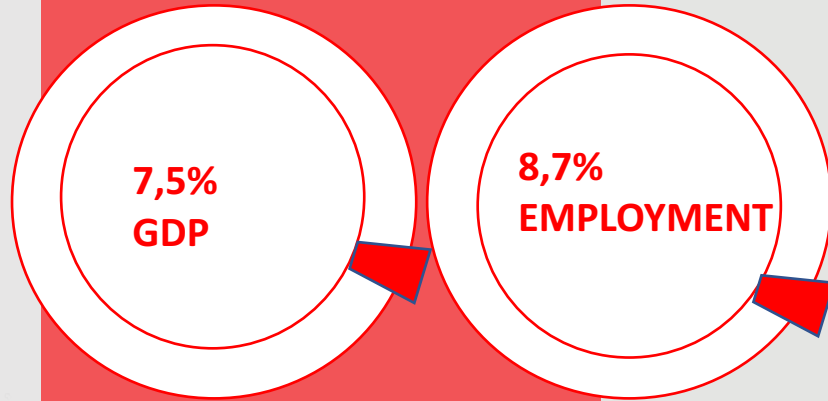
SUPPORTED  
**2851**  
SMEs





## **2. Competences for the transformation of digital industry**

# BUILDING INDUSTRY



**\$11.864.531**

**711.290**

**MM**

**PEOPLE**

TOTAL GDP: \$157.510.721 MM  
SOURCE: CENTRAL BANK, 2015

TOTAL JOBS: 8.165.190 POSITIONS  
SOURCE: INE, 2015



**Building information modeling (BIM)** is a process involving the generation and management of digital representations of physical and functional characteristics of places.

**TABLE 4-3. Gap in training in BIM for professionals and technicians to 2020**

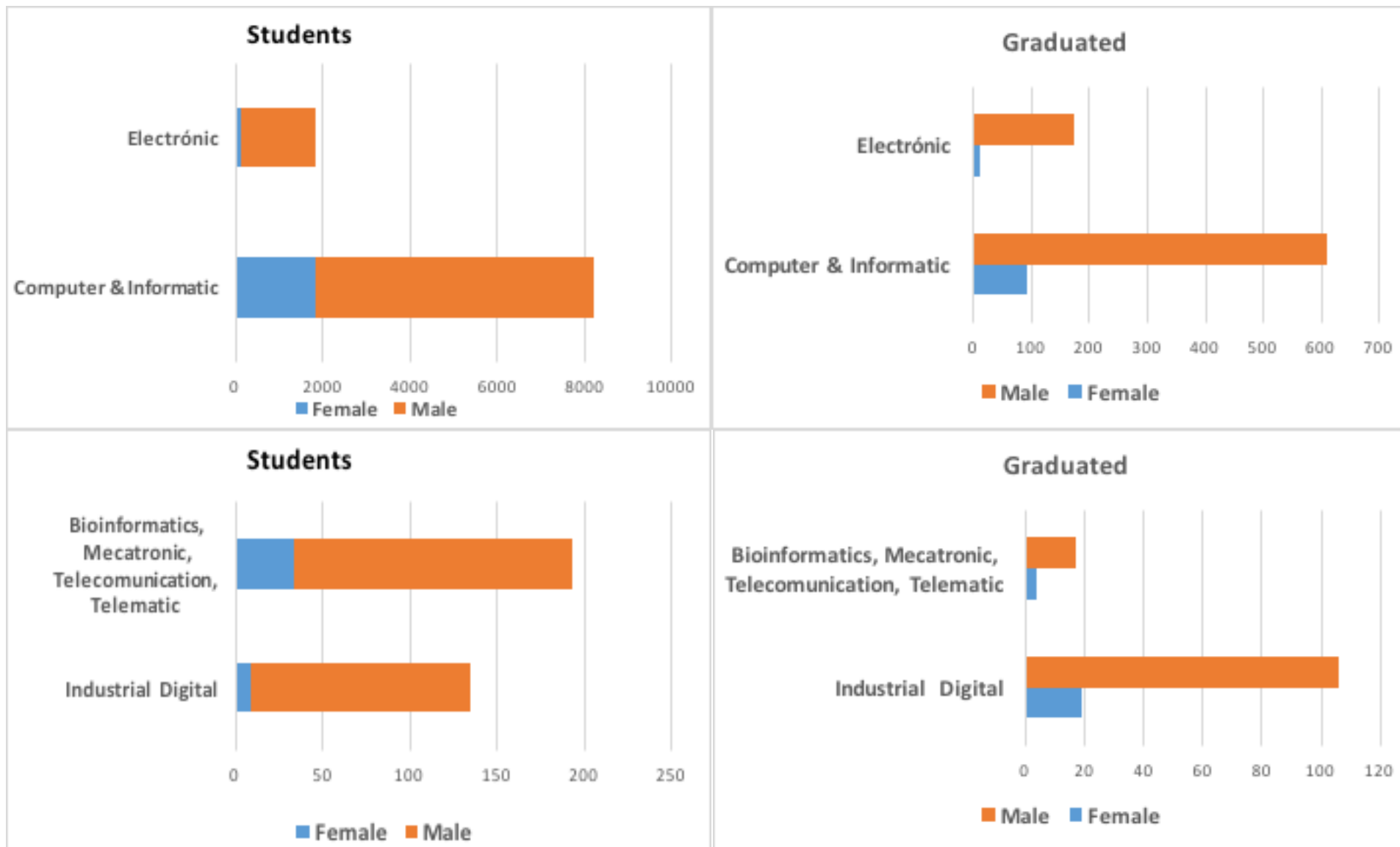
Carrier	Professionals and technicians trained in BIM by 2020	Demand for professionals and technicians with BIM skills by 2020	Gap in training as quantity of professionals and technicians by 2020
Architects	9,942	20,869	10,927
Civil Engineers	2,458	27,977	25,519
Other professionals	11,690	34,608	22,918
Technicians in building	3,568	31,580	28,012
Technical drawers	1,495	3,288	1,793
Technicians in civil engineering	557	4,261	3,704
Other technicians	2,630	15,322	12,692
Total	32,34	137,905	105,565

Source: Corfo, based on IALE Tecnología Chile, 2017

# CIVIL ENGINEERS IN DIGITAL INDUSTRY IN CHILE 2016

## Students and graduates by gender

(average of last four/three years)



Source: ING 2030 with data of MINEDUC

# PILLARS FOR TRAINING AND FORMATION OF ADVANCED HUMAN RESOURCES IN INFORMATION TECHNOLOGIES

1. Governance: Private Public Council
2. Gathering information: framework of IT competences, gaps studies, baseline of key indicators
3. Coordination of public and private entities
4. System improvement: strategy for shorter undergraduate programs, synergies with others national strategies, creation of specialized capacities in IT
5. Diffusion: regarding the cultural relevance of digital technology, benefits of studying IT careers (such as industry demand, entrepreneurship, wage)

# NEW DEMANDS FOR COMPETENCES FROM ICT INDUSTRY IN LATIN AMERICA

## Essential networking technologies

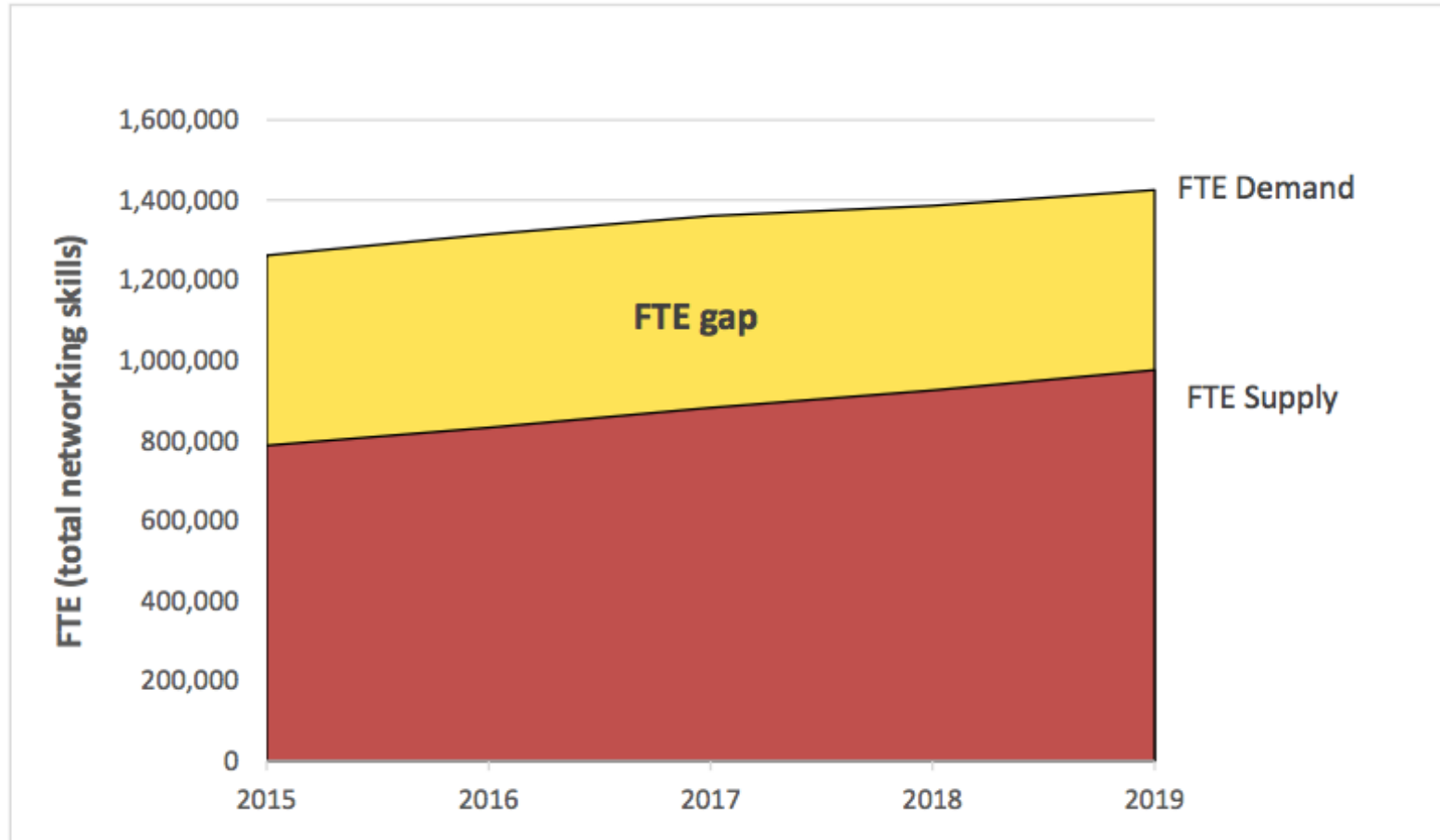
basic router, network security,  
wireless networking, VoIP and  
unified communications.

Emerging networking  
technologies: video, cloud,  
mobility,  
datacenter&virtualization, big  
data, cybersecurity, IoT and  
software development.

- Latin America have the challenge of mastering the necessary skills to operate their ICT infrastructure and leverage technology for a sustainable growth.
- Skills are related to essential and emerging emerging networking technologies
- The demands for networking skills is triggered strongly by Internet of things

**FIGURE 2**

Total Networking Skills Demand and Supply Trends in Latin America, 2015-2019



Source: IDC, 2016



## Total Essential Networking Skills Gap Index by Country

	2015		2019	
	FTE Gap	Gap %	FTE Gap	Gap %
Argentina	5,882	27%	2,257	10%
Brazil	82,607	34%	65,665	30%
Chile	4,811	18%	1,110	5%
Colombia	11,998	24%	8,627	16%
Costa Rica	2,421	24%	935	8%
Dominican Republic	3,122	38%	2,318	25%
Ecuador	4,952	39%	3,476	25%
Mexico	79,736	37%	75,316	34%
Peru	7,497	30%	956	4%
Venezuela	1,883	23%	3,305	29%
Rest of Latin America	9,154	18%	6,455	7%

Source: IDC 2016

## Emerging Networking Skills Gap Index by Technology

	2015		2019	
	FTE Gap	Gap %	FTE Gap	Gap %
Video Technologies	20,604	62%	22,953	61%
Cloud	40,105	47%	25,946	21%
Mobility	29,321	46%	46,955	62%
Data Center & Virtualization	124,740	46%	136,277	53%
Big Data	9,638	52%	7,053	24%
Cybersecurity	4,128	35%	3,338	22%
Internet of Things	4,465	34%	3,86	20%
SW Development	27,316	29%	32,35	31%

**Source: IDC 2016**

## Emerging Networking Skills Gap Index by Country

	2015		2019	
	FTE Gap	Gap %	FTE Gap	Gap %
Argentina	7,698	42%	10,514	49%
Brazil	112,758	49%	95,916	41%
Chile	14,702	42%	4,192	11%
Colombia	16,352	38%	16,568	28%
Costa Rica	2,477	38%	2,631	30%
Dominican Republic	2,968	44%	4,321	51%
Ecuador	3,718	31%	5,725	36%
Mexico	78,197	42%	72,736	31%
Peru	8,034	52%	16,192	56%
Venezuela	5,943	38%	19,862	66%
Rest of Latin America	7,470	37%	30,074	62%

Source: IDC 2016

# Lessons learned and recommendations for mid- and long-term

- ✓ Establish governance that includes government, academia and enterprises.
- ✓ Quantify gaps before defining the public sector's efforts.
- ✓ Establish a comparative diagnostic with international referents.
- ✓ Choose which gaps close and goals before design any initiative.
- ✓ Link academy with industry as a base for developing the change.
- ✓ Validate undergraduate's and postgraduate's curriculums with the industry.
- ✓ Promote women's participation in digital careers.

# THANK YOU!

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de Chile**

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