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INDUSTRIAL CIVIL ENGINEERING CURRICULAR UPDATE UC TEMUCO BASED ON ENGINEERING CHALLENGES OF THE NEW CENTURY

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Abstract: In recent years, the industry has been forced to adapt to the dynamism of today's world and complex problems, where there is a demand for personalized products. In this sense, innovative engineers capable of facing these new challenges are required. Due to this, engineering training itineraries must be up to date with the new times. The Industrial Civil Engineering (ICI) program at UC Temuco, in its need to adapt to the global context, has decided to update the training itinerary based on a bibliographic review on the new approach to the program and surveys of different key actors. The results showed that the old ICI program must present more electives that allow the insertion of topics such as data science, simulation and sustainability. Furthermore, it was observed that the duration of the degree did not contribute to internal performance indicators of the university. The new training itinerary covers 11 semesters, 300 SCT credits, with 5 specific and 5 generic competencies. This new itinerary aims to respond to the challenges posed and improve the performance indicators of the graduate.
Keywords: Industrial civil engineering, curricular update, new engineering, training itinerary, professional skills

INTRODUCTION

In recent decades, the complexity of society and its organizations in a global world has increased, which, together with the intensification of international competition, the growing volatility of the market and demand for personalized products, has forced the industry to adopt the use and application of cybernetic systems, cloud computing, internet of things, big data, analytics, among others [1-2]. This continuous challenge for the industry is reflected in industrial engineering, which has experienced various changes; evolving from rather mechanical methods to electronic or automated methods; from

qualitative procedures to new techniques that require modeling, simulation, programming and extensive use of data analysis sciences and statistics; from an approach focused mainly on production and its efficiency to an integrative approach that considers the environment, the development of people, the company's strategy, value addition, among many other elements [3-4]. Interest is now focused on macrosystems, and on the design, management and analysis of larger, more complex systems [5]. Faced with this scenario, industrial engineering programs require a new rethinking to face these new challenges. In this context, several authors propose that curricular innovation must not be determined by the use of software per se but rather by the development of new skills in students [2, 6].

At the national level, Chile faces different challenges, which deserve to be addressed by engineering education, such as: moving towards an economic development model based on an industry of products and services with greater and better added value, increasing the productivity of processes by incorporating technology. and improving the capacity and skills of human capital, taking advantage of the competitive advantages of their territories, and the synergy of medium and small businesses, as well as continuing to promote innovation and entrepreneurship, among others. This situation has been reported by other countries such as Colombia in the work carried out by Mendoza-Mendoza [7]. Likewise, in the short term, it is necessary to overcome the economic crisis in which the country finds itself and incorporate those sectors that have been marginalized from the "successes" in terms of growth and economic development of recent decades. Therefore, an industrial engineer is required capable of conducting himself in this context with due social responsibility and citizen commitment. Under this scenario, La Araucanía, despite being a region rich in natural resources and tourism potential, shows economic and social indicators below the national average. The territorial claims and the actions of groups that use violence to raise their demands have caused private investment to migrate from the region, and industrial development is not evident in the territory.

In the area of higher education, the inclusive and diverse ``Universidad Católica de Temuco``has served the region of La Araucanía for more than 60 years, showing its commitment to the most vulnerable sectors of society and assuming its role in reducing of the gaps of socioeconomic, gender, ethnic-cultural inequalities and disabilities, through educational processes and mainstreaming in study plans, research and links with the environment [8]. The industrial civil engineering (ICI) degree at UC Temuco has been offered since 2007, showing in more than 15 years a distribution of student income of 31% women and 30% indigenous peoples. The training itinerary to be analyzed has a duration of 5 years, after a shortening made in 2013, based on an analysis of the international context and with financing from MECESUP. However, since the first cohort of this training itinerary (2018 onwards), a persistent difficulty has been observed for students in achieving the competencies declared in the graduation profile during the 5 years of the training itinerary, impacting the graduation indicators. of the career as the appropriate degree as shown in Figure 1.

As it was seen in Figure 1, ICI and the Faculty of Engineering present similar percentages of timely graduation, with the Faculty showing slightly lower values. When comparing the percentages of the faculty and ICI, the latter two are lower by approximately almost 25 percentage points than the University, which borders between 27 and 34% of timely degrees [9].

As a team from the ICI-UC Temuco degree program and based on what was mentioned above, it has been decided to analyze the current study plan and propose its curricular update. This update will ensure that the new training itinerary not only adapts to new times, but also ensures better student academic progression. Furthermore, it ensures that future graduates are effectively prepared to take on and contribute to the challenges described above not only in large companies, but also and even more so in our territory in small and medium-sized companies, public organizations, non-governmental organizations, ventures and others.

MATERIALS AND METHODS

CURRICULUM UPDATE OVERVIEW

The work of the curricular update covered the months of March to July 2019, and the information was updated in the month of July 2020. The work methodology was based on international literature by the authors De Miguel and collaborators [10], who has given rise to the guidelines established by UC Temuco to carry out curricular updating and the formulation of competencies in the study plans [11-12]. The process included three phases for curricular updating. The first two phases provide the diagnosis of the current career, and the last phase delivers the curricular products of the updated career.

STAGES OF PHASE I

Phase I was carried out in 5 stages. The first consisted of a bibliographic review, which in addition to including metasearch engines such as Google academic and Scopus, included the College of Engineers of Chile, CORFO, Universities, G9, and Mercosur. Likewise, and due to the fact that little information was found in general, opinions from colleagues, blogs from graduates and businessmen were also retrieved. Regarding stage 2, the training areas of the national academic offers of industrial civil engineering were compared with ICI-UC Temuco. For this, the areas or guidelines proposed by the College of Engineers of Chile (AG) were considered. In this search it was not possible to access the course programs to compare contents and/or learning results, so based on the name of the subject they were grouped into the AG training areas. Stage 3 considered the employability of the career, with the web portals of job offers analyzed: (i) indeed, (ii) Laborum, (iii) National Employment Exchange, (iv) Trabajondo, (v) Chiletrabajos, (vi) LinkedIn and (vii) Senior public management. It must be emphasized that, in the period of this work, Chile was trying to return to relative normality after the social outbreak, which was later complicated by the Pandemic.

Finally, the current situation of lCI-UC Temuco was analyzed in the 5 dimensions of the National Accreditation Commission [13] and that affect its performance, dynamism and development (stage 4). On the other hand (stage 5), the internal and external educational policies and guidelines documents were reviewed, which support and impact the curriculum of the analyzed career.

DESCRIPTION OF PHASE II AND III

Phase II, called Field Study, consisted of the application of surveys to different interest groups regarding some relevant components of the curriculum, such as their identity (graduate profile, duration of studies, validity of specific and generic competencies, correspondence of subjects, among others. The groups of interest were: (i) Regular ICI students with the exception of 1st year, (ii) Graduates of the degree, (iii) teachers and key informants and (iv) employers related to graduates of the race.

Finally, in Phase III, the curricular products were developed based on the

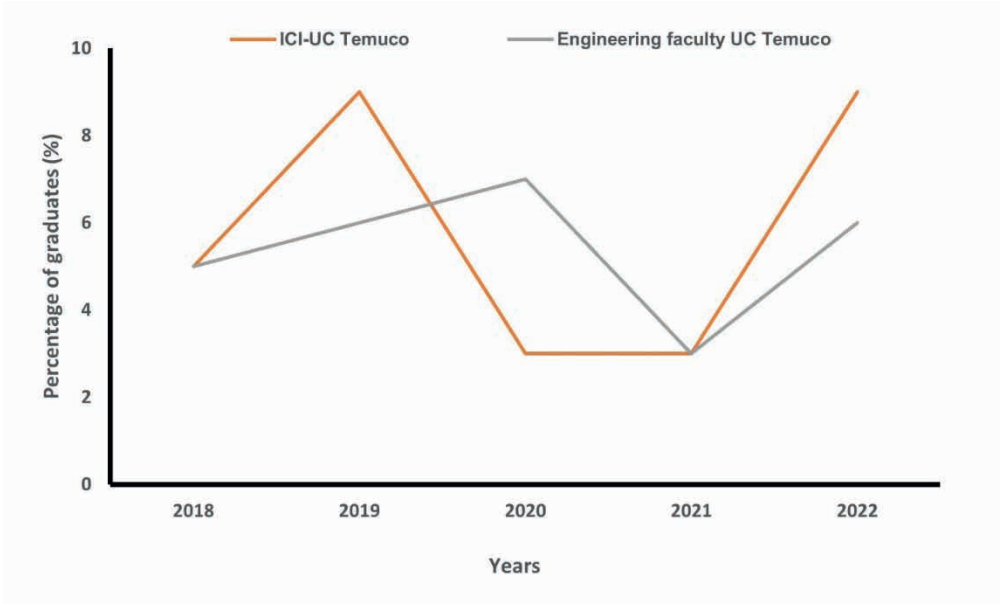


Figure 1: Graduates in a timely manner from ICI and the UC Temuco Faculty of Engineering. Information extracted from [9].

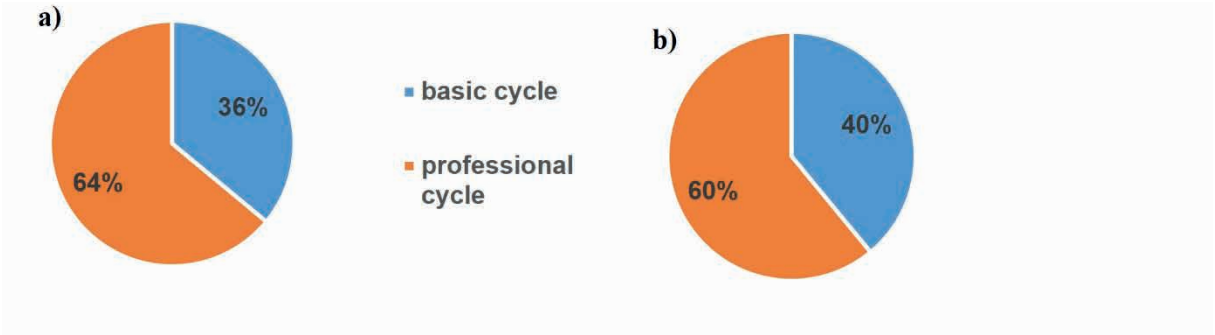


Figure 2: Percentage distribution between the basic and professional cycle of the average of all industrial civil engineering majors (a) with respect to the industrial civil engineering major at UC Temuco (b).

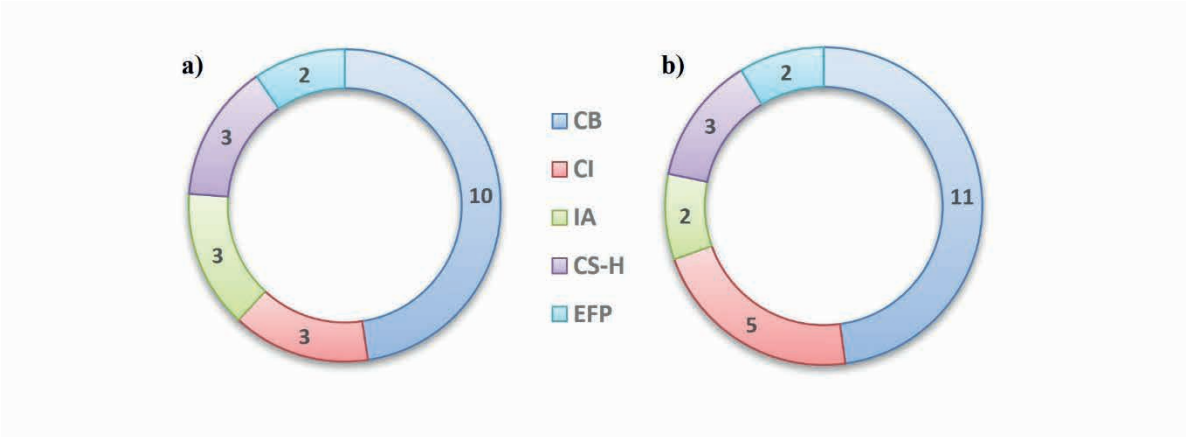


Figure 3: Number of basic cycle subjects by areas for the average of all industrial civil engineering majors (a) and the ICI-UC Temuco major (b). Where CB: basic sciences, CI: engineering sciences, IA: applied engineering, CS-H: social sciences and humanities and EFP: vocational training electives.

previous diagnosis. The curricular products were established by consensus of the curricular updating commission, and with the guidance of the General Directorate of Teaching of UC Temuco. The curricular products that represent the purpose of the developed curricular update are: (i) Identity of the Industrial Civil Engineering Career, (ii) Generic competencies, (iii) Specific competencies, (iv) Training itinerary together with the configuration of the training system. transferable credits and (v) Interlinkage matrix.

RESULTS AND DISCUSSION

MAIN RESULTS OF PHASE I

The analysis of phase I was divided into 5 stages, related to the bibliographic review, employability, internal and external analysis of ICI-UC Temuco. The bibliographic review corresponding to stage 1 of phase I showed from an international point of view that the current training itinerary of the ICI-UC Temuco degree provides training similar to the American one and addresses necessary and appropriate topics to practice the profession of industrial civil engineer in Chile, such as management and optimization. However, authors such as Sari and González-Hernández and Granillo-Macías suggest that, to face the world of work, the Industrial Civil Engineer must academically address: (i) inferential statistics, (ii) multivariate statistical methods, (iii) big data, (iv) data envelope analysis, (v) theory of solving inventive problems and (vi) programming and use of software relevant to the specialty [3, 14]. This information is supported by a study published by The Organization of American States, which showed that the prioritized areas that can directly impact the development of Industrial Civil Engineering in the coming years are New Technologies (includes all technological advances in the industry). 4.0), optimization (includes statistical tools), Production, Administration and Finance and finally, transversal aspects of quality, which include generic competencies and skills [15]. This study is in accordance with what was proposed by the College of Engineers of Chile, which states that the training of industrial civil engineers must be broad and flexible [16]. In terms of flexibility, they propose that the new training itinerary allows the student to select an area of expertise and does not address all areas with the same depth, that it combines the technical skills acquired with business acumen, that it master effective communication in their native language and English and that incorporates basic knowledge in data sciences and innovation. Finally, the aforementioned authors agree that the topic of sustainable development must be treated in its transversality.

The analysis of the comparison of the national training itineraries of the industrial civil engineering career resulted in 35 Chilean universities teaching the Industrial Civil Engineering career out of a universe of 58, which belong to the higher education system. Regarding the academic degree, 100% grant the degree of bachelor in engineering sciences, but they differ in the moment of granting it. Likewise, 25.0% grant the degree of Bachelor of Engineering Sciences at the end of the fourth semester. In relation to the duration of the study plan, 61.0% of industrial civil engineering courses have a duration of more than 10 semesters with a maximum of 12. On the contrary, 39.0% have a duration of 10 semesters. and no University offers a regular program, with a smaller extension. In addition, it was observed that 70.0% of the programs offered have a common plan with other civil engineering careers, which in 85.0% have a duration of 4 semesters.

In relation to the graduation profiles declared by the institutions, the main

differences were seen in the means proposed to achieve said graduation profile. For example, almost half of the statements include "innovation", many others "implementation", "optimization", use of "technology", "resolve", and others, which are not found in the UC Temuco statement. The current statement of ICI-UC Temuco, which includes the words "Design", "Manage" and "Control", obeys the paradigm of the last decade and is insufficient for the role of the Industrial Civil Engineer in the coming years.

When grouping the subjects into the basic cycle (1st-2nd year) and professional cycle (3rd-final degree), it is observed that their percentage distribution shows slight differences between the average of the degrees taught in Industrial Civil Engineering in Chile with respect to ICI- UC Temuco (Fig. 2). In particular, the UC Temuco program presents a greater load of subjects in the basic cycle and less in the professional cycle, showing a deviation from the national trend.

By detailing the number of subjects that make up the basic cycle (Figure 3) according to the areas proposed by the National Accreditation Commission [13] in: Basic Sciences (CB), Engineering Sciences (CI), Applied Engineering (IA), Social Sciences and Humanities (CS-H) and Vocational Training Electives (EFP), it is highlighted that the itineraries are similar, but with some differences from the macrocurricular point of view. When comparing both itineraries, a greater number of subjects associated with basic sciences and engineering are highlighted in the ICI-UC Temuco degree program (Figure 3b), while a smaller number is observed for the area of applied engineering.

If we carry out this analysis for the professional training cycle (Figure 4a and b), it is detected that the UC Temuco program has the same number of applied engineering subjects as the other industrial civil engineering programs. However, with a greater number of engineering science subjects and a significantly smaller number of subjects associated with vocational training electives. Therefore, this shortcoming must be made up for in the new proposal for the training itinerary and provide greater flexibility in the curriculum.

In the microcurricular, differences are seen with respect to courses related to statistics and innovation. In addition, there are other subjects that are mentioned recurrently in other itineraries and that do not exist in the UC Temuco itinerary, such as: simulation, production management, econometrics, decision theory, data analysis, machine learning, complex systems, programming, organizational development, databases, electrical engineering, statistical inference, among others. Furthermore, it was observed that most of the programs had a duration of their training itinerary greater than 10 semesters.

In the analysis of job offers and employability that corresponded to stage 3 of phase I, it was observed that there are more than 4,000 job offers (January 2020). This offer is concentrated in the metropolitan region with almost 75.0% and the lowest percentage of jobs offered corresponds to the Araucanía region (IX) with 0.1%. In relation to the areas of job offers, the largest number of offers correspond to the areas of production and manufacturing, supply and logistics, technology, systems and telecommunications, administration, among others, while, in the southern macro zone of Chile, (regions of Biobío, Araucanía, Los Lagos and Los Ríos) correspond to: integrated quality and environment manager, head of operations, head of control, management and people, regional director, among others.

Job offers request or mention certain knowledge, experiences and skills that those who apply must preferably have.

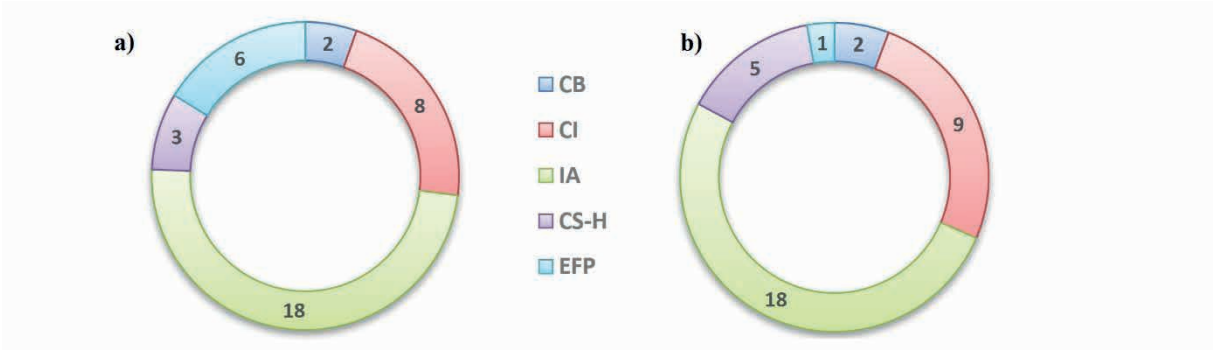
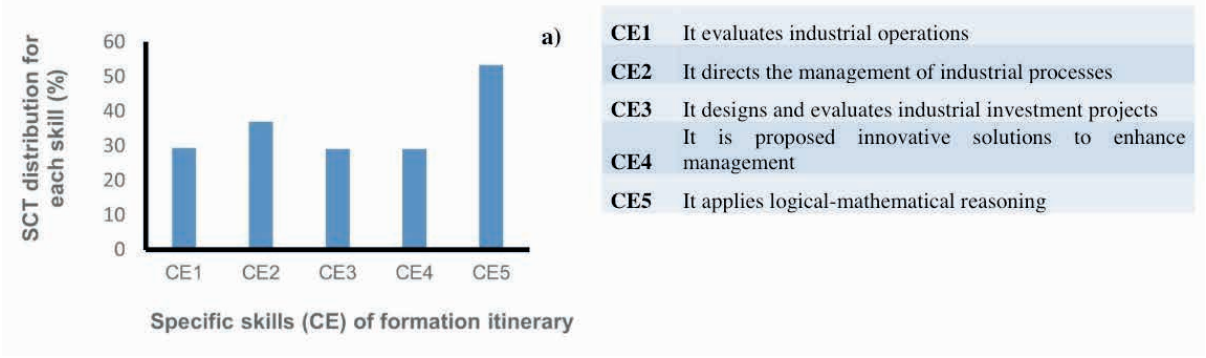


Figure 4: Number of subjects in the professional cycle by areas for the average of all industrial civil engineering courses (a) and the ICI-UC Temuco course (b). Where CB: basic sciences, CI: engineering sciences, IA: applied engineering, CS_H: social sciences and humanities and EFP: vocational training electives.



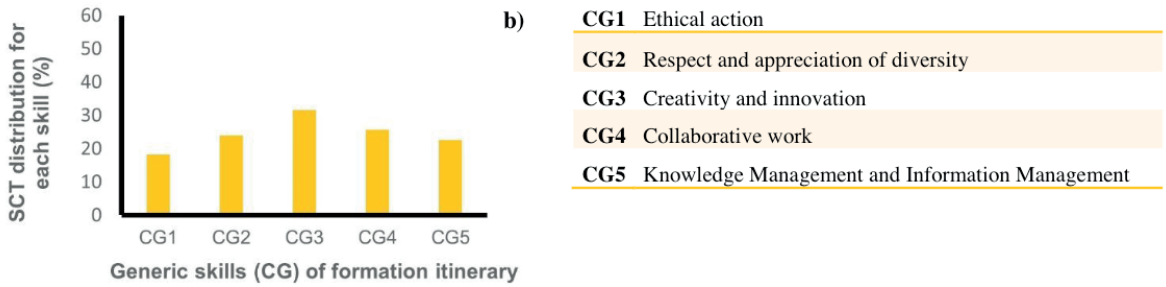


Figure 5: Distribution of credits according to the SCT for specific competencies (a) and generic competencies (b) in the new ICI UC Temuco itinerary plan.

Among the requested requirements are mastery of Microsoft Excel, English, labor and environmental legislation, knowledge of environmental impact assessment, SAP management, KPI, logistics, among others. A relevant aspect in the offers is that they request certain attitudes or skills called soft, most notably teamwork, technical language, ability to adapt to new situations, social skills and ethics. A relevant aspect is that the employability of industrial civil engineers is high. However, the employability of ICI-UC Temuco is the lowest in the system, even though there is a wide labor supply, mainly in the metropolitan region, and a possibility of job growth in the Araucanía region, due to fiscal investment. This shortcoming shows the need to update the itinerary, to provide training relevant to the needs of the market, which tends to employ industrial engineers, not only for factory production, but in public organizations, prosecutor's offices, hospitals, with approaches to complex systems, management, logistics, technology, among others.

In relation to timely employability (the graduate does not take more than 6 months to access their first job), 42.9% of those surveyed took an average of 3 to 6 months to access their first job. Likewise, 70.0% of graduates declare that there is a high relationship between their current job and the studies completed. Regarding the contractual relationship they maintain, the majority of graduates declare that they are under the Indefinite Contract modality (54.5%), while the remaining percentage is distributed in the term and fee contract modalities.

To respond to stage 4 of Phase I, information was collected from the origin of the ICI-UC Temuco degree with the help of the public platform KIMN UCT [9]. The ICI program received its first generation in 2007. From that date until today, 148 Engineers have graduated. In 2020, it had 315 students in regular status, of which 53 are in their first year. Its study plan has been modified on 3 occasions, with the so-called Plan 3 in force since 2013. The graduation rate for 2019 was 8.8%, well below the institutional average, which for That year it was 31.0%, the result in 2018 being even worse, reaching 1.0% of timely graduation, the institutional average being 31.2%. It must be taken into account that Plan 3 reduced the duration of the degree, compressing content, installing professional practice in the eighth semester, separating it from the possibility of a degree project. Furthermore, the title work subject was in the last semester along with other subjects, with students choosing to pass the subjects and postponing completing a title work, which obviously lengthened the process. Regarding first-year retention, this indicator remains very close to the institutional average (83.0%). Regarding third-year retention, the program (53.0%) is also below the institutional average (71.1%). This retention has been increasing in terms of its moving average in recent years. But it clearly remains below the institutional average. To improve the first and third year indicators, the ICI-UC Temuco career team proposes bringing disciplinary courses closer to the first years, to achieve knowledge of the discipline early and thereby achieve delight and motivation. Likewise, explore the potential that experiences such as learning and service could have, in the first years as an element of commitment and development of competencies in contexts of the discipline.

The internal analysis also detected challenges to be resolved such as the need to: (i) update the regulations of the degree, (ii) advance in the transformation of Engineering Sciences and vocational training courses, (iii) formally incorporate technological resources in the courses, (iv) advance in technologicalizing the curriculum and (v)

articulate the training itinerary of the degree with the postgraduate and continuing training through diploma courses.

The last analysis of phase I, corresponding to stage 5, highlighted that the degree curriculum (2020) complies with most of the areas of the National Accreditation Commission [13], showing a weakness in the low number of electives professional deformation. Another aspect that is suggested from the analysis is precautionary in the process of curricular updating, the criteria or attributes, as they are called in the Washington agreement, and in which the guidelines are established to internationally recognize engineering graduates, since The College of Engineers applies this agreement.

MAIN RESULTS OF PHASE II AND III

The second phase (Phase II) consisted of a field study based on surveys carried out with key actors such as graduates, teachers and employers. A relevant result showed that both students and graduates, and key informants and teachers, declare that they know the current graduation profile, and find it possible to achieve, with the training provided. Likewise, all segments positively value current skills, both generic and specific. Regarding the training itinerary, all segments indicate that they do not agree that it is well structured. They also indicate that there are contents that are repeated in the subjects, and that there are subjects that do not contribute or are disconnected from the rest of the itinerary. The students suggest that the professional practice must be in the last semester along with the degree work. All segments only partially agree or disagree that the career has the necessary implementation for the development of competencies. The majority of teachers and key informants also raise the need to extend the duration of the degree, by at least one semester.

In the last Phase corresponding to the third (III), the main curricular products were obtained through the consensus of a working commission and based on the analyzes carried out with the help of the previous phases. The first product was the graduation profile, which was formulated as follows: "The industrial civil engineer, graduated from the Catholic University of Temuco, is a professional, trained to manage and direct companies and/or institutions of industrial production of both goods and materials. of services; To this end, it proposes creative and innovative solutions by applying technological tools, data and information management, and operations research, among others, with the purpose of improving the results of the economic, social, and environmental performance of the organization, under a multidisciplinary, ethical and valuing diversity, contributing with it to improving the quality of life of people and the sustainable development of the territory of the southern macro zone and the country."

To comply with the declared graduation profile, the specific and generic competencies were formulated again, becoming more robust and incorporating the trends that industrial engineering is following, and providing training in accordance with the paradigms that are developed today, such as the management of innovation, probabilistic models, simulation, data analysis, programming, sustainable development, complex systems, risk management and financial instruments, among others. The generic competencies are: (i) Ethical action, (ii) Respect and Valuation of diversity, (iii) Creativity and Innovation, (iv) Collaborative Work and (v) Knowledge Management and Information Management, and the specific competencies : (i) Applies logical-mathematical reasoning (Common Plan), (ii) Evaluates industrial operations, (iii) Directs

the management of industrial processes, (iv) Designs and evaluates industrial investment projects and (vi) Proposes innovative solutions to enhance business management and development. All competencies are evaluated at three levels of scope. Figure 5 shows the distribution of the SCT, showing that the number of specific competencies in both the old and new plans is maintained, but the generic competencies are reduced from 6 to 5, eliminating the competency of "oral and written communication". and multimodal" and the "orientation to excellence" competency is replaced by "Knowledge Management and Information Management."

The new Industrial Civil Engineering program consisted of 300 credits according to the Transferable Credit System (SCT). Regarding face-to-face and mixed hours, these represent 48.0%, while autonomous hours correspond to 52.0% of the total hours. The duration of the new training itinerary covers 11 semesters (Table 1), increasing by 1 semester compared to the old plan (Plan 3). An important aspect is that in the eleventh semester only the professional practice and the degree project are found, giving the student the facility to dedicate themselves full time to the activities leading to the degree. Another aspect to highlight is the professional practice, which is carried out during vacations (transition between semester 10 and 11), therefore, it would favor the student to mature on the thesis topics or specify controlled practice topics during their stay in the industry.

CONCLUSIONS

The proposal for the new formative itinerary of the Civil Industrial Engineering career at UC Temuco is proposed based on information collected from scientific literature and the experiences of key actors with the goal of adapting the curriculum to the new challenges of society. This new itinerary extends over 1 semester, presents flexibility in incorporating optional in-depth studies, decreasing assignments in basic sciences and delivering more tools in the areas of Engineering Sciences and Applied Engineering. All assignments are interconnected and respond to a formative line. Another interesting aspect is that data science is introduced alongside information management and more inferential statistics. The committee that obtains the itinerary also proposes that the formative itinerary be evaluated in two instances: finalizing the basic cycle and ending the fourth year with the objective of diagnosing failures before obtaining the first cohort of the new plan. Furthermore, it is proposed that in the signature programs we ensure the incorporation of sustainable development and the use of professional software.

THANKS

The team of authors thanks María Isabel Valdivieso for her support and guidance in the curriculum updating process. Furthermore, thanks are due to all the students, graduates, teachers and key informants who participated in the surveys and who, without their responses, made it impossible to carry out the curricular update.

Formation itinerary of ICI-UC Temuco	Area*	Credits	P** (h)	M** (h)	A** (h)	CG/CE***
Year 1-Semester I						
Algebra	CB	5	4	2	2	1/5
Calculation I	CB	6	4	2	4	3/5
Introduction to Engineering	IA	5	2	2	4	2,4/5
Engineering communication workshop	IA	3	2	1	2	1,5/5
Programming workshop	IA	5	2	4	2	3/5
Fundamentals of chemistry	CB	4	2	2	3	1,4/5
Year 1-Semester II						
Christian Anthropological Elective	EFP	3	2	0	3	1
Physics I	CB	7	4	3	5	2,3/5
Linear algebra	CB	5	4	2	2	4/5
Calculation II	CB	6	4	2	4	3/5
Representation systems	IA	5	2	2	4	5/5
General chemistry	CB	6	4	4	2	5/5
Year 2-Semester I						
Theological elective	EFP	3	2	0	3	1
Thermodynamics	CI	7	4	2	6	3/1,5
Industrial Chemistry	CB	4	3	1	3	3/1,3
Systems modeling	IA	6	2	2	6	2/2,4
English I	CS-H	4	2	1	4	2/2,4
Calculus III	CB	6	4	2	4	4/5
Year 2-Semester II						
Physics II	CB	7	4	2	6	4/5
Material balance	CI	5	2	3	3	3/5
Material resistance	CI	4	2	2	3	4/5
English II	CS-H	4	2	1	4	2/2,4
Differential equations	CB	6	2	2	6	5/5
Statistics I	CB	4	2	2	3	1/1
Year 3-Semester I						
Fluid mechanics	CI	5	2	2	4	3/5
Micro economy	CS-H	4	2	2	3	1/2,3
Electric machines	IA	4	2	2	3	4/1
Industrial engineering workshop	IA	6	2	2	6	2/1,3
Numerical operation	CB	6	3	2	5	3/5
Statistics II	CB	6	2	2	5	5/1,4
Year 3-Semester II						
Heat transfer	CI	6	3	2	5	4/5
Industrial Civil Engineering training itinerary (Continued Table)	Area*	Credits	P** (h)	M** (h)	A** (h)	CG/CE***

Macroeconomy	IA	4	2	2	3	1/3
Industrial management and administration	IA	4	2	2	3	2/1,2
Industry, society and interculturality	IA	5	2	2	4	1,2/3
Labor and environmental law	CS-H	4	2	2	3	1/4
Operations Research I	IA	6	3	2	5	5/2
Year 4-Semester I						
Diversity Elective	EFP	3	1	1	3	2
Unit operations	CI	6	3	2	5	4/2
Formation itinerary of ICI-UC Temuco (Continued Table)	Area*	Credits	P** (h)	M** (h)	A** (h)	**CG/CE*** **
Industrial costs and budgets	IA	4	2	2	3	4/4
Supply chain management	IA	5	2	2	4	5/2
Automation	IA	5	2	2	4	3/4
Operations Research II	IA	6	3	2	5	3/2
Year 4-Semester II						
Diversity Elective	EFP	3	1	1	3	2
Quality management	IA	5	2	2	4	5/2
Economic engineering	IA	4	2	2	3	5/3
Organizational development and human capital	CS-H	4	2	2	3	2/2
Operation management	IA	5	2	2	4	4/2
Simulation	IA	5	2	2	4	3/2,4
Industrial practice		5	0	2	6	
Year 5-Semester I						
Diversity Elective	EFP	3	1	1	3	1
Evaluation of industrial projects	IA	5	2	2	4	4/3,4
Corporate finance	IA	5	2	2	4	5/3,5
Environmental management and sustainable development	IA	6	2	3	5	2/1,3
Planning and production control	IA	5	2	2	4	3/2,5
Innovation and enterprise management	IA	5	2	2	4	3/1,4
Year 5-Semester II						
Professional ethics	CS-H	3	1	1	3	1
Information systems	IA	6	2	2	6	5/2,4
Analysis and data science	IA	5	3	2	3	4,5
Strategic planning	IA	6	2	2	6	4/1,4
Title seminar		6	2	2	6	1/1-5
Optional depth	EFP	5	2	2	4	
Year 6-Semester I						
Professional practice		18	0	2	28	2,3/1-5

Title work		12	0	2	18	1/1-5

* Classification according to CNA, Where CB: basic sciences, CI: engineering sciences, IA: applied engineering, CS_H: social sciences and humanities and VET: professional training electives. **P: face-to-face hours, M: mixed hours and A: independent hours. *** review reading of Figure 4.

Table 1: Extract from the interlinkage matrix of the new training itinerary of Industrial Civil Engineering at UC Temuco [17].

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