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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Outline

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Outdated Engineering schools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

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

WE MUST INFLUENCE THE LABOUR MARKET

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

Source: National Innovation Council (2008); OECD, 2007: OECD Reviews of Innovation Policy CHILE
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
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)
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**
Smart processes, early detection of failures, safety monitoring, autonomous fleets

Efficient irrigation and fertilization; logistic chain traceability

Energy efficiency, Security, Transport & mobility

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

New capabilities and services for storage and processing of big data from astronomical observation (Chile hosts 70% of world’s observation)
Strategic Programs: Typologies of Public Investment

- Advanced and Qualified human capital
- Adoption of Generic Technologies
- Public Information
- Physical enabling infrastructure
- Standards and Quality
- Scientific knowledge and relevant technology
- Infrastructure and technological equipment.

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.
• 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.

• 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.

• 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.

• 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.

• 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.

• 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.

Fuente: elaboración propia a partir de Cunningham, P. y A. Gök “The Impact and Effectiveness of Policies to Support Collaboration for R&D and Innovation” Manchester Institute of Innovation Research, University of Manchester (2012)
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

"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
2. Competences for the transformation of digital industry
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

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

Source: Corfo, based on IALE Tecología Chile, 2017
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

- 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 networking technologies.
- The demands for networking skills is triggered strongly by Internet of things.

**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.
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

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

Source: IDC 2016
## Emerging Networking Skills Gap Index by Technology

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

*Source: IDC 2016*
## Emerging Networking Skills Gap Index by Country

<table>
<thead>
<tr>
<th>Country</th>
<th>2015</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FTE Gap</td>
<td>Gap %</td>
</tr>
<tr>
<td>Argentina</td>
<td>7,698</td>
<td>42%</td>
</tr>
<tr>
<td>Brazil</td>
<td>112,758</td>
<td>49%</td>
</tr>
<tr>
<td>Chile</td>
<td>14,702</td>
<td>42%</td>
</tr>
<tr>
<td>Colombia</td>
<td>16,352</td>
<td>38%</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>2,477</td>
<td>38%</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>2,968</td>
<td>44%</td>
</tr>
<tr>
<td>Ecuador</td>
<td>3,718</td>
<td>31%</td>
</tr>
<tr>
<td>Mexico</td>
<td>78,197</td>
<td>42%</td>
</tr>
<tr>
<td>Peru</td>
<td>8,034</td>
<td>52%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>5,943</td>
<td>38%</td>
</tr>
<tr>
<td>Rest of Latin America</td>
<td>7,470</td>
<td>37%</td>
</tr>
</tbody>
</table>

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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