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Redesigning Engineering Education in Chile: How Selective Institutions Respond to an Ambitious National Reform

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Introduction

In 2012, the Chilean government launched the "Nueva Ingeniería para el 2030" program, which aims to redesign engineering education, enhance applied research, technology development, innovation and entrepreneurship around engineering campuses.[1] The program has allocated more than 60 million dollars into ten selected engineering schools, an impressive sum for the Chilean educational system. New Engineering 2030 represents an ambitious curricular and organizational change that requires an intense commitment from administrators and faculty. At multiple levels, this program means a transition from a traditional engineering education, where disciplinary silos are highly dominants, to a more flexible and multidisciplinary one, where global requirements need to be met in order to increase the contribution of engineering graduates to the economy and society.

This study focuses in the approaches to change of two institutions participating in New Engineering 2030: Universidad de Chile (UCH) and Pontificia Universidad Católica (UC), the most prestigious and oldest engineering schools in the country. A key difference between these two institutions' proposals is that UCH developed its own strategic plan, while UC created a consortium with Universidad Técnica Federico Santa María (UTFSM), another prestigious institution within the region. By comparing both strategies, this investigation seeks to understand curricular and organizational change in selective institutions after the first years of the designing and implementation of the program. As a conceptual framework, we ground our work in the rich literature of change in engineering education, in particular the branch that studies national efforts and coalitions for change. Our data set consists of documents, secondary data, interviews to leading administrators and faculty, and the results from instruments that measure entrepreneurial intention in both schools. Since the New Engineering 2030 is just at its early stage, this study represents a baseline of multiple studies to come that will examine the consequences and effect of an ambitious national reform of engineering education. What we, and the engineering education community at large, be able to learn from this initiative will be important to understand curricular and organizational change at the national system, institutional, and program level. Moreover, the case of the New Engineering 2030 presents an opportunity to contribute to the understanding of engineering education from the Latin American region and the global south.

National efforts and institutional coalitions for changing engineering education

Attempts to change engineering education from a regional or national approach have a long history in higher education. Over the last three decades, the most emblematic case has been the Engineering Education Coalition in the U.S., established in the early 1990s and funded by the National Science Foundation. Among its goals, this program sought "a dramatic increase in both

the quality of engineering education and the number of degrees awarded in engineering, including those to women and underrepresented minorities."[2] This program founded six coalitions of engineering schools for two rounds of five years. From these coalitions multiple pedagogical innovations emerged (e.g., collaborative and active learning, project and problem based learning, and more technology in the classroom) and great amount of information was exchanged among participants. However, the diffusion and adoption of these innovations were rare within participant institutions and those who did not participate.[2] From there, a large series of studies tried to understand the main challenges associated to processes of change in engineering schools.

Clark, Froyd, Merton, and Richardson (2004) focus on the perspective of those leading the changes promoted by the Foundation Coalition.[3] At an initial stage of the program, leaders' and authorities' approaches to curricular innovation followed a product development process.[3] This approach trusted in the idea that a good design, well executed pilots, and evidence of positive outcomes would be sufficient for proving success and for promoting diffusion and adoption. After going through the multiples faces of the change process, the same leaders and authorities realized that the process of change is essentially political and requires complex strategies in order to achieve sustainability.[3] After these experiences, campus leaders and scholars shifted their view of the curricular change models from a focus on the improvement of a new curriculum towards a focus on people and their behavior.[4] Moreover, the realization of the complexities associated to curricular change learned from the coalition experiences set engineering education as a rigorous discipline itself.[5]

Concurrent to the coalition programs, ABET, the main accreditation agency for engineering schools in the US and around the globe, changed its accreditation standards in 1997. This new standards known as Engineering Criteria (EC) 2000 put emphasis on the outcomes of engineering education and their capacity to meet the demands of the XXI century. ABET EC2000 criteria are considered a milestone in the efforts for reforming engineering education nation-wide.[6] Volkwein, Lattuca, Harper, and Domingo (2006) found evidence of the impact of these changes in accreditation on student experiences and learning outcomes.[7] Furthermore, not only regulatory powers of accreditation mobilized engineering schools, but also multiples alliances that emerged to share experiences and promote change in engineering education, such the well-known CDIO initiative, which based its framework in the ideal of an engineering student who learn to conceive, design, implement, and operate complex systems.[8] In addition to these networks, innovative efforts have emerged at every type of engineering schools.[9]

However, after more than two decades of continuous effort for change, the effectiveness, sustainability, and diffusion of these efforts have been questioned.[10, 11] The scholarly debate about why certain changes in engineering education take hold and others do not is still well alive.[3, 12, 13, 14] Kezar (2012) calls for using more bottom-up or grassroots perspective for

understanding change in science, technology, engineering, and mathematics (STEM).[14] Graham (2012) suggests that successful and sustainable experiences of change in engineering education have in common: a context of change, leadership and faculty engagement, a clear educational design and careful implementation, and a strategy for sustainability focused on long-term impact evaluations and continuous improvements.[11]

In the Chilean context, the National Agency for Innovation and Development (CORFO) launched the New Engineering 2030 initiative in 2013, as a bid to transform the economy.[15] Along the international trends in engineering education, CORFO decided to motivate the renewal of engineers training, in order to be more prepared to address significant challenges of the society. Thus, New Engineering 2030 co-finances strategic plans that serve as a 6-year roadmap to create engineering education that meets global requirements.[1] Leading engineering schools participating in this program are expected to contribute to the society by means of applied research, technology transfer, innovation and technology-based entrepreneurship. By motivating universities to prepare more engineers towards national competitiveness and productivity, CORFO intends to propel Chile from a developing to a developed knowledge-based economy.[15]

In summary, since the 1990s multiple national and cross-institutional initiatives have pushed for changes in engineering education. Despite some progress, there is still the perception that the rate of diffusion and adoption is slow and that most change models are not sustainable over-time. However, it is undeniable that scholars have documented and proposed multiple perspective to the phenomenon of change in engineering education. Based on this fact, designing and implementing change today should be different from what was seen more than twenty years ago. We expect that school leaders and champions are aware of what has been learned about these processes. We examine this assumption by studying the approaches to change of two selective engineering schools in Chile under the context of an ambitious national reform that focuses on fostering entrepreneurship education in engineering and on creating entrepreneurial ecosystems around engineering schools.

The quest for creating entrepreneurial ecosystems around engineering schools

Before we continue it is also important to review experiences of institutions that are transforming themselves in order to create entrepreneurial ecosystems and a more entrepreneurial educational experience. For the context of our cases, it is relevant to review the experience of institutions that are far from mature and developed entrepreneurial regions, such as San Francisco Bay Area or Boston Area. Graham (2014) analyzed the case of four engineering schools that developed a strong entrepreneurial capacity, despite being located in challenging environments.[16] Among the common factor that explained their progress, Graham (2014) identified: strong leadership, an academic culture that supports entrepreneurship and innovation, distributed responsibility for delivering necessary support, empowered student-led initiatives, and the involvement of the regional and/or national entrepreneurship community.[16] Yoon and Lee (2013) defined a strategic

model for late-comers to entrepreneurship in engineering by studying the case of KAIST (Korea Advanced Institute of Science and Technology).[17] This model has four strategies: creating a long-term strategic intent by key leadership, systematic networking with industry, nurturing supporting organizations, and vitalizing entrepreneurship resources through educational programs and initiatives. Similarly, in a study of the rise of entrepreneurship education in the College of Engineering at the University of Michigan, Celis (2015) describes the process of change as a social and intellectual movement marked by student activism, the engagement of external actors, and a fine articulation among top administrators, faculty, and students at the grassroots level.[18]

The cases described above show that fostering entrepreneurship education within engineering schools is a particular form of curricular change, which requires the participation and coordination of multiple actors at different levels. In this study, we analyze the two cases with these findings in mind, comparing how much of these learning from successful cases has been internalized and/or adopted in the Chilean case.

Method: A multi case study

This research uses a multi case study to understand how the Chilean most prestigious and oldest engineering schools respond to a national effort for redesigning engineering education: Universidad de Chile (UCH) and Pontificia Universidad Católica de Chile (UC). Although both institutions are comparable in terms of student admission criteria, research productivity, resources and prestige (see Table 1), this study intends to compare their approaches to change considering that both schools represent very different cultures. UCH is a public institution, and its engineering school, an isolated campus from the rest of the university, has highly specialized programs with a strong presence of physics science, mathematics, and engineering sciences. On the other hand, UC is a private and confessional institution that claims a clear public role, and its engineering school, which is part of multi-school campus, has a traditionally close relationship with the private sector, and an earlier commitment to entrepreneurship and innovation.[19]

Our data set consists of documents, secondary data, interviews to leading administrators and faculty, and the results from instruments that measure entrepreneurial intention in both schools. Since New Engineering 2030 is just at its early stage, this study represents a baseline of multiple studies to come that will examine the consequences and effect of an ambitious national reform of engineering education. The analysis will be inductive,[20] although guided by the literature on curricular change in and the creation of entrepreneurial ecosystem around engineering schools. In order to organize the findings we describe each case according to the following categories: Motivation, guiding principles, organizational structure, strategic partners, milestones, metrics of success, and major challenges. More comparative analyses will be addressed in the discussion section.

Table 1
UCH and UC-Engineering main indicators

	UCH (FCFM)	UC-Engineering
Year of foundation	1842	1892
N° of fulltime professors	220	152
N° of ISI publications per year	333	213
% of ISI Q1 publications	50%	55%
N° of patents	11	24
N° of undergraduate students	4,900	+4,000
N° of first-year students	800	+800
N° of graduate students	1,200	+1,000
1st year students entrepreneurial intent	72%	63%
3rd year students entrepreneurial intent	79%	80%
QS Ranking in Latin America (2015)	4th	3rd

Results

Meeting Global Engineering Demands at UCH

In the late 1990s, the Facultad de Ciencias Físicas y Matemáticas (FCFM) at UCH initiated an ambitious plan for renewing its faculty, fostering high quality research, and renewing the curriculum. Since then, FCFM has envisioned to become a world-class institution and a top leader in the Latin American region. In this context, the call for the New Engineering 2030 program was seen as an opportunity for continuing this path for excellence. The opportunity was also seen as a way of accelerating the processes of change. Thus, the main goal for the project states, "for the year 2030...FCFM will become a world-class institution recognized by its leadership in science, technology, and innovation, driven by a multidisciplinary cutting-edge research facing the global challenges that society needs, and providing an outstanding and broad educational experience, with social impact and responsibility within the country and Latin American region." In order to achieve this objective FCFM identified five work areas or change agents:

- Curricular Harmonization: Changing the system of academic and professional degrees to make it more aligned with international schemas and reinforcing engineering education, improving active learning, co-curricular experiences, and opportunities for entrepreneurship and innovation.
- Entrepreneurship: Improving the structure and infrastructure for promoting entrepreneurship education and enhancing campus entrepreneurship and innovation activities around science and technology.
- Technology Transfer: Improving links with society and industry, generating an entrepreneurial ecosystem around the engineering campus and fostering multidisciplinary work in research and development.
- International Alliances: Creating new courses and educational experiences for the campus community (students, faculty, and staff) with international partners. In addition to these courses, international partners will support each work area.
- Change Management: Handling change management (including identification and mitigation of resistance), defining communication strategies, and encouraging participation of the entire campus community.

The project was conceived from the top with a strong participation of young faculty, who had promissory careers and an orientation towards entrepreneurship and innovation. The head of the project is the Deputy Dean, which ensures an alignment between the programs and the top administration (See Figure 1). Down the hierarchy line of Nueva Ingeniería 2030 at UCH, the Deputy Head is responsible for the communication with the government agency in charge of program. The Deputy Head is an associate professor with a strong background in technology transfer and with experience working with agencies that support innovation in the nation. The Deputy Head is also the leader of the curricular harmonization work area. Each of the other areas has a faculty member in charge. These leaders belonged to the group that conceived the UCH project, and they represent different engineering disciplines. This representation in not an easy task since currently FCFM has ten engineering and three sciences programs, as well as a geology program. Each working area has committees of faculty and staff that support the initiatives. At the general level, there is a Project Advisory Committee that includes the rector and other five top executives and entrepreneurs.

Even though the Dean is not in the day-to-day execution of the project, he closely oversees the main orientations and milestones of the project. The Dean assumed his position in 2014. Deanship changes are often related to key shifts in orientations and emphases. This was not the case with issues related to the project, which implies the strong alignment that exists among FCFM leaders about the project.

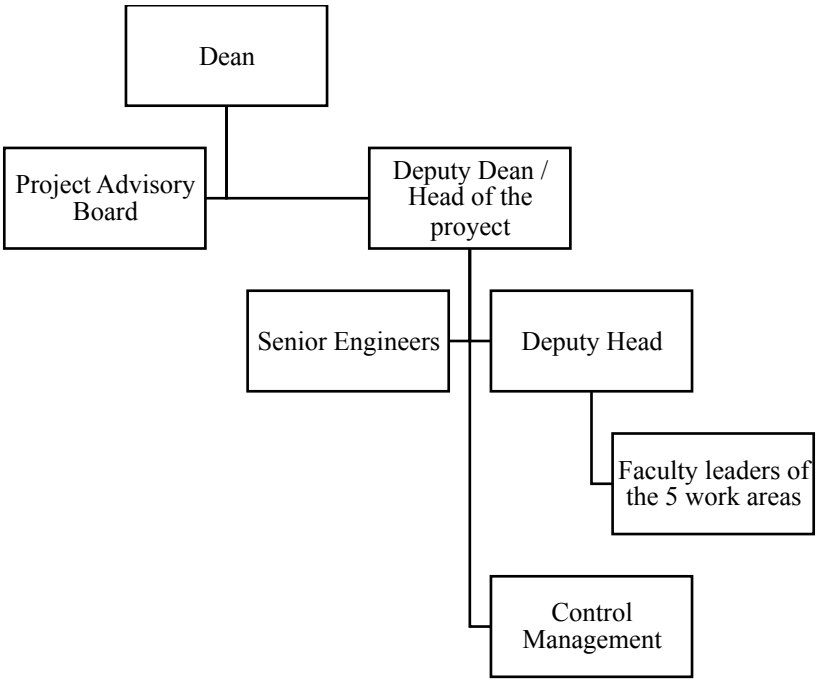

Figure 1. Organizational Structure for UCH 2030 project

There are several international partners. Some of them were part of the benchmark conducted in order to design the project. Others are collaborating in current initiative of the Nueva Ingeniería 2030 at UCH. In particular, four new alliances were established with the University of Manchester (UK), Cornell University (USA), Technion (Israel), Techion-Cornell Institute, and MIT (USA). Among the four, the University of Manchester has become the most important role model. This university is seen as closer to the UCH's identity and context. The University of Manchester is also a public institution and transformed itself from a rather traditional institution within a challenging environment to an entrepreneurial hub.

Among the milestones, perhaps the most significant is the launch of OpenBeacuhef (October 2015). This is a unit conceived as the center of the entrepreneurial ecosystem of the FCFM campus. It includes OpenLab and FabLab, both spaces dedicated to student and faculty start-ups. OpenBeauchef also organizes several competitions and special programs with technology companies, such as IBM. At the beginning of the program, FCFM lead a team of national governmental and entrepreneurial leaders that were accepted as regional partner of MIT Regional Entrepreneurship Acceleration Program (REAP), a program designed to promote an innovation ecosystem. Regarding engineering education, the program enabled an office for research in engineering education in charge of a tenure-track faculty and strengthened the Engineering Center for Teaching and Learning (December, 2015) and the Curricular Management Unit.

The metrics of success were conceived as process outcomes and long-term effects. Process outcomes include new courses, graduate programs, infrastructure, and co-curricular experiences for the promotion of entrepreneurship and innovation (number of students participating). A new scientific and technology innovation and entrepreneurship lab was also considered a process outcome of the project (i.e., number of participants: students, faculty, and external actors). The long-term vision speaks of improvements in world and regional rankings. This means to be among the top 100 engineering schools in the world and top 3 in the Latin American region.

So far, there are three main challenges that slow down the process of change and appear as sources of resistance. First, although there is an enthusiastic link with the local industry, it is still of modest size and engagement. Chilean private sector seems rather traditional, with low commitment to research and development. Internally, there have been difficulties in communicating the project goals and orientations. The project seems huge and with a not clear set of priorities. Finally, hallways and informal talks mention that faculty leaders are seen as belonging to a clique close to the top administration, which risks the wide adoption of the program.

The Clover 2030 Engineering Strategy: A joint venture between UC and UTFSM
New Engineering for 2030 has been the opportunity that UC-Engineering was expecting to validate its efforts to create world-class education in Chile. Along CORFO' s intention to transform Chilean engineering schools towards national competitiveness and productivity, UC-Engineering had already defined and implemented curricular and co-curricular initiatives to meet this objective (e.g. new curriculum 2013, The Bridge UC). From the dean's perspective, top engineering schools are the engine of knowledge-based economies across the globe. Since he was appointed, most of the implemented changes have intended to build the innovative and entrepreneurial culture needed for enhancing applied research and technology development within the school (e.g., redesign liaison with the industry). Aware of the importance of reaching critical mass effect for long-term success, UC created a consortium with UTFSM, other prestigious school of engineering in the country. This strategic effort not only widened UC-Engineering local network in the eye of CORFO, but also confirmed its intention to create an engineering ecosystem in Chile that is recognized worldwide for its academic excellence.

According to CORFO international advisers, The Clover 2030 Engineering Strategy awarded the first place of all New Engineering 2030 proposals. The four leaf clover was chosen as the project icon, in order to describe the strategy as a system that interconnects different pillars:

- The stem is constructing the new liaison with society as the basis for sustainable development (Pillar 5)
- The stem feeds the four leaves with the needs of the society, in order to:
    - Transform engineering education (Pillar 1)
    - Face societal grand challenges (Pillar 2)

    - Orchestrate effective innovative and entrepreneurial networks (Pillar 3)
    - Build a world-class organization, structure and community (Pillar 4)
- By the stem, the pillar initiatives contribute to society through our students, staff and faculty.

After one year of implementation, the consortium has held several meetings in order to reach consensus about the key priorities of each pillar. The activities that have been initially prioritized are:

- Research hub in science and engineering education (Pillar 1)
- World-class double and dual doctoral programs (Pillar 2)
- Insertion of scholars in world entrepreneurial networks (Pillar 3)
- Recruitment and retention of talent (Pillar 4)
- Creating of an innovation hub (Pillar 5)

In order to orchestrate both engineering schools, the governance of the consortium relies on a shared organizational structure (see *Figure 3*). The superior institutional board is conformed by the Presidents and Vice Presidents of Administrative and Financial Affairs of both universities, besides the UC Provost of Institutional Management, and the UTFSM General Director of Planning and Development. The Dean of UC-Engineering is the 2030 Director, and the Vice President of Academic Affairs in UTFSM is the 2030 Associate Director, and both are also members of the superior board. The international advisory board is conformed by venture capitalists, authorities and faculty from world-class universities (i.e., Texas A&M, Columbia University, MIT, University of Notre Dame, UC Berkeley, Catolica-Lisbon School of Business and Economics, Edinburgh), leaders of nonprofit organizations, engineers that have become entrepreneurs, and independent consultants in science and engineering. In what respects to faculty, they were appointed as team leaders, and their teams are integrated by other faculty and staff.

Since the project started, different strategic partners have helped the consortium to put ideas into perspective. The Global Engineering Dean's Council (GECD) has also served as a key ally to widen the consortium's international network. International recognized consultants in engineering education guided authorities and faculty during the two phases of the project design. David E. Goldberg participated in the first phase, which consisted on a benchmark process, study visits (e.g. UC Berkeley, University College London, among others), and strategic meetings held with authorities from different world-class universities. Later on, Ruth Graham joined the project during its second phase, becoming a strategic partner up till today, considering her work with other universities in the implementation of curriculum and cultural change for the long term. She is also a member of the international advisory board, whose mission is to analyze the project from a global perspective. A meeting with this board was held in January 2016, with the

objective of discussing the consortium aspirations, besides revising the allocation of resources and efforts.

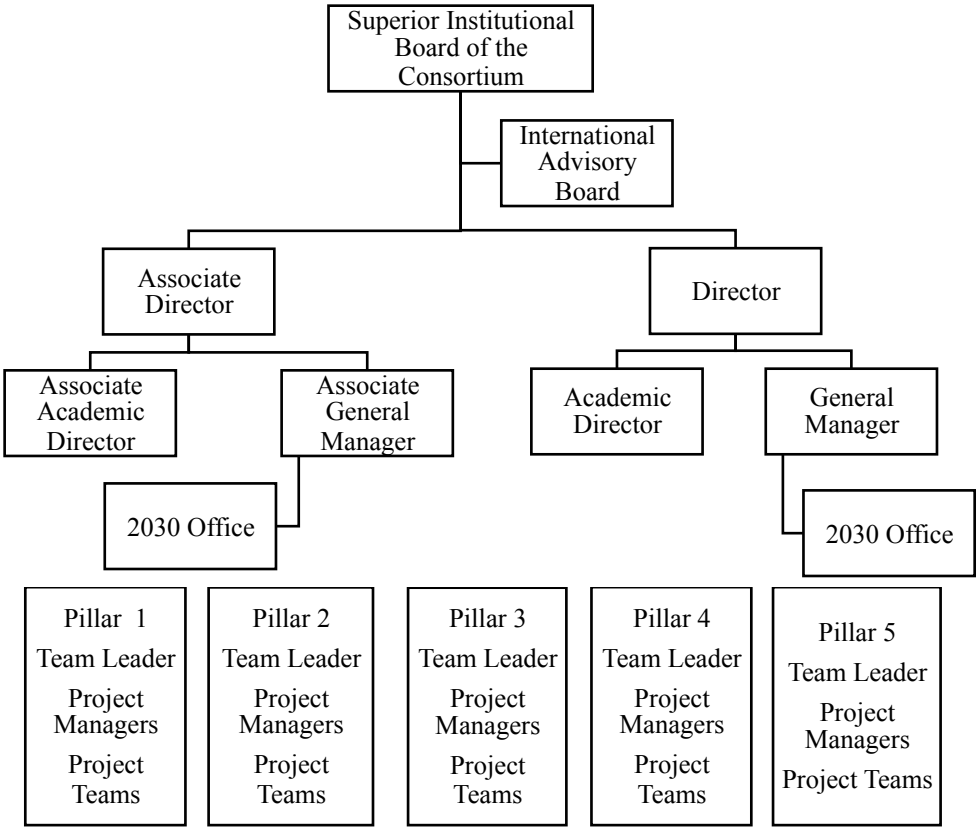

Figure 3. Organizational structure of The Clover 2030 Engineering Strategy (UC-UTFSM)

In addition to international partners, UC-Engineering has demonstrated an early concern of involving local stakeholders in both project design and implementation. Part of that is explained by the agreement with UTFSM to apply for funding as a consortium rather than individually, in order to work collaboratively in the cultural transformation of more than one institution. Second, the role of the institutional board has been crucial for the viability of some proposals included in the strategic plan (e.g., creation of an Engineering Education Division in a new UC-Engineering school structure). Third, UC-Engineering's advisory board has also been an important strategic partner since it was created, so its members have also provided valuable insights for The Clover 2030. Finally, new entrepreneurial and industrial networks are expected to be widened shortly, so The Clover shows early results without losing its societal focus.

According to The Clover 2030 manager, most project activities are explicitly targeted to students and faculty. *Figure 4* shows some of the milestones reached after one year of project implementation, particularly those who involve directly the teaching and learning process. For example, a massive course about research, innovation and entrepreneurship (R+I+E) was created

in order to invite all third year students to explore knowledge-based entrepreneurial endeavors. In what respects to faculty, new criteria for evaluating professors was approved to honor prior and future efforts related to the New Engineering 2030 initiative.

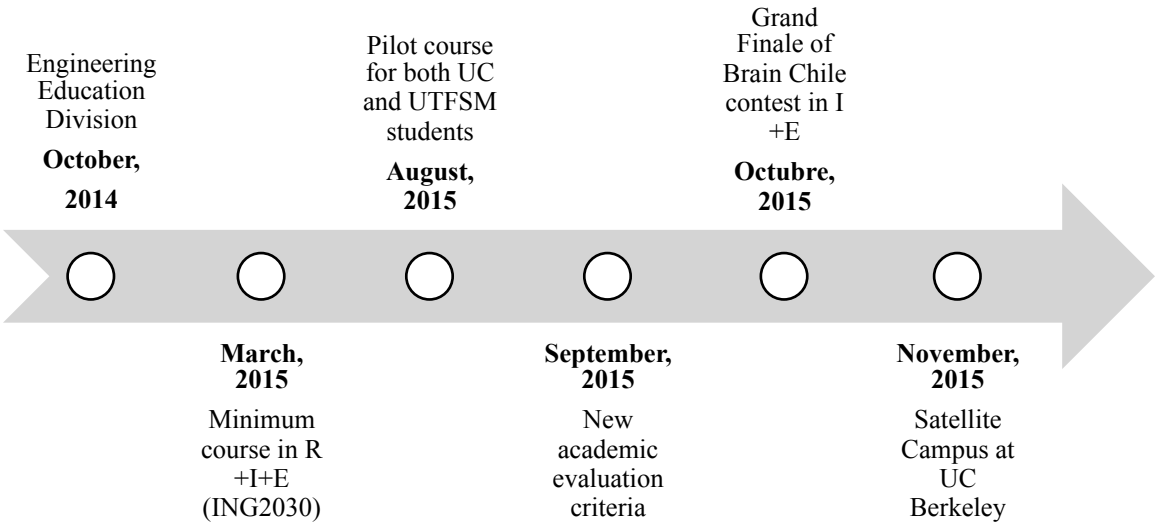

Figure 4. Some of year 1 main results of The Clover 2030 Engineering Strategy

Today, it is challenging to define short-term metrics of success because of the wide variety of project activities. Nevertheless, a cultural transformation is expected from the students, considering that most of milestones reached were conceived as a way to enrich the entrepreneurial spirit within the campus (see *Figure 4*). For example, the R+I+E course known as ING2030 was created to enhance students' entrepreneurial mindset. In addition to the ING2030 course, mobility between UC and UTFSM was piloted in other course during the second semester of 2015, so students from UTFSM would be capable of taking UC courses like ING2030 in the future periods, and vice versa. Therefore, the real challenge is to let students know that they are the most important participants of a big educational change. Then, all student-centered initiatives are crucial for ensuring the consortium success in a near future.

Table 2

Summary of comparison between two approaches of change of leading engineering schools participating in New Engineering 2030

	UCH –FCFM	UC-Engineering – UTFSM
Motivation	Become a world-class institution and a top leader in Latin-America	Create a world-class consortium in engineering education in Chile
Guiding principles	Curricular harmonization Entrepreneurship Technology transfer International alliances Change management	Transform engineering education Face societal grand challenges Orchestrate effective I+E networks Build a world-class community New liaison with society
Organizational structure	Deputy Dean (2030 Director) Deputy Head (articulation with CORFO) Faculty (work areas) Project advisory head (transversal)	Superior institutional board International advisory board UC Dean (2030 Director) UTFSM Vice-president of academic affairs (2030 Associate Director) Faculty and staff (team leaders and managers)
Strategic partners	University of Manchester (UK) Cornell University (USA) Technion (Israel) Technion-Cornell Institute (USA)	Ruth Graham (consultant) UC Berkeley (USA) MIT (USA) Texas A&M (USA) Columbia University (USA) Católica-Lisbon (PT) University of Notre Dame (USA) Edinburgh (UK)
Milestones	Launch of OpenBeauchef Creation of a research in engineering education unit Strengthening Center for Teaching and Learning Strengthening Curriculum Management unit Partnership with MIT REAP	Creation of an engineering education division Creation of a minimum course in R+I+E Pilot course for UC and UTFSM students New academic evaluation criteria Brain Chile contest in I+E UC Berkeley satellite campus
Long-term metrics of success	Improvements in world and regional rankings: to be top 100 engineering schools in the world and top 3 in the Latin American region	Improvements in world and regional rankings: to be top in the Latin American region in 2020, and top 50 worldwide in 2030
Challenges	Develop a closer link and partnership with the local industry Difficulties in communicating the project goals and orientations Faculty leaders seen as part of a clique	Diversify the international network Develop closer link with the entrepreneurial ecosystem and the local industry Sustain the consortium consensus over priorities

Discussion

As seen in the description of both cases—regardless of cultural and institutional differences—there are several common places between the two approaches to change presented in this paper (see Table 2 for a summary). There is a common motivation and goal, which is achieving excellence in engineering education within the region and worldwide. Although each institution describes its guideline principles in a different way, they all respond to the logic model suggested by CORFO. Of note is that both leading engineering schools were aware of previous experiences related to cultural change in engineering education and to the creation of university-based entrepreneurship ecosystems. This awareness can be reflected in three major change strategies considered from the beginning of the project implementations: the creation of multiple links with powerful and international constituencies, a balance between top-down and bottom-up strategies, and explicit strategies for change management and risk control.

Both institutions are also conscious of world's attention to the success of their strategic plans. During his visit to Chile in 2015 as board member of CORFO's advisory board, Norman Fortenberry—ASEE Executive Director—stated, "engineers are required to be not only technically excellent, but also engaged to society"[21]. The world is demanding engineers that are prepared for a new set of constraints, so both approaches are actively relying on their international networks in order to become a replicable approach to the continual improvement of engineering education. Educating engineers to address real challenges of the industry demands what it takes to prepare them to meet society´s needs. Therefore, both institutions are planning to diversify their constituents to put their ideas into perspective, besides developing closer links with the industry and the entrepreneurship ecosystem.

For FCFM, the organizational structure of the project suggests a top-down approach that attempts to distribute responsibility among young faculty members, taking into account the numbers of departments and a sizable faculty. This balance although hard to operationalized, it ensures the commitment of a broad base of scholar who will have greater responsibilities in the future. The awareness of the critical aspects of cultural change is addressed with a special work area, in which faculty members are those proposing the institutional political and structural changes that will sustain the new efforts. Between the conception and beginning of the Nueva Ingeniería 2030 and the current stage of the project, there was a dean change. Despite this important organizational change, the project has continued it path, which demonstrate the alignment among those involved in the process of change.

For UC-Engineering, sustaining a consistent organizational structure is challenging concerning the complexity of a consortium approach. However, leadership has been efficiently distributed among faculty, who have actively participated as team leaders and project managers. Additionally, the project vision has been communicated in different instances where all faculty have been involved. For example, the 2030 engineering strategy was completely revised during a

strategic planning meeting that took place in January 2014. A year later, a lunch with the CORFO advisory board took place in the faculty lounge, so board members were able to share with faculty and staff their impressions of the initiative so far. Cultural and rewards procedures have also been considered. As it was explained in the UC case, faculty evaluation criteria were changed during 2015, in order to motivate and honor faculty efforts aligned to the 2030 initiative. From the literature perspective, faculty involvement is critical aspects for successful reforms in engineering education.[11]

No doubts, the leaders and faculty of both schools were prepared for the change they were embarking on. The design and implementation of the first stage of the program is a reflection of that. Nevertheless, there were key blind spots or issues that have not been addresses and, in our opinion, are critical for the advancement and impact of both projects. The most salient blind spot is the breadth but not depth participation of students. Student engagement is what the specialized literature highlights as a key factor for successful change.[16, 18] Make no mistake, in both school students participate in most of the activities, use the spaces, and create inspiring startups. But, targeting initiatives to students is not enough. Furthermore, students are seen as a sort of client or user of the new spaces, rather than change agents. There is no student organization promoting the cultural change needed in both schools. In UCH, students are constantly invited to key meetings and fill all the seats in all activities and competitions. They used the new co-work spaces. However, they are not in charge of any massive activity or are not reclaiming spaces or asking for more opportunities to entrepreneurship education.

Something similar happens at UC-Engineering. The institution has taken bold steps for implementing a new massive course and targeted opportunities for connecting students with the entrepreneurial circuits in Chile and abroad. However, there are no student seats in main advisory boards. Student associations have been involved in open conversations about the project, but the student body is not necessarily conscious of what the New Engineering 2030 strategy means for them or the country. It is important to communicate students some concepts, so they know that they are helping their schools to become top 50 worldwide in 2030. Moreover, an entrepreneurial student organization should be advocating for entrepreneurship and entrepreneurship among their peers. This is important because students listen to other students.

Imagine you walk into any of the two analyzed campuses and ask to any student, faculty, or staff about the New Engineering 2030. Probably that person would have heard about it, but probably you will hear different aspects, objectives, and narratives about the program. None of the two schools have been able to produce a sharp statement about their program that will efficiently spread throughout the organization. The programs are big in structures, definitions, personnel, and ideas, with many pillars (five in both cases) and with ambitious goals in all of them. Thus, it is difficult to align the institution and to communicate with others. We speculate that this is produced by two factors. First, each school is trying to maximize participation and to attract

many current and potential constituencies, but the involvement of multiple parties makes the project more complex and its goals less clear. Second, CORFO is constantly demanding information, changes, and activities that are seen as a distraction. There is not a specific project led by students, considering that the responsibility of managing CORFO funding is huge and complex. The schools have few spaces for autonomy because of having few options of reassigning recourses and changing priorities. Then, metrics of success might be revised along project implementation moves forward.

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