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Research Article

Towards the Determination of Competencies of the Commercial Engineer in Chile

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Abstract

This document summarizes the main findings derived from a 5-year study aimed at determining the competencies of the professional in the undergraduate degree in Commercial Engineering in the Chilean context. To identify the professional's competencies, workshops were held with graduated professionals, businessmen from various industrial sectors, and teachers from various disciplinary areas, aimed at collecting their respective perceptions. In general, it is concluded that competencies are key resources that give professionals autonomy and capabilities to create wealth through the construction of new spaces for growth and development. Likewise, based on the uniqueness of people, they can develop and maintain lasting relationships, maintain collaborative relationships, and actively commit to the public and civic life of organizations and the country.

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Introduction

The fundamental concepts that underpin the identification of the professional competencies that shape a business engineer come from a variety of sources, including academia, students, graduates, and employers [1].

Similarly, it is important to mention the macro-social components that originate from the environment and from which perceptions are derived from the segments of society in which business engineers work [2].

This work also aims to present to the academic community that trains these professionals the analytical framework and procedural mechanisms implemented to develop a coherent, appropriately formulated, and well-supported curriculum based on the competencies that societal segments expect and value [3,4]. This study hopes to make this curriculum available to researchers and analysts at its various stages of formulation and design [5].

The study aimed at identifying the professional competencies of a business specialist, referred to here as a commercial engineer, was developed using a specific method called Development of a Curriculum (DACUM) [6]. This method is designed to gather input from various stakeholders on the set of skills and abilities expected of this professional [7-9].

Starting with the determination of various categories of skills that are technically [10] called cognitive skills, procedural skills and interpersonal skills [11,12]; together required in the expected performance and to which it is possible to add those that come from other areas of performance that give space to new skills and disruptive classifications that the professional commercial engineer must progressively incorporate into his training and that the present work presents in its various stages [13-16].

Methodology

Curriculum development, DACUM

The Curriculum Framework for Development (DACUM) is a conceptual and methodological framework that establishes a sequence of activities aimed at aligning the functions and tasks performed by a worker or professional with curriculum [17]. DACUM represents one of the first widely used efforts to identify observed competencies and their academic link to the creation and development of professional training.

Originating in Canada in the late 1960s, DACUM was designed to create a curriculum guide that engages learners in the program and helps define achievable objectives [18]. The methodology is highly participatory, involving supervisors and professionals in the collaborative identification of the processes inherent in professional tasks, the required functions, and the knowledge, skills, and attitudes essential for performance, as well as the equipment and materials needed to reach higher levels of competence.

Procedurally, the core of formulating a DACUM profile chart or map involves conducting an intensive workshop with experts. The result is a profile chart or map that details the functions and tasks, which is subsequently used to develop curricular content, assessment criteria and instruments, and teaching resources [1]. This map serves as a matrix of essential functions and tasks, called performance domains, which define the competencies that the professional must possess. In addition to identifying these areas, the general knowledge and skills considered important for the profession are identified, along with the required social behaviors, such as attitude and teamwork, as well as the materials and tools used, based on current labor trends and future emerging prospects.

As a complementary approach to the DACUM map, the AMOD methodology was developed as a curriculum development model derived from DACUM. AMOD, which stands for Analysis of Functions and Tasks, is a rapid and flexible method enabling prompt responses to training innovation identification [19]. These workshops foster group interaction and synergy, enabling participants to gain a comprehensive understanding of their roles and providing a general direction for enhancing performance. The process of reaching consensus among participants also serves as a training activity.

Conceptual framework

The following is a summary of the concepts that underpin this work.

Skill categories

A first approach to understanding competencies [20] is based on their synonyms, such as aptitude, suitability, sufficiency, capacity, and ability. Consequently, professional competency is described not as a simple aggregation of knowledge, skills, and values, but as the dexterity with which professionals articulate, balance, and continuously evaluate these resources as a result of their integration [20]. In a competency, professionals are expected to possess the "know why" to explain causality. Likewise, "know what" is required for descriptive understanding. Next, "know how" is required as an active expression of practical skills, and finally, "know who" is needed to identify knowledge holders and their networks, emphasizing the importance of performance of knowing where to find information to apply it [21].

The EU's Tuning project [22] specifies that competence generally encompasses what a person can do (being competent in a given area), the level of preparedness to perform tasks, and the sufficiency and/or responsibility for specific tasks. The study involved 101 universities, each of which selected 150 graduates from seven disciplines (mathematics, physics, chemistry, history, geology, education, and business), as well as 30 employers of these graduates, totaling 5,783 graduates and 944 employers. In addition, 998 academics were surveyed to rank 17 competencies (generic and professional), resulting in a high Spearman correlation coefficient of 0.973 between graduates and employers [23]. It is worth noting that, in the context of knowledge transmission in classroom teaching, the most emphasized categories, according to Gagné (1971), were 1) verbal information, 2) intellectual skills, and 3) cognitive strategies, while categories such as 4) attitudes and 5) motor skills achieved less importance in the learning process.

Cognitive competencies

Cognitive competencies are directly associated with mental learning processes, as described by theorists such as Bruner (1991), whose concepts were later refined by Gagné (1971) in his classification of learning objectives, characterized and updated as intellectual skills and cognitive strategies [24]. One of the primary cognitive competencies is likely "learning to learn," which can also encompass analytical, synthetic, and critical thinking skills.

In line with this perspective, cognitive competencies, in a more updated context, include the abilities to understand and manipulate ideas, concepts, and thoughts, transforming them into abstract models that facilitate a deeper understanding of facts or constructs that represent theories [23]. These models can then be translated into systems of related hypotheses or structured sets of ideas based on established criteria, allowing for the elucidation of generalizable physical, chemical, biological, social, psychological, ethical, or aesthetic characteristics [25]. In accordance with this, cognitive competencies enable the development of strategies for managing novel situations in personal and professional life, thus stimulating critical thinking, which stands out among the competencies in this category and catalyzes analytical, synthetic, and evaluative skills essential for current and relevant professional practice (Table 1) [4].

Table 1: Classification of competencies by areas

Cognitive	Procedural	Interpersonal
- Ability to Learn to Learn. - Investigative Capacity in Interdisciplinary Teams. - Ability to Generate New Ideas – Creativity.	- Ability to Execute Quality Production. - Ability to Apply Knowledge. - Management Capacity. - Work Capacity in an International Context.	- Ability to Work Autonomously. - Ability to Generate New Ideas – Creativity. - Management Capacity. - Work Capacity in an International Context. - Leadership. –Interpersonal.

Procedural competencies

Procedural competencies, defined as being more utilitarian than cognitive competencies, focus on mastering methods and techniques to achieve specific results (Alles, 2002). While they serve an instrumental function within the context of competencies, they are often pragmatically complex in a contemporary context [26]. For example, when working with people, social communication skills are required, and collectively, there is a need to develop the ability to design interactive processes that correlate knowledge, an understanding of current contexts, and prior history regarding the origin and evolution of the theory (Alles, 2003). Consequently, a competency requires, in principle, planning, which implies effectively establishing goals and priorities, specifying actions, deadlines, and the resources necessary to achieve success in performing complex functions (Barbier, 2004).

Procedural competencies can be subdivided into methodological competencies, which involve time management and learning strategies to control the environment, encompassing decision-making and problem-solving.

On the other hand, linguistic competencies are associated with oral and written communication, as well as language proficiency [27]; Barbier, 2004), which are increasingly linked to technological competencies. Currently, this refers to the use of computer tools and information management, as is generative artificial intelligence, emphasizing the ability to manage technologies based on computers, software, and structures [28,29]. Finally, modeling competencies focus on the optimization, management, and development of highly complex processes (Barbier & Galatanu, 2004).

Procedural competencies are more utilitarian in nature compared to cognitive competencies, focusing on the mastery of methods and techniques to achieve specific outcomes (Alles, 2002). While they serve an instrumental function, they are often intricate [26]. For instance, when working with people, one needs social communication skills, the ability to design interactive processes, and knowledge of history and theories (Alles, 2003). Planning competence, on the other hand, involves effectively setting goals and priorities, specifying actions, deadlines, and required resources to achieve complex functions (Barbier, 2004).

Procedural competencies can be further categorized into Methodological competencies, which involve organizing time and learning strategies to control the environment, encompassing decision-making and problem-solving skills. Linguistic competencies are associated with oral and written communication, as well as language proficiency [27]; Barbier, 2004). Technological competencies pertain to the use of computing and information management tools, emphasizing the ability to manage technologies such as computers, software, and structures [28,29]. Lastly, Modeling competencies focus on optimizing, managing, and developing processes (Barbier and Galatanu, 2004).

Interpersonal skills

Interpersonal skills, which originate within individuals, facilitate interaction and cooperation among them, manifesting themselves in the various contexts in which they carry out their activities (Table 1). These encompass Individual Skills, related to the ability to express feelings, critical thinking, and self-criticism, as well as Social Skills, which involve demonstrating professional, ethical, and social commitments, and valuing and understanding the individual and cultural diversity expressed in the workplace (Belisle & Linard, 1996) [30].

These skills foster the capacity for self-criticism, multicultural awareness, and ethical coherence derived from self-analysis (Barbier, 2000(a). They also enable the development of essential skills for collaborative work, such as teamwork and openness to the initiatives of others (Le Boterf, 1994) [30]. Consequently, at a personal level, these skills include awareness of one's own role within the service chain, which constitutes an adaptive and balancing ability for managing work-related stress and leadership skills for guiding organizations toward their objectives (Le Boterf, 2000).

In a professional context, these key skills include the ability to search for and process relevant information, improve service attitudes to optimize the institutional image, overcome psychological barriers, and develop methods for conflict resolution (Le Boterf, 2001) [3]. Furthermore, individuals, in their unique way, can improve their job performance through language proficiency for intercultural communication and electronic communication skills, which are increasingly important due to the rapid pace of change in the work environment (Table 2) [31].

Table 2: Combined classification of competencies.

Categories	Scopes	Levels
Cognitive Procedural Attitudinal or Interpersonal	Systemic Citizen Professional	Generic Specific Others

Areas of competencies

A further categorization of competencies delineates the specific domains in which they are applied, identifying systemic, civic, and professional areas that characterize identifiable and interrelated contexts. Understanding these areas allows us to know and appreciate how human talents and virtues manifest themselves in daily performance, whether in personal life, in understanding the world in its breadth and complexity, or in the participation that each individual plays in their respective service within the organization, and their connection to and foreseeable impact on the specific sphere of society they serve. (Levy-Leboyer, 1995) [6].

Systemic competencies imply a broad systemic vision, encompassing the understanding, sensitivity, and knowledge to perceive how the parts of a whole relate and interact [10]. These competencies include the ability to plan changes for system improvement and to design new systems (Alles, 2002) [32].

Additionally, systemic competencies require mastery of procedural and interpersonal skills, since professionals are expected to understand technology and possess the skills to model and understand human behavior (Alles, 2003; [26]. These competencies, whether cognitive, procedural, or interpersonal, foster the development of new capabilities (Table 1) [7]; for example, the competency in systems modeling involves the methodical and integrated application of basic sciences, engineering, and social sciences to design, evaluate, diagnose, analyze, plan, control, operate, administer, manage, optimize, develop, improve, install, and implement various types of engineering systems (Alles, 2003; Pérez) [10].

From the perspective of applying Civic Competencies, these are based on the idea that a modern society functions effectively when people actively participate in achieving its unique objectives (Barbier, 2002; [12]. University students, at their level of knowledge, have a particular responsibility in managing social issues in the cultural, economic, and social spheres. This is how leaders emerge from certain situations, contexts, options, and limitations that depend on each individual's actions in relation to those of everyone else, understanding that they are an integral part of a given context [9].

Consequently, fostering social participation skills requires a foundation of basic world knowledge, which in turn necessitates methodological skills for critical analysis and balanced personal and social development based on ethical and aesthetic principles (Bruner, 1991; [26]. This is expressed through environmental responsibility, the strengthening of social institutions, the exercise of rights and duties, coexistence, and the adoption of attitudes of tolerance and dialogue [23]. In contrast, professional competencies encompass cognitive, procedural, and interpersonal skills exercised within professional settings (Delgado & Gutiérrez, 1994), which have direct manifestations in individualized professional practice [7].

From the perspective of the organizational context, it is crucial to observe that this directly influences the exercise of professional competencies [24]. Consequently, professional training must encompass a wide range of resources so that future professionals can perform effectively, regardless of the combination of available local and contextual resources (Denison, 1991).

In summary, each profession is characterized by specific sets of key areas or domains grouped into functions, activities, and tasks, which are developed in specific contexts and conditions of professional performance corresponding to each occupation. In the field of business engineering, this is carried out within the context of economics and business (Table 3) [1].

Other competency classifications

Expanding on this analysis, the literature offers additional typologies that can help deepen the understanding of professional competencies, especially relevant for those working in semi-skilled and skilled higher-level positions at a sociocultural level [23]. These competencies include the following dimensions:

Basic competencies, such as those acquired during preschool and primary school, which in Chile extend to age 13 or 14. These competencies include reading, writing, basic arithmetic, formal logical operations, basic geometry, and computer use, as well as those necessary for oral communication, understanding signs and symbols, and understanding the ethical implications of interpersonal relationships (Alles, 2002; [25].

Thus, Table 4 presents a matrix of competency classifications that further develops the analysis, including properly categorized examples [8].

Among these are those related to professional skills for litigation, pedagogy, and regulatory planning, followed by some procedural skills for preparing balance sheets, selling products, and developing programs, ending with personal skills, such as those aimed at developing self-esteem, among others [33,34].

In brief, the so-called specific competencies relate to professional specialization. These competencies are not directly transferable [26], but they are indirectly influential through adapted skills whose content is strictly linked to a specific specialty (Alles, 2003).

Next, the essential competencies, also known as generic skills or competencies, include problem-solving, communication, personal attitudes, the ability to use

Table 3: Competency classification matrix.

Categories Levels	Cognitive		Procedural		Interpersonal	
	Generic	Specific	Generic	Specific	Generic	Specific
Areas	Learn to learn.	Analyze a communication.	Problem resolution. Innovation.	Operate a specialized machine or equipment.	Service attitude.	Stand in front of an unknown group.
Systemic	Science as a system of codes.	Explain the interaction between the subjects of a communication system.	Delimitation of the social, biological, and technological system analyzed.	Apply an algorithm to a problem derived from a predefined system.	The prevalence of the common good over the individual good.	Ability to compensate group expectations with personal interest.
Citizen	Language for action.	The socialization of the child in language.	Citizen rights and duties.	Method of electing authorities.	Present social behaviors appropriate to the context.	Deference in compliance with schedules.
Professional	The tradition of the profession.	Code of ethics of the profession.	Economy Administra-tion Finance, Human Resources.	Calculation of Net Present Value of a Project. Depreciate an Asset.	Establish interpersonal relationships of trust.	Kindly explain decisions and actions to the subordinate.

Table 4: Performance Areas of the Commercial Engineer identified through DACUM.

1 Production	2 Marketing	3 Finance
Plan production. Monitor and control tasks. Process design. Prepares and produces technical reports. Evaluate credits. Evaluate consumer credits. Manage compliance with ISO standards. Controls the quality of products and processes. Solve production, sales, and after-sales service problems. Solve product problems.	Manage sales processes. Serves clients. Negotiate with clients. Capture clients. Manage client portfolio. Assign sales goals. Manage points of sale. Manages after-sales services. Participate in the loyalty awards. Manage the pricing policy. Hierarchize discounts by sales volumes. Promote products. Develop the market. Manage the credit policy. Manage foreign trade.	Manage the treasury. Manage the budget. Determination of costs. Accounting. Accounting analysis. Generation of financial reports. Foreign trade financing. Investment decisions. Capture and placement of resources. Financial. Project evaluation. Collections. Credit policy. Flexibility of accounts receivable. Credit evaluation. Tax planning.
4 Human Resources.	**5 Operations**	**6 Information Systems.**
Human Resources Selection. Training. Performance evaluation. Disengagement of personnel. Staff induction. Determination of remuneration structure. Reward for meeting goals. Social security and welfare systems. Payment of salaries and social laws. Welfare. Evaluation and management of the organizational climate. Risks prevention. Organizational design. Workload division. Physical distribution of staff. Evaluate and design organizational charts. Collective negotiation.	Logistics. Inventory management and control. Product distribution. Catering. Quote prices. Bidding and negotiation with suppliers. Supplier quality assurance. Implement new technologies and processes. Outsourcing of services. Equipment maintenance management.	Identification of information needs. Search for information sources. Statistics update. Generation and analysis of statistics. Background check. Background Check. Document management. Design information systems. Maintenance of computer systems. Acquisition of new information technologies.
7 Comunication	**8 Comptroller**	**9 R&D**
Corporate image. Develop the brand. Promotion of the organization. Public relations. Media management. Web-page design. Creation and implementation of an intranet.	Control standards. Definition of control tools. Verify compliance with goals. Legality. Compliance with standards. Build internal regulations of the organization. Protect the information. Identification of risks in processes.	Development of businesses, products, and strategic units. Research of new markets. Capture and evaluate new technologies and processes. Formulation of R&D projects. Analysis of the competition. Software development.
Transversal Tasks		
Strategic planning. Assignment of responsibility. Monitoring and control of tasks. Task prioritization. Task assignment. Motivation of staff. Definition of business policy. Decision making.	Communicate. Meet quality standards. Conflict management. Negotiation. Optimization of processes. Decision making. Entrepreneurial capacity. Ability to search for financing sources.	

arithmetic and information technology, and modern language skills (Barbier, 2002;) [7,17].

Complementarily, and from a broad perspective, general or generic competencies stem from academic training and work experience, applicable to any professional activity [23]. These competencies are based on scientific principles, which translate into technology and human attributes such as creativity. Through intellectual skills, these competencies can be progressively transferred to new situations and contexts [12]. Some examples include abilities such as decision-making, initiative, empathy, and numerical and computational skills, accompanied by verbal skills and effective communication (Barbier, 2002) [35].

Thus, professional competencies, acquired through professional experience (Bedoya, 2014), are demonstrated through skills in managing and adapting to the social environment (Belisle & Linard, 1996) [24].

Based on the above, the so-called tacit competencies, which stem from daily work or the "secrets of the trade," do not derive from formal education, but rather from work experience [20]. That is, they originate from practical activity, which Aristotle termed "phronesis" or "practical judgment," in contrast to "episteme," referring to scientific knowledge, and "techne," which encompasses the artisanal knowledge that shapes technology (Belisle and Linard, 1996; [21]. In this way, common sense, referred to as tacit knowledge, is grounded, acquired over the long term through acculturation within the profession [17].

Finally, transversal skills, identified as common to various professions, allow transfer between professional profiles [26], shaping new domains essential for innovative and up-to-date practice in professions such as, for example, writing skills, statistical management and some impactful sales techniques in the service sector (Díaz, 20250) [28,29].

Results

The following pages detail the findings of the research, beginning with the evolution of the profession in Chile and the various information gatherings carried out with relevant actors for the development of DACUM.

Evolution of the business engineering profession in chile

A five-year study identified a significant shift in the demands for conceptual training during the early years of the period, moving towards a greater emphasis on soft skills in later years (Hanna, 1990; [36]. While the theoretical knowledge requirements that are fundamental for business engineers [37,38] appear to be adequately met, particularly because they are typically taught in classrooms based on relatively stable content (Landier, 1992; [39], they relate to the most in-demand skills in the professional field [40].

Among the skills mentioned are computer skills and a second language (Carrasco and Flores, 2019) [37], in addition to those requiring further specialization (Le Boterf, 2000), considering that the market and society as a whole value multifunctional and cross-role competencies within an organization [12]. It is highlighted that personal skills are currently gaining greater relative weight since they influence teamwork, creativity, and initiative, among others. However, from a conceptual point of view, selection based on language proficiency maintains a high degree of influence (Le Boterf, 2001) [7], considering age, experience, professional trajectory, personal skills, and fundamental knowledge [17].

A deeper analysis reveals that the correlations between the required attributes in knowledge skills correspond to specific theoretical and instrumental content derived from the field of Management Sciences, with a specialized focus on Marketing and Communication Technologies (Le Boterf, 1994) [28,39]. Furthermore, it highlights professional competencies derived from personal aptitudes, skills, and abilities, whose correlations are generally positive with variables related to the capacity to creatively and analytically guide future decisions in the professional sphere (Levy-Leboyer, 1995; Iriarte Padilla, 2018) [29,31].

Thus, in recent years, there has been a growing demand for interpersonal skills, such as teamwork, achievement orientation, dynamism, and leadership, which are highly sought after by organizations (Menéndez, 19800) [12].

On the other hand, among the attributes of medium impact are training, total quality management, economic analysis, and organizational development [1,22], which underscore the importance of theoretical and conceptual skills and understanding of the environment. In the current context, this includes increasingly indispensable computer skills [28]. Consequently, universities must not only train professionals but also prioritize skills for up-to-date learning in highly dynamic and changing contexts [21]; [17].

Consequently, the aim is to arrive at a generic profile for business engineers that includes instrumental components such as mathematics, theoretical and conceptual components such as pricing theory, economics, and management, followed by innovative and updated content such as computer science and marketing, as well as a second language as essential structuring elements (Moller and Rapoport, 2003; [31].

In general, the identified content aligns closely with the needs of real companies and organizations, providing analytical models for decision-making and resource management in teaching for competency development to improve performance levels and the results of professional practice in the workplace [23,29]; (Mouton, et al., 1964). Additionally, relevant content is identified from other professional fields such as Labor Law and Information and Communication Technologies, along with the high-impact role of artificial intelligence in the current state of professions [7].

Personally, ethics and morality emerge as important aspects of professional development. Despite their recent incorporation [2]; Cortina, 2007 they reveal a set of highly important content within the profile required by organizations, who suggest that these topics be taught by universities, given the demands expressed by the market [21]; Mouton and Scrève, 2005).

In conclusion, it is necessary to concentrate resources on personal skills (Chapman, 2021) related to business management and evaluation technologies [31], followed by detailed knowledge of contexts and ethics that can raise the expected professional performance (Revans, 1985)[24].

DACUM of commercial engineering graduates

This activity lasted two months, extending over six months, and included the participation of graduate business engineers from various productive sectors, both public and private, with experience in medium and large organizations (Vermersch, 1996)[19].

The methodology (Table 4) consisted of workshops for identifying, analyzing, and consolidating the participants' perspectives; specifically, seeking to share findings based on the principles that form the theoretical and operational foundation of professional curriculum design [23]; Barbier and Galatanu, 2004).

Business engineers, considered experts by the design method, were invited to accurately describe and define their work, as well as their ability to define a function or describe the tasks they routinely perform in their professional roles. This includes tasks and activities requiring varying levels of knowledge and the use of tools and constructs that generate specific skills. These skills must be executed with attitude, aptitude, and sound judgment to be considered correctly performed, thus shaping and giving meaning to what is defined as successful professional performance, making it possible to determine professional competence (Barbier, 2000)[6,20].

Identified through DACUM

In its first stage, the workshop focused on defining professional work areas [19]. Subsequently, the business engineering graduates developed a list of relevant activities, classified into 10 functional categories of professional performance [6], including Production, Marketing, Finance, Human Resources, Operations, Information Systems, Communications, Accounting, and Research and Development [41].

Then, in a second phase, transversal activities applicable regardless of the specific professional role were identified (Le Boterf, 2000) [42] (Table 5). These activities include strategic planning, policy definition, decision-making, quality standards management, conflict management, and other strategic, tactical, and operational tasks [32].

In the second stage, to identify a basis for prioritization, a brainstorming session was conducted, recording all statements on pre-organized cards for each of the defined areas [1]. In this phase, an academic facilitator played a non-directive role, fostering participation and consensus among the participants [19]; Le Boterf, 2001), fulfilling a non-directive role to encourage participation [6]; Le Boterf, 2001).

Gradually, the contributions (ideas, suggestions, and proposals for activities, presentations, and tasks) were compiled by noting the participants' input on cards, which were then displayed to the group in order of priority on the whiteboard [23]; Le Boterf, 1994).

Brainstorming facilitated the generation of concepts and sequences of related statements on structured cards [19]. Subsequently, analysis and consensus were promoted regarding identifiable activities and tasks consistent with professional practice [23]; Levy-Leboyer, 1995). In this working context, the observing academics formed a committee to analyze the collected information, interpreting and translating the expressions into competency terms [15]. These competencies were then classified according to the most frequent categories, as shown in Table 5, forming a synthesis matrix categorized into significant areas [13].

Expert observers [23], academics with extensive experience, analyzed the records without expressing any opinions but asking clarifying questions before definitively establishing an assessable professional competency [43]. In this way, a list of relevant activities was developed, classified into functional performance categories (Agudelo-Orrego, 2019) and associated with a list of competencies duly categorized according to the new work scenarios, as shown in Table 6 [2].

Dacum professionals graduated from commercial engineering

DACUM of employers of commercial engineers

In addition to the previous effort, a DACUM Workshop was conducted with employers who hired graduates in Commercial Engineering. A summary of the findings is presented in Table 7.

In general, the activity was conducted using a brainstorming methodology, recording the judgments, statements, and suggestions of a group of observing teachers. The facilitator was also present to encourage participation and facilitate discussion about the skills that employers require of business engineers. Table 7 summarizes the competencies proposed by employers for business engineers.

An additional phase of the work involved the academic observers [19] interpreting the identified competencies to develop a preliminary outline of the training content for a business engineer. Table 8 summarizes the content based on the previously defined competencies.

Table 5: Synthesis of competencies and attitudes by areas of professional performance.

1 Production	2 Marketing	3 Finance
Planning, evaluation, design.	Persuasion, Empathy, Communication, Motivation, Coordination/Control, Creativity.	Evaluation, Prospective, Analytical Thinking, Management.
Actitudes	**Actitudes**	**Actitudes**
Quality.	Sociability.	Inquiry.
4 Human Resources.	**5 Operations**	**6 Information Systems.**
Strategic management, Coordination, Communication, Application of standards, and teamwork.	Programming ability, Logical thinking, Process management.	Logical thinking, control ability, research, and evaluation.
Attitudes	**Attitudes**	**Attitudes**
Social Responsibility and Ethics. Sensitivity, Empathy, Respect, and Commitment.	Order, Rigor, Quality.	Curiosity, Willingness to Innovation, Continuous improvement.
7 Comunication	**8 Comptroller**	**9 R&D**
Strategic thinking, Communication, Design, and Creativity.	Evaluation, Analysis, and Control, Application of Standards.	Strategic Thinking, Analysis, Creativity, Foresight.
Attitudes	**Attitudes**	**Attitudes**
Empathy, Sociability, and Commitment.	Ethics, Prudence, Social Responsibility (Justice, Honesty).	Curiosity and Ethics.

Table 6: Competency classification matrix: Dacum professionals graduated from commercial engineering.

Categories Levels	Cognitive		Procedural		Interpersonal	
	Generic	Specific	Generic	Epecific	Generic	Specific
Areas	Learn to learn.	Analysis.	Resolution.	Operate.	Attitude.	Stand in front of a group.
Sistemic	Logical thinking. Creativity, systemic vision. Critical thinking. Analysis.	Communication of ideas. Know how to interpret data. Know the process thoroughly. Process methodology.	Process management. Planning. Programming capacity. Analysis of the information.	Design. Social security systems. Welfare systems. Search for information sources.	Self-appraisal. Prospective. Creativity. Curiosity. Social responsibility.	Network formation. Teamwork. Sociability.
Citizen	Behavior based on social norms.	Interpretation of constitutional and civil norms.	Application of Standards. Persuasion. Communication. Social responsibility.	Entrepreneurial capacity.	Willingness to innovate. I respect. Commitment. Multiculturality.	Empathy. Social sensitivity. Prudence. Negotiation techniques.
Proffesional	Management. Analytical Thinking. Investigation. Assessment. Strategic thinking. Quality.	Search for financing sources.	Motivation. Coordination / Control. Assessment. Analysis and Control. Rigority. Social responsibility.	Give instructions to employees. Formulation and evaluation of projects. Application of professional standards.	Continuous improvement. Control capacity. Commitment. Ethics. Social Responsibility (justice, honesty). Order. Management of power. Leadership.	Application of the standard. Technical procedural language. Professional networks.

Table 7: Dacum competency classification matrix for entrepreneurs – employers.

Categories Levels	Cognitivo		Procedimental		Interpersonal	
	Generic	Specific	Generic	Specific	Generic	Specific
Areas	Learn to learn.	Analysis.	Resolution.	Operate.	Attitude.	Stand in front of a group.
Sistemic	Formalization of realities. Make conceptual “maps” of reality.		Mastering a foreign language is not differentiating; it is a requirement.	Legal and regulatory trends.	Network formation.	Student trips abroad, to universities and companies in the country.
Citizen	Driving Cultural.	Know how to function in a world with an agenda of travel, customs, airports, hotels.	Promotion of university-business trust.	Legal and accounting criteria.	"Inquisitive" power, "be attentive." Work to reduce the gap between theory and practice.	Social skills of dialogue, empathy, and negotiation.
Proffesional	Technological literacy. New information and communication technologies.	Public management, given the reform of the State, which is advancing more than expected, advertises and knows.	"Inquisitive" power, "be attentive."	Management of public financial instruments (Corfo, Municipalities, etc.).	Commercial skills: knowing how to buy and sell.	Competence in formulation, competition, and project management.

Table 8: Classification matrix of minimum training contents.

Categories Levels	Cognitivo		Procedimental		Interpersonal	
	Generic	Specific	Generic	Generic	Specific	Específico
Areas	**Learn to learn.**	**Analysis.**	**Resolution.**	**Operate.**	**Attitude.**	**Stand in front of a group.**
Sistemic	Economy. Sociology. Anthropology. Policy. Philosophy. (humanities in general).	Systems theory. Process theory.	Optimization.	Negotiation techniques. Administrative support tools. Outsourcing techniques, logistics. Evaluate new technologies.	Assessment. Prospective. Surrounding analysis. Creativity. Entrepreneurial spirit.	
Citizen		Communication theory.	Tax, commercial, accounting, tax, civil legislation.	Short courses on legislation associated with business. Labor regulations.	Communication theory. Motivation Theory. Leadership Theory. Public relations theory. Protocol, rules of good manners.	Personal finances (Personal financial background). Oratory and body language.
Proffesional	Economic theory. Administration Theory. Theory of microeconomics and macroeconomics. Financial Accounting. Records and statistics. Client portfolio management. Standards theory (index numbers),	Planning and production techniques. Cost accounting. Analysis of business policies and financial analysis. Financial analysis workshop, Integration workshop. Market research. Statistics related to the business. Inventory management techniques. Statistics and Venture Capital.	Responsibility center structures Financial statement analysis.	Writing techniques. Financial analysis. Foreign trade techniques. Cash flow, budgets. Financial intermediation instruments. Balanced scorecard (Management Control). Archiving techniques. Indicators and means of validation and organization of documents. Writing plan. Financial indicators. External review.	Theory of intelligence.	Development of own financial indicators. Determine knowledge and skill needs. Teach how to handle power. Stress management. Integration workshop.

From the initial profile officially approved for the Commercial Engineer, which states:

"The Commercial Engineer is a professional trained to make decisions related to the administration of companies of any type [9,10,12] especially in the areas of organization, control, finance, marketing, and personnel. Your training allows you to define problems, propose solutions, and choose between viable [13,45,46].

Managing means achieving previously defined objectives, using human and material resources [14]. It is therefore a universal activity that applies to all human action [13]. It implies the business attitude of taking risks, seeking profits, and creating new businesses.

For their performance, the commercial engineer requires a good knowledge of the subjects related to their specific areas of action, as well as the ability to express themselves correctly in complex and technical languages to interact with professionals from other disciplines and be able to progressively learn and adequately handle concepts that were not part of their regular training [47,48].

The work of a business engineer takes place within or in collaboration with senior management. Therefore, it requires a deep understanding of the environment in which companies operate [14]. The importance of their work demands a strong ethical foundation and the ability to understand and consider the impact their actions may have on the community and the environment [11,26]. Consequently, this perspective should be conveyed by instructors throughout all courses in the program [7,21].

In the training of business engineers, a new educational paradigm has been [21], in which a key factor is defining and recognizing that educational programs in general, and Business Engineering in particular, seek to generate superior differential value [3,8]. To achieve this, the strategy of "values- and competency-based student training" has been defined, which includes the following objectives: a) redesigning undergraduate and graduate programs based on general, personal, and professional values and competencies; b) making the curriculum structure compatible with that existing in the field of European higher education; and c) modifying the educational paradigm, moving from the "teacher-instructor" model to the "student-learner" model [21].

The commercial engineer training model (Table 9) is consequently defined based on 4 Domains, 14 Competencies and 54 capabilities [23,26] each of which are detailed in the form of a matrix that identifies the cognitive, procedural, and interpersonal components and attitudinal skills necessary for the exercise of the corresponding capabilities and competencies [1,49].

In general, the University's Competency Development Plan for professionals [19] jointly considers the areas of fundamental training and professional and disciplinary training [12,26]. In summary, Table 9 shows the competency

Table 9: Curriculum Analysis Matrix

Domains	Competencies	Capacities
1. Environment management.	1. Systemically understand the macroenvironment	1
		2
		3
	2. Manage the organization's microenvironment	4
		5
		6
		7
2. Organizational management.	3. Analyze, design, and participate in the implementation of business strategies	8
		9
		10
		11
		12
		13
		14
		15
		16
		17
	4. Manage the organization to optimize its results.	18
		19
		20
		21
		22
	5. Demonstrates entrepreneurial capacity (intra-entrepreneurship and new projects)	23
		24
		25
		26
		27
3. Management of organizational functions.	6. Manage the financial resources of the organization	28
		20
		30
		31
		32
	7. Manage staff	33
		34
		35
		36
	8. Manage the Supply, Operation, and Production Processes, and Distribution	37
		38
		39
		40
	9. Manage Marketing	41
		42
		43
		44
	10. Manage information technologies	45
		46
		47
4. Transversal skills.	11. Use technical language and communicate	48
		49
	12. Use quantitative methods in management	50
		51
	13. Manage the Ethics of organizations	52
		53
	14. Master the English language	54
Total 4	**14**	54

profile of a Business Engineer, defined in the following matrix of Domains, Competencies, and Capabilities [37,45].

To describe to a greater degree, the profile detailed in the previous matrix, it is necessary to indicate that, in relation to the Professional and Disciplinary Training Competencies, in the professional training of Commercial Engineers, it is recognized that their contents will be those that allow them to function as administrators of organizations, whatever their type [17,46]. Additionally, the training plan contemplates the development of capabilities understood as those that provide the student with mastery of thematic content, skills, and attitudes capable of sustaining the competencies [49]. Specific professional training modules are also contemplated, which consist of cognitive, procedural, and interpersonal skills [14,47,50].

The professional profile innovated and defined based on Competencies verbatim states the following:

"The Commercial Engineer is endowed with potential and skills in the management of organizations, whether for-profit or non-profit, public or private institutions, or various organizations of organized society [50,51], where, the training enables the graduate to combine their disciplinary knowledge with their skills, abilities, and attitudes that, together, lead them to be a professional of excellence in the exercise of their professional domains [24,52].

Vocational training considers a) Knowledge, b) Abilities, and c) Attitudes, in a curricular plan structured based on the formation of competencies that allow you to implement and make your own the disciplinary knowledge of the Areas of Fundamental Training, Vocational Training, and Disciplinary Training." [12,44,53]. In relation to Knowledge, the curricular structure develops in students sustained competencies in the mastery of fundamental concepts of the disciplines that found the profession, as well as in the understanding of professional practice in various areas of performance [15,37,50].

Regarding Capacities, the training process of the Commercial Engineering program at the University promotes the development of capabilities inherent to the professional to exercise the skills required by their field of occupation [12,54]. Next, creativity and innovation are demonstrated through the individual's ability to generate new ideas and solutions, using acquired knowledge and skills to identify opportunities and enhance their employability characteristics [2,4].

Furthermore, the efficient and effective management of resources involves recognizing the need to use an organization's limited resources efficiently and effectively [16]. In this way, graduates would be equipped to lead and collaborate effectively in teams, address problems with a holistic and strategic perspective, and solve both operational and strategic challenges [17,20].

Regarding effective leadership, communication, and motivation, the focus is on developing skills to create coherent, persuasive, well-founded, and supported documents and [12,45,55]. Finally, the selection, integration, and application of knowledge highlights the need to enhance skills in applying knowledge and integrating it into projects based on competencies [13,15,56].

Regarding attitudes, the University's Business Engineering program seeks to foster an entrepreneurial mindset [57,58], promoting a willingness to take risks and participate in business activities, encouraging entrepreneurial initiative both individually and in teams, and promoting a proactive approach among graduates [14,44,59]. Likewise, social responsibility is emphasized, addressing how professionals should consider economic, social, cultural, legal, and political factors holistically and in an integrated manner, with a focus on ethical behavior, corporate responsibility, and the integration of organizations within broader social systems [60,61].

Thus, self-directed learning and the promotion of organizational learning focus on developing the capacity for observation to understand and implement strategies in complex local contexts [5], with openness and globalization [50]. Consequently, the fundamental competencies of training in Commercial Engineering include general modules that address culture and society, as well as focus on the integral development of people [12,26].

Conclusion

Based on the findings of the study on the multidimensional nature of the expected competencies of business engineers, the following conclusions are drawn:

Competencies enable graduates to comprehensively understand the world and the society in which they operate.

Professionals are considered autonomous, supportive, and responsible individuals, endowed with the necessary capabilities to create environments that foster growth and social development.

The competencies that comprise the profile of business engineering graduates combine intangible elements such as (disciplinary) knowledge and procedural skills (tools) with intangible aspects of personality and attitudes (being).

From a more personal and individual perspective, interpersonal interactions are identified and generated within society, where business engineering professionals are expected to maintain collaborative relationships and actively participate in the public and civic life of organizations within their areas of specialization and specific performance units.

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Ethical considerations

This study was conducted in accordance with established ethical standards for research involving human participants. All participants involved in the DACUM workshops, including graduates, employers, and academic professionals, were informed about the purpose and scope of the study prior to their participation. Informed consent was obtained from all participants, and their contributions were treated with strict confidentiality and used exclusively for academic and research purposes. No personal or sensitive data were disclosed at any stage of the research. The study adhered to institutional and international ethical guidelines for qualitative research.

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