# ENGINEERING 2030 AND NEW SKILLS FOR DIGITAL TRANSFORMATION IN CHILE AND LATIN AMERICA

**CSTD Intersessional Panel**

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# Outline

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

# Chile at a glance

- **Population:** 17.7 million people

- **Capital City:** Santiago

- **GDP per capita, PPP 2015:** US$23,563

- **Inflation dic 2015:** 4.4 %

- **Unemployment 2015:** 6.2%

- **Official Language:** Spanish

- **Currency:** Chilean Peso (CLP)

- **Corporate Tax:** 22.5% - **Value Added Tax:** 19%

- **Major Trade Partners:** USA, Japan, China and Europe

- **Labor force:** 8.7 million people

CORFO
since 1939
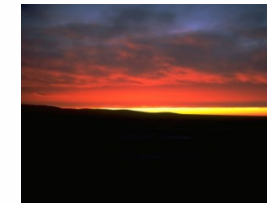
# NATIONAL AND INTERNATIONAL CONTEXT

## - 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Outdated Engineering schools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. Foresting 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**



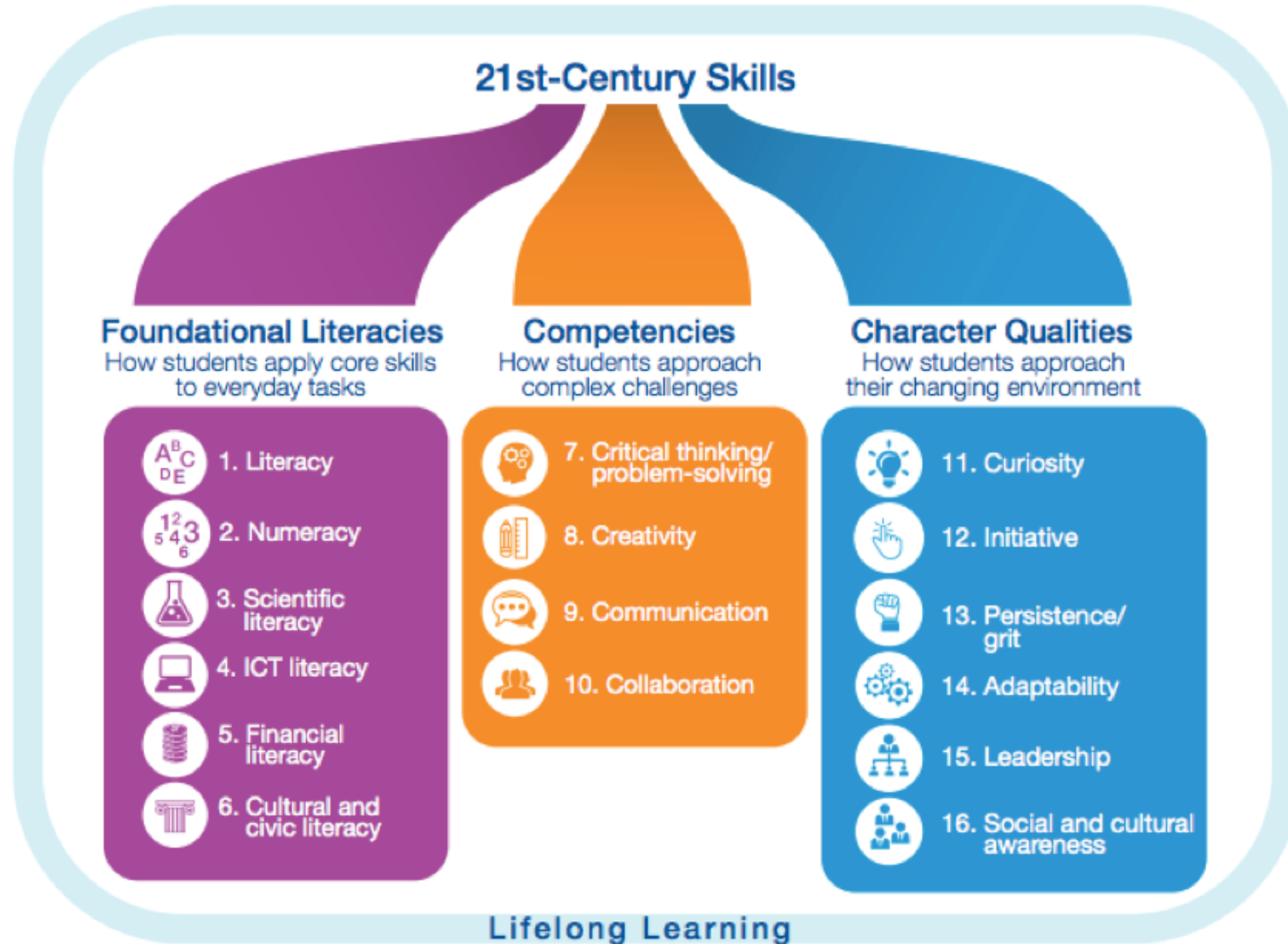**Evolution process in the practice of engineering**

- **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



## 21st-Century Skills

### Foundational Literacies
How students apply core skills to everyday tasks

1. Literacy
2. Numeracy
3. Scientific literacy
4. ICT literacy
5. Financial literacy
6. Cultural and civic literacy

### Competencies
How students approach complex challenges

7. Critical thinking/ problem-solving
8. Creativity
9. Communication
10. Collaboration

### Character Qualities
How students approach their changing environment

11. Curiosity
12. Initiative
13. Persistence/ grit
14. Adaptability
15. Leadership
16. Social and cultural awareness

**Lifelong Learning**

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

# WE MUST INFLUENCE THE LABOUR MARKET

**G20** | **ILO** International Labour Office

***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

**Stage II**
Implementation of Strategics Plans

**Stage III**
Follow up and Consolidation

**2013-2014**

**2015-2020**

**2020-2030**

**24 Universities**

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

**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.

# GINEERING 2030 PROGRAM

niversities participating
– 7 Projects in Implementation phase (phase 2)



**.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
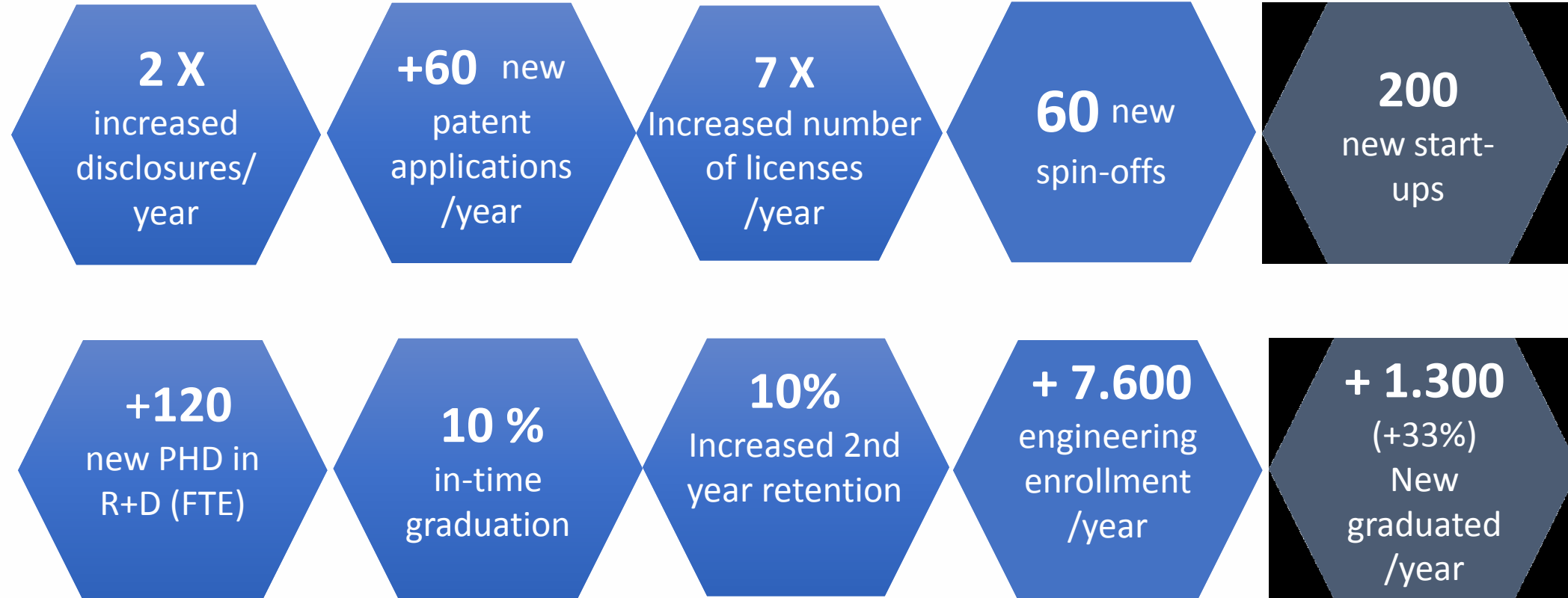
INTERNATIONAL PARTNERSHIPS/MOBILITY

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

**2 X** increased disclosures/ year

**+60** new patent applications /year

**7 X** Increased number of licenses /year

**60** new spin-offs

**200** new start-ups

**+120** new PHD in R+D (FTE)

**10 %** in-time graduation

**10%** Increased 2nd year retention

**+ 7.600** engineering enrollment /year
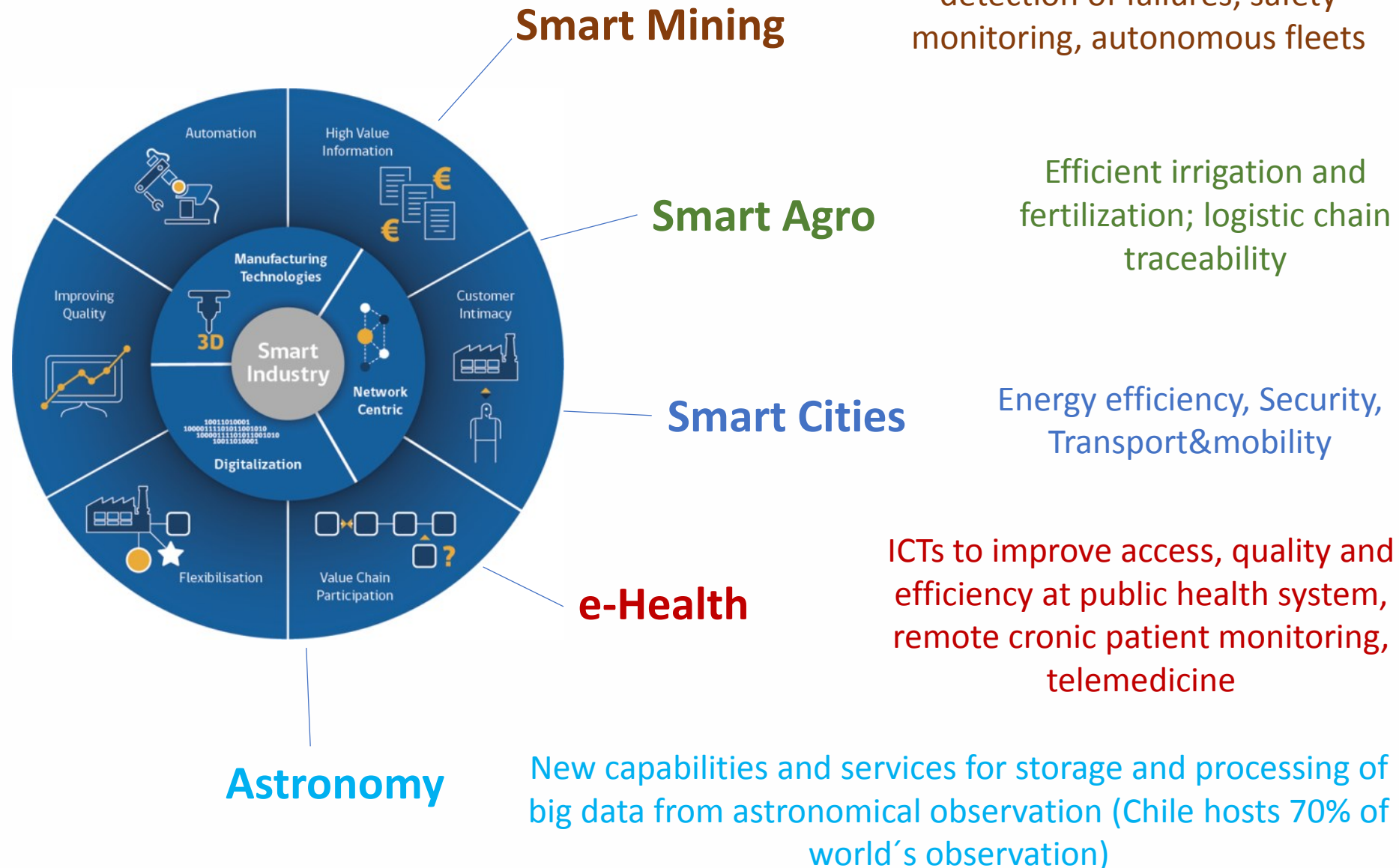
**+ 1.300** (+33%) New graduated /year

*Goals by 2020*

# 2. Competences for the transformation of digital industry

# NATIONAL SMART INDUSTRY PROGRAM: emerging industries

**5 experimental sectors or Labs**



**Smart Mining**

Smart processes, early detection of failures, safety monitoring, autonomous fleets

**Smart Agro**

Efficient irrigation and fertilization; logistic chain traceability

**Smart Cities**

Energy efficiency, Security, Transport&mobility

**e-Health**

ICTs to improve access, quality and efficiency at public health system, remote cronic patient monitoring, telemedicine

**Astronomy**

New capabilities and services for storage and processing of big data from astronomical observation (Chile hosts 70% of world´s observation)

# BUILDING INDUSTRY

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

**7,5% GDP**

**8,7% EMPLOYMENT**

**364.531**

**711.290**

**MM**

**PEOPLE**

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

TOTAL JOBS: 8.165.190 POSITIONS
SOURCE: INE, 2015

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

| Carreer | 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 |
|---|---|---|---|
| Architecs | 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 Tecología Chile, 2017

# CIVIL ENGINEERS IN DIGITAL INDUSTRY IN CHILE 2016
## Students and graduates by gender
**(average of last four/three years)**
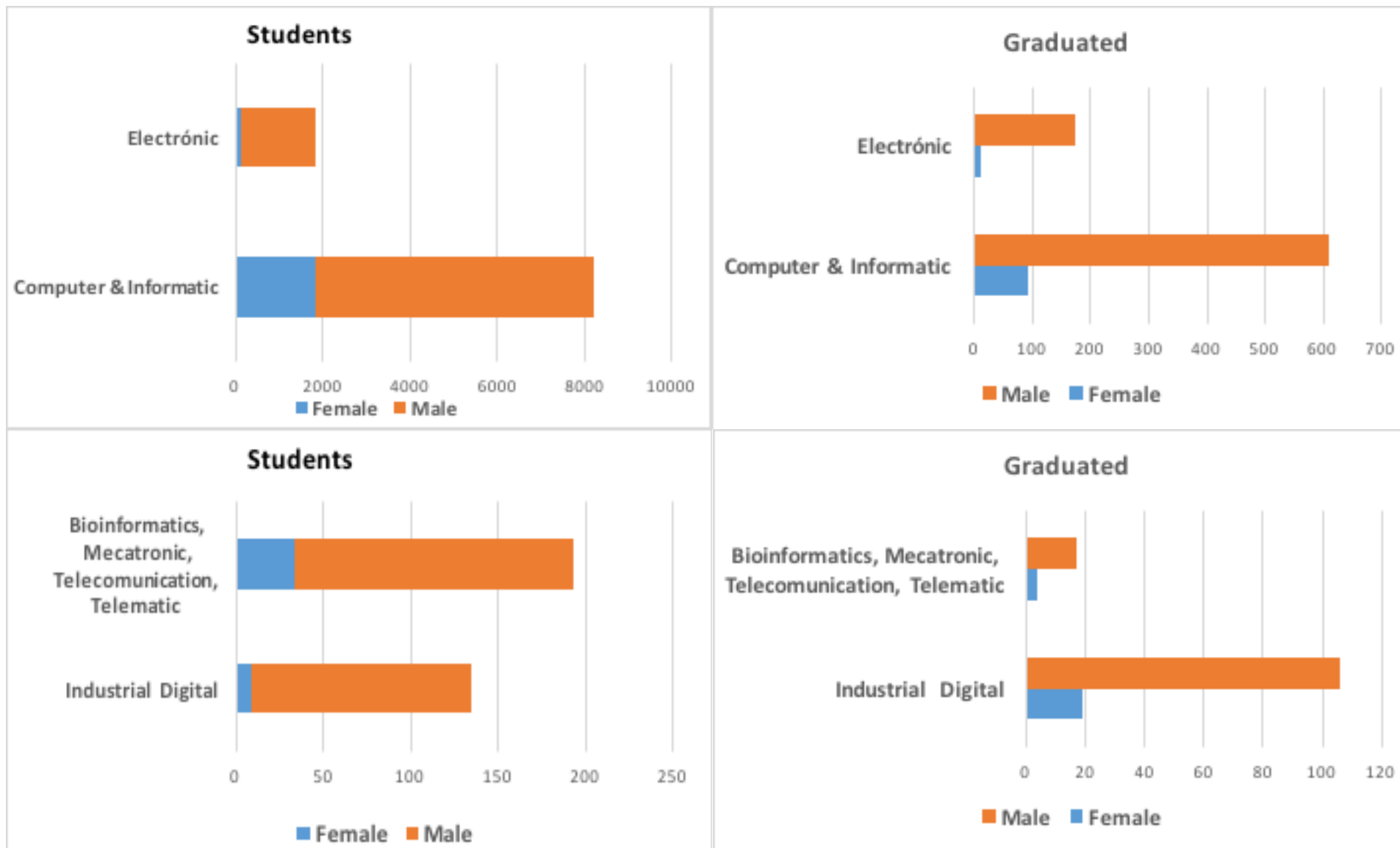
**Source: ING 2030 with data of MINEDUC**

# 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 us 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
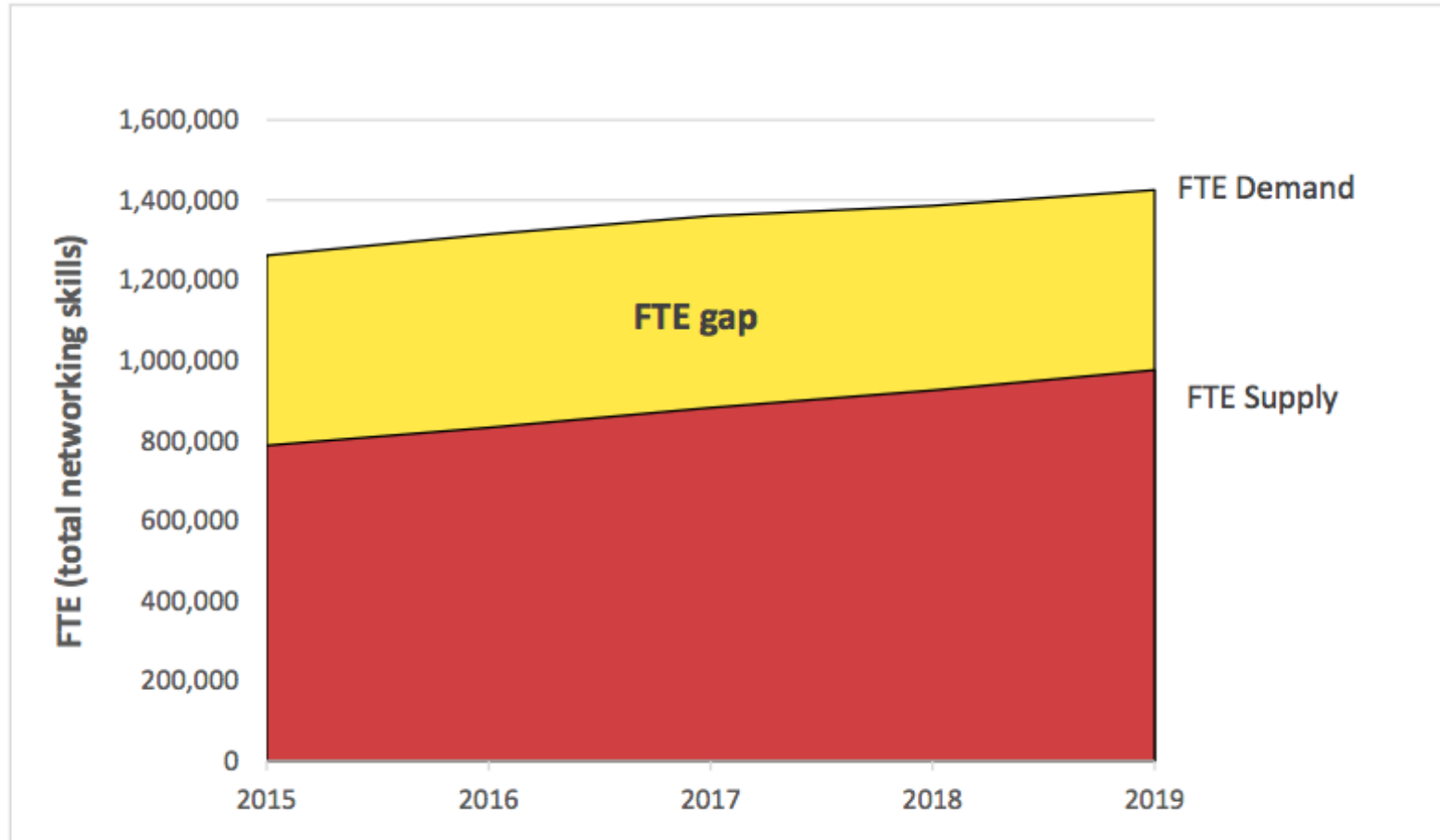


Source: IDC, 2016

# Total Essencial 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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Gobierno
de Chile