A Framework of Skills in the Food Industry to Better Meet Job Market Requirements

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Abstract

In Morocco, a regulatory framework governs the design of vocational bachelor's degree training program which the Ministry of National Education, Higher Education and Scientific Research must validate for professional licenses. This ensures that the programs meet the quality criteria and educational standards set by the government. This research focuses on the design of a skills framework of bachelor's degree in food industry that meets the needs of the job market and aligns with the Ministry's directives, by examining the generic and specific skills of academic programs in the food industry offered by Moroccan universities and vocational training institutions.

We identified a catalog of generic and specific skills following an examination of the vocational education programs offered by various universities both domestically and abroad. Then, we subjected this list to evaluation and verification through a survey. The questionnaire asked the evaluators, which included teachers, lecturers, students, graduates, and employers, to rate the importance of each generic and specific skill.

The results found through the survey validated the initial list of the generic skills inventory. According to our findings mastering the technologies of food processing, mastering food chemistry and food microbiology, mastering unit operations of food engineering, mastering quality control and management, knowing food legislation and regulations, and mastering production management basics are all specific skills essential for achieving mastery in the field of food production.

Keywords: bachelor's degree, professional training, Morocco, food industry, curriculums

1. Introduction

The quality of training has a direct impact on integration into the job market and the Moroccan government has put several strategies in place to align training with the specific needs of the market. These strategies include reform of the education and vocational training system through the creation of training centers tailored to sectoral needs, particularly in the agri-food, automotive, IT and tourism industries. Furthermore, they involved encouraging partnerships with foreign companies and universities to bring training more into line with international standards and to enhance the quality and relevance of training.

In order to meet the needs of the market in the technology sectors, the Moroccan government has opted for the Digital Morocco 2020 Plan, which consists of promoting the teaching of digital skills throughout the country. It has also launched initiatives to create jobs for young graduates through the National Strategy for the Promotion of Youth Employment, in particular by supporting entrepreneurship and improving skills adapted to growth sectors.

The New Development Model of Morocco is a comprehensive and ambitious strategy that seeks to foster economic growth, enhance social inclusion, and reinforce governance. The implementation of various structural reforms within this model has been undertaken across all sectors. It places significant emphasis on the reform orientations of the higher education and professional training system. This is reflected in the second axis of transformation, which according to the project claims "a system of university education, professional training and research focused on performance and carried by an autonomous and responsible governance." (New Development Model, 2021)

An essential objective in the advancement of professional education is to enhance the availability of training opportunities. During the period spanning from 2017 to 2021, there was a notable rise of 5% in the number of trainees enrolled in their preliminary professional training, with the total number of attendees surpassing 455,576. The current job market is experiencing an influx of over 1,329,195 newly graduated individuals. Additionally, there has been an increase in the number of training institutions, with the creation of 51 new establishments (i.e.: the creation of cities of professions and skills), resulting in a total of 712 training institutions. (Activity reported by the Ministry - Department of Professional Training-Morocco, September 2021)

As stated in the report by the High Commissioner for the Plan [HCP] (2021), the unemployment rate has declined considerably (from 12.3% to 11.8%) from 2021 to 2022. In rural areas, the prevalence rate rose by 0.2-point from 5.0% to 5.2%. Conversely, in urban areas, the prevalence rate decreased by 1.1 points, from 16.9% to 15.8%. According to the 2021 data, individuals holding degrees in higher education degrees experienced an unemployment rate of 25.4%, whereas those with technical and middle management degrees had a slightly higher unemployment rate of 28.8%.

During the presentation of the study titled "Training and Employment in Morocco" in Rabat on May 2, 2018, Mr. Ahmed Lahlimi, the Commissioner for the Plan of Morocco, suggested that the rates of unemployment vary depending on the type of degree. He further added that the unemployed population comprises consists largely of general education and vocational training graduates, making up roughly 48% and 17% of the total, respectively.

Additionally, the Human Capital Perspective posits that training is a significant determinant of the unemployment rate. In fact, according to the High Commissioner for the Plan (2018), «difficulties in entering the labour market in Morocco may be manifested by the exposure of the labour force to a situation of mismatch between qualifications and the requirements of employment ».

A key objective in the roadmap for professional training development, which was presented to the head of state (the Moroccan king) on April 4, 2019 highlighted the need for prioritizing the identification of skills and requirements while developing corresponding training programs. Furthermore, the project "Strategic Vision of the 2015-2030 Reform" by the Higher Council for Education, Training, and Scientific Education of Morocco emphasizes the significance of aligning training programs with the economic requirements of the country and the emerging employment needs for enhanced socio-cultural and economic integration.

As highlighted above, the Moroccan government took many initiatives to improve training in higher education thar is because its significance is paramount to the progress of developing nations, as institutions of higher education and vocational training ought to serve as venues for endowing students with the cognitive and occupational proficiencies and resources necessary for their future careers.

These strategies should aim at boosting Morocco's economy and meeting the challenges of the labour market, particularly in terms of youth unemployment, while incorporating the rapid changes taking place in the world of work.

2. Literature Review

2.1 The Coherence of the University Training Curriculum

Several universities around the world have conducted studies to assess the quality of the curriculum to ensure quality training. Before we illustrate this with an example, let us begin with the definition of “curriculum” given by Raynal and Rieunier (1997). A curriculum according to Raynal and Rieunier (1997) is “the set of learning experiences offered to a learner, organised in a structured way by an educational institution. It encompasses not only the content taught, but also the pedagogical methods, assessment strategies and learning objectives, aimed at ensuring consistent and effective training”.

The Higher Institute of Education and Continuing Education of Tunis has conducted research which has focused on the evaluation of the quality of training systems by concentrating on the coherence of the curriculum. This evaluation was carried out through two complementary studies. The first study focuses on evaluating the alignment of student training objectives with desired outcomes and examining he effectiveness of the student achievement evaluation system. The second study analyses the retrospective evaluation of the quality of university training provided by graduates with professional experience.

According to Boussaada (2018), “The results of these two studies, integrated into the present research on the quality of the university training curriculum and its effects on the professional future of young Tunisian graduates, show that university training as provided and perceived by students is too exclusively academic ("enough is the enemy of the

good") and too out of step with the requirements of professional integration and the development of the knowledge society. The training system and the system for assessing students' achievements must be improved. The link between training and employment should be re-examined in the light of recent societal developments and in order to orient higher education curricula around a profile of a citizen capable of acting on his environment."

Barrier, Quéré and Vanneuville (2019) assert that, "As is the case in many European countries, higher education in France has undergone profound transformations since the early 2000s. However, although these developments have given rise to a great deal of research, it is striking to note that only a minority of studies are interested in the content of the knowledge taught and its structuring in a curriculum".

Three insightful points of Julien Barrier et al, which warrant a deeper exploration but are only marginally addressed in the previously existing literature are:

•How students integrate into and evolve within their professions.

•Analyzing the content and delivery of knowledge by using research from science studies that explores the inscription of knowledge in formalized media, incorporated know-how, collectives and material devices.

•A deeper examination of university-industry collaborations in shaping curricula, especially the way pedagogical frameworks, theoretical knowledge, and professional practices mutually influence one another.

Recent research on university curriculum design highlights a shift toward more inclusive, coherent, and evidence-based approaches to improve the quality and effectiveness of higher education.

2.2 Near Program: Competency Framework

Many research articles have adopted various approaches and methodologies for the design of the competency framework.

Between 2006 and 2007, a team of seven professors from the Télé-Université of Québec, developed a competency framework–which enabled the adoption of a programmatic approach, incorporating the desired skills into all the courses. This team achieved this by:

a. Developing a concerted definition of the field,

b. Specifying the actors in the field targeted by the study programs,

c. Analyzing existing repositories and job offers in the field,

d. Choosing a frame of reference for the design of the repository,

e. Developing the graphical model of the competency framework using the MOT technique,

f. Validating the graphical model of the competency framework,

g. Representing the reference framework in the form of a table and specify the level of performance expected from the different actors for each skill.

According to Basque (2015), "A competency framework needs to be reviewed regularly in order to take into account the evolution of the field of knowledge and skills concerned or in view of changes in the training offer (e.g. expansion of the framework to make it usable by several programs in the same field such as short programs, specialized graduate diplomas and master's degrees). The work of developing a reference framework of the target competencies of a study program is therefore a continuous and iterative process."

In 2019, Escrig, teacher-researcher at National Polytechnic Institute of Toulouse - National School of Electrical Engineering, Electronics, Computer Science, Hydraulics, and Telecommunications (INP-ENSEEIHT), proposed a method for designing a competency framework for the implementation of a competency-based approach. This method is inspired by professional didactics and aims to define the final objectives of a training course by analysing the activity of future graduates. It is broken down into several stages, including the following:

- Defining a list of authentic professional situations,

- Identifying families of professional situations in order to identify the associated skills,

- Formulating the essential components relating to each defined competence,

- Establishing development trajectories for each skill, marking out the expected progression,

- Identifying the critical learnings needed at each stage of development.

According to Escrig (2019), "the Competency Framework is thus a document reporting on the final objectives of a training course in terms of skills. It is to training what the learning objective is to the teaching module. In addition, from an evaluative perspective, the CF sets the references to which the performance and productions of students at the end of the course will be compared."

The design of competency frameworks was based on theoretical models and disciplinary expertise. Current approaches favor empirical validation, involving self-assessment processes, consultations with external experts and analysis of graduates' professional activities. This is intended to ensure a better match between defined skills and the actual requirements of the labor market, while enhancing the relevance and effectiveness of university training programs.

2.3 Training Engineering

Training Engineering is a structured approach designing and implementing training systems. According to Ardouin (2017), "Training is the action of equipping oneself with the means to allow the acquisition of knowledge by a person or a group, in a contractual perspective, related to a given context to achieve a specific objective".

Training Engineering applies across diverse sectors—including business sectors, such as industry, construction, public works, the tertiary sector, and economic and social sectors—even extending to training itself as a specialized service area. Le Boterfy (2006) gives us his perception of engineering: « engineering, as the coordinated set of activities to master and synthesize the information necessary for the design and construction of a structure (production unit, building, training system, telecommunications networks) with a view to optimize the investment it contains and to ensure the conditions for its viability ».

According to Ardouin (2017) «The training engineer therefore must coordinate and manage four main steps (Analyze, Design, Realize, Evaluate) in the engineering approach in two main phases (investigation, implementation), in order to act, an action, an optimal training system or device for the development of people and organisation ».

First, analyze: is a fundamental step. This step involves understanding the situation, establishing an inventory, defining training needs and determining training objectives. The analysis must be based on questions and information collection, the organization of interviews and investigations.

The second step is design. For Ardouin (2017) "this stage is thus the link between the desirable and the achievable. To do this, the training engineer seeks to objectify the approach and the training content by relying on the standards and specifications in a contract-based approach".

The approach we used in our research is based on training engineering, adopting a skills-based approach grounded in references. To enrich the bibliography of this study, we presented below multiple definitions from various authors.

Figarik (1994) defines referenialization as follows: "Referencing is the process of identifying a context and constructing, based on data, a body of reference for an object (or situation) against which diagnostics, training projects and evaluations can be established".

In this sense, Ardouin (2017) defines referenialization "Referenialization is therefore a reading of reality, a model that allows us to better understand and comprehend it. It is a reconstruction of reality that is never given directly to see and that must be analyzed, dissected and reconfigured. If referenialization is the method of elaboration, the referential therefore, is the product of this approach".

Ardouin (2017) gives us his perception of the referenialization process: "Referencing is this work of producing reference systems, and as far as our field is concerned, referencing is part of a work that makes it possible to move from the professional field to the educational field, by translating the profession into reference activities or employment and then a skills repository to lead to the training repository". Ardouin goes on to say: "Referenialisation thus leads, in the socio-educational field, to the elaboration of three reference systems: employment, skills, training".

Ardouin (2017) defines these reference systems as follows:

- The employment reference system is a summary of information on a professional activity or on a trade. It is obtained from the repository of achievements and current activities (job description, exercise procedures, observed skills, relationships within the company and with the environment, etc.). It is the reference system for future achievements and activities (forecasting the development of activities and skills required in the short to medium term).
- The skill reference system is directly derived from the activity reference system and is deduced from it. It includes all professional knowledge and attitudes implemented to obtain employment. The skills reference is

directly derived from the activity reference; it is deduced from it. It includes all the professional knowledge and attitudes used in employment. It is therefore a translation of the first reference system into observable and declinable elements in connection with the observation and analysis method used.

- The training reference system outline both the description of the training objectives and method for reaching them. It is at the interface of employment, with its analysis and translation in the context of employment, skills, and the training activity itself. This reference system can be used at different times of training, it is essential to identify and evaluate learning at entry, during and after training. The training reference framework is based on the competence framework. The expertise of the trainer and the pedagogue produces this framework. The trainer links employment, skills and translation into training objectives. The pedagogue transcribes the training objectives into pedagogical objectives and registers them in a progression whereby he may elaborate. It is, trainers and pedagogues, based on their pedagogical knowledge and didactic questioning, who will define this structured set of knowledge, cognitive abilities, know-how, pedagogical methods, and experience. All would be necessary to acquire and perform the job duty with adequate skills.

The third step is Realization. This is the heart of any training project since it is the actualization of a training action that will allow learners or collaborators of an organization to acquire new skills.

The fourth and final step is Evaluate. For Ardouin (2017), “evaluation has only recently appeared as such in training engineering. This is not to say, of course, that there was no evaluation before, but it was most often little or no evaluation”. Ardouin (2017) goes on to say that “Evaluation may be carried out as part of an evaluation-regulation; it is evaluation in training; and at the end of the evaluation- control, it is evaluation of training. Similarly, evaluation may be directed towards individuals, the group, the objectives, or the device. Evaluation can be qualitative and/or quantitative”.

Training engineering is therefore part of an iterative approach, alternating phases of analysis with phases of design and evaluation.

2.4 Overview of the Competency Approach

The term "skill" is frequently used in both professional and everyday contexts. Rey, Carette, Defrance and Kahn (2003) define a skill as « the capacity to proficiently execute a task. As per Tardif's (2006) definition, skill is a complex knowledge-action based on the effective mobilization and combination of a variety of internal and external resources within a family of situations ». By integrating the definitions of these two authors, we can say that “skill” refers to the ability to use available resources efficiently to successfully achieve a given task.

The approach of competence-based education represents a progression from objective-based pedagogy, enabling the organization of training based on a competence-related objective. Within the same framework, «This approach is based on an analysis of the actual performance of jobs in the company and determines the skills required to adequately perform the tasks assigned to those jobs prior to setting up the corresponding training programs. » (Department for Vocational Training, Ministry of Economic Inclusion, Small Business, Employment and Skills-Morocco, no date)

According to Postiaux, Bouillard and Romainville (2010), frameworks are defined as, “a global description of the skills expected of a student at the end of a training or part of a training”.

This paper aims to present a competency framework for professional degree programs in the food industry, which will be outlined through a series of steps. The initial step will provide an overview of the competency approach, followed by a discussion of the methodology, sampling, results, and conclusion**.**

2.5 Structure of the Education and Training System in Morocco

The organization of higher education in Morocco is governed mainly by Law No. 01-00 promulgated by Dahir No. 1-00-199 of 15 Safar 1421 (19 May 2000), which establishes the foundations of the Moroccan higher education system by defining the structures, missions and modes of operation of the institutions concerned. According to Article 2 of Law No. 0100, teaching is provided in faculties, engineering schools preceded by preparatory classes, higher schools and institutes, institutions for the training of educational executives and the training of specialized technicians or equivalent.

According to the National Agency for Evaluation and Quality Assurance of Higher Education and Scientific Research [ANEAQ] (2021), the Moroccan higher education system is composed of three main sectors:

(a) Public higher education, which includes:

-Universities: these are public institutions under the supervision of the Ministry of Higher Education, Scientific

Research and Executive Training. The Kingdom currently has twelve (12) public universities and one privately managed public university spread over the different regions of the country.

-Higher Education Institutions Not Attached to Universities (EENSNPU): these are specialized higher education institutions under the administrative and financial supervision of technical ministries and under the pedagogical authority of the Ministry of Higher Education, Scientific Research and Executive Training.

(b) Higher education, which includes non-profit foundations created as part of the internationalization dynamic of Moroccan higher education. These universities and institutions are under the pedagogical authority of the Ministry of Higher Education, Scientific Research and Executive Training.

(c) Private higher education includes universities and establishments created by private initiatives but under the pedagogical authority of the Ministry of Higher Education, Scientific Research and Executive Training.

According to Article 77 of Law No. 01-00 promulgated by Dahir No. 1-00-199 of 15 Safar 1421 (May 19, 2000), "the higher education system is subject in its entirety to a regular evaluation, covering its internal and external profitability, and affecting all pedagogical, administrative and research aspects. This evaluation will be based, in addition to pedagogical, financial and administrative audits, on the self-evaluation of each education and training institution and the periodic survey of the opinions of educational actors and their partners, in the fields of work, science, culture and the arts."

According to the vague report Pilot Evaluation of Establishments 2020-2021 carried out by the ANEAQ, a number of assets, strengths to capitalize on and niches were identified for improvement. Among the findings, in terms of training, "the establishments visited offer and provide a rich and diversified initial training system according to their vocation, and to achieve their objectives and to improve their performance, it is important to multiply efforts and strengthen the professional component of the training and to support it with support and incentive actions at the level of the development of the courses, programming, conduct and evaluation. Partnerships with the socio-economic world need to be strengthened and partners must be involved in the entire training process, from the design of the courses based on the profile of the targeted skills, through the contribution to teaching, the supervision of internships, evaluation, etc. The training should also be enriched by teaching (content and modes) aimed at the development of soft skills in future graduates."

Our research work is part of the national policy to develop the higher education and vocational training sector, while aligning it with the needs of the labor market. It also follows the recommendations made by the study carried out by the National Agency for Evaluation and Quality Assurance of Higher Education and Scientific Research (ANEAQ) "Report of the pilot wave of evaluation of higher education institutions 2020-2021".
Our research stands out for its ability to broaden the scope of questioning while involving the four key players, employers, teachers, graduates and students.

This study aims to develop a competency framework for the agri-food industry that aligns closely with the current job market needs in Morocco's Oriental region, enhances graduates' employability by ensuring their skills match the industry's demands, and maximize the value of recruit professionals' expertise for local business. On the basis of this competency framework, a training program will be created for the Bachelor's level in Ago-Food at Mohammed Premier University. It will follow Morocco's "National Pedagogical Standards Handbook for Bachelor's Degree in Sciences and Techniques – LST–", defined by the Ministry of Higher Education, Scientific Research and Innovation, to ensure quality and approval, as part of a push to strengthen various sectors like agri-food.

3. Methodology

The approach used is identical to one used in the "Tuning Project" where a survey was conducted to evaluate and verify the proposed lists of generic and specific skills by the following evaluators: teachers or lecturers, students, graduates, and employers.

This method has the advantage of involving all stakeholders which helps to accurately determine the skill needs in the job market.

The questionnaire asked the evaluators to rate each generic and specific skill in terms of importance, using a scale from 1 (indicating the lowest score) to 4 (indicating the highest score).

The questionnaire was distributed in two forms:

- Printed questionnaires given to the targeted population during short meetings aimed at providing respondents with an explanation of the context of the survey.

- Online questionnaires "electronic format: GOOGLE FORM", in which the briefing was carried out via e-mail to explain the context of the survey.

3.1 Tuning Methodology

Tuning, according to Beneitone and Dyukarev (2016), "…began as a project in 2000, initiated by higher education institutions and their academics, and strongly supported morally and financially by the European Commission. Over time, Tuning has gone beyond the EU and gradually transformed into a comprehensive methodological system covering educational sectors in many regions of the world."

Moreover, Beneitone and Dyukarev (2016) add that, "Tuning aims to meet the needs of higher education institutions and structures and to propose a concrete methodology for implementing the competence-based approach at the level of higher education institutions and training fields. Tuning offers a methodology for (re)designing, developing, implementing, and evaluating study programs for each of the higher education cycles. In addition, Tuning serves as a platform for developing benchmarks at the specialty level. These are relevant for making study programs comparable, compatible, and transparent. The agreed benchmarks for a specialty and its study program are expressed in terms of competencies and learning outcomes."

Universities in the Middle East and North Africa have used generic and specific competency descriptions in educational planning and designing degree programs. Mohammed Premier University participated in the Tuning Middle East and North Africa (T-MEDA) project to determine the Reference Points for the Design and Delivery of University Study Programs in Architecture, Tourism and Nursing.

According to Sackey et al (2014), "The Tuning methodology is an interactive process in which academics develop high quality curricula and learning standards for students through the identification of generic and subject specific competencies in consultation with employers, students, graduates, peers and other stakeholders involved in higher education."

3.2 Identification of Specific and Generic Skills

3.2.1 Specific Skills

According to Colomo-Palacios, Cabezas-Isla, Crespo, and Soto-Acosta (2010), "specific skills" refers to the abilities, knowledge, and competencies required to execute a job-specific task.

To define these specific skills, we carried out an analysis on the training programs of the Bachelor's level in Agri-Food found in universities of countries that stand out as global pioneers in this field, thanks to their innovation, production and exports, such as the United States, Germany and France. Furthermore, we worked on a training program found at a university in Russia to broaden our scope to western Europe since Russia is considered an important player in the agri-food field as it has considerable assets in this sector, thanks to its immense agricultural territory, its natural resources, and its recent efforts to develop its agri-food industry.

The universities consulted are: Bremerhaven University in Germany, Kaliningrad Technical University in Russia, University of Florida in the United States and the University of Avignon in France, after an analysis of the training programs of the universities listed above, and after discussions with people within the agri-food sector, we list the identified specific skills in table 1 below:

Table 1. List of Specific Skills

Code	Skill
S 1.1	Mastering data analyses: Mathematics
S1.2	Mastering data analyses: Statistics
S1.3	Mastering data analysis and presentation: Informatics tools
S 2.1	Mastering food chemistry
S 2.2	Mastering food microbiology
S 2.3	Mastering unit operations of food engineering
S 3.1	Mastering Quality Management
S 3.2	Mastering quality control
S 3.3	Knowledge food legislation and regulations
S 4	Mastering the technologies of food processing

Table 1. List of Specific Skills(continued)

Code	Skill
S 5.1	Mastering thermodynamics
S 5.2	Mastering fluid mechanics
S 5.3	Mastering utilities (cold, steam, compressed air, etc.)
S 5.4	Mastering maintenance basics
S 6.1	Master the basics of accounting
S 6.2	Mastering logistics basics
S 6.3	Mastering marketing basics
S 7.1	Mastering production management basics
S 7.2	Mastering personnel management basics
S 7.3	Mastering business management basics

3.2.2 Generic Skills

According to Hahn and Teferra (2014), generic skills are defined as “generic competences identify shared elements common to any degree, such as capacity to learn, ability to make decisions, design projects, and skills in interpersonal communication, among others. They are complemented by subject related competences inherent in a degree program which relates to the specific circumstances of a given field of study.”

After an analysis of the list of the generic skills identified for “ Design and Implementation of Degree Programmes in Civil Engineering” (Bala et al., 2018), “Higher education in Latin America: Reflections and perspectives on agronomy” (Barrios et al., 2014), “Design and implementation of degree programmes in agricultural sciences”(Boodhoo et al., 2018), "Reference points for the design and delivery of degree programmes in management” (McCabe, Dyukarey, Karavaeva and Kostin, 2013) and “Reference points for the design and delivery of degree programmes in environmental engineering” (Silina et al., 2013), and after discussions with the people within this sector, it was possible to identify the generic skills grouped together in the table below:

Table 2. List of Generic Skills

Code	Skill
G 1.1	Capacity for analysis and synthesis
G 1.2	Ability to resolve problems
G 1.3	Ability to make reasoned decisions
G 2.1	Ability to work autonomously
G 2.2	Ability to apply knowledge in practical situations.
G 2.3	Ability to plan and manage time
G 3.1	Being organized
G 3.2	Being methodical
G 3.3	Work in an interdisciplinary team
G 4.1	Ability to learn new knowledge and acquire new skills
G 4.2	Ability to generate new ideas
G 4.3	Ability to have a strategic vision
G 5	Communicate orally and in writing in the language of the region
G 6.1	Communicate in a foreign language: French
G 6.2	Communicate in a foreign language: English
G 6.3	Communicate in a foreign language: Spanish
G 7	Ability to formulate and defend a position in a discussion
G 8.1	Ability to act ethically
G 8.2	Respect diversity and multiculturalism
G 9.1	Ability to have empathy

Table 2. List of Generic Skills (continued)

Code	Skill
G 9.2	Ability to keep your disruptive emotions and impulses in check
G10.1	Commitment to protects and preserve the environment
G 10.2	Commitment to safety procedures at work

3.3 Outline of the Meta-profile for the Food Industry

Charles et al. (2014) define the meta-profile as follows: "a representation of the structure and combination of skills in order to give an identity to a specific area study (Figure 1). A meta-profile is a mental construct that categorizes skills in major components recognized and illustrates their interrelationships".

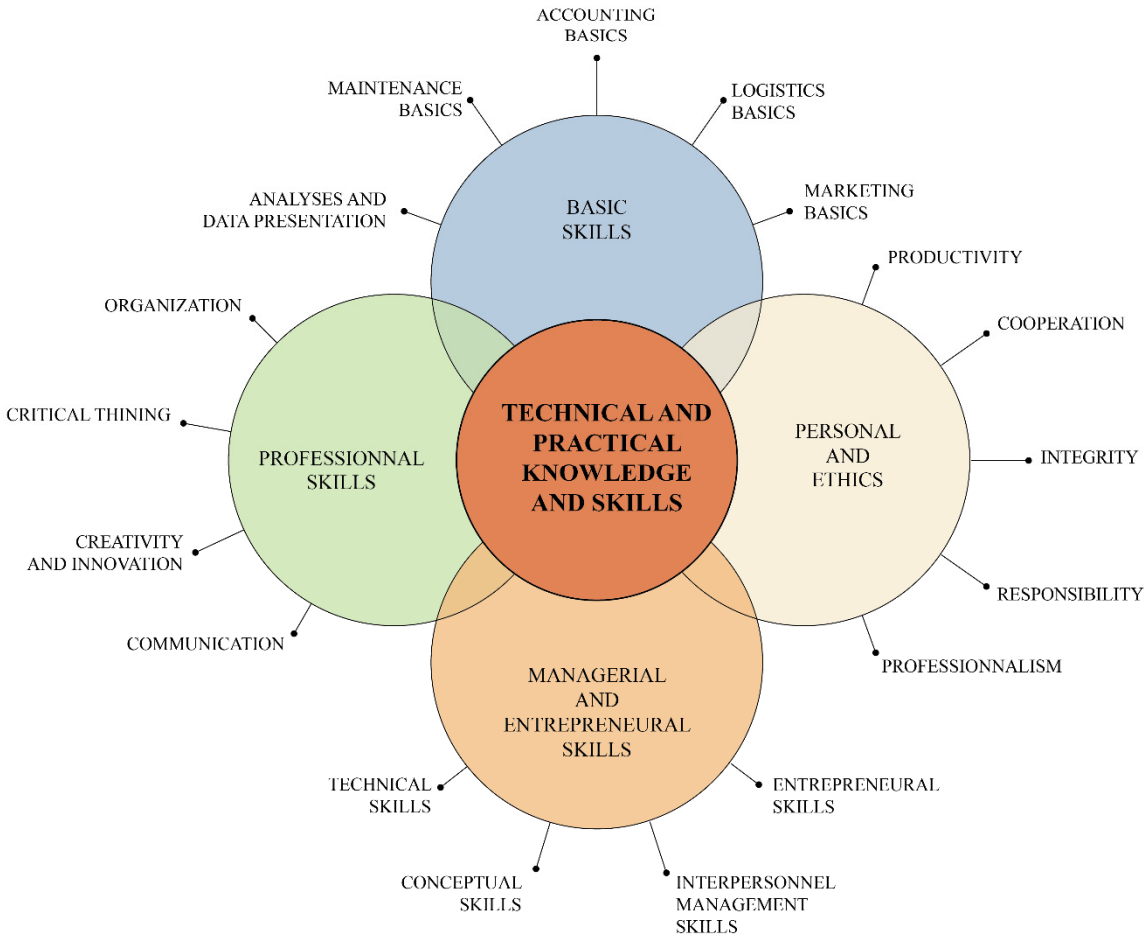

Figure 1. Food Industry Meta-Profile (professional degree)

3.4 Sampling

(a) "Laureate" category:

The entire population is represented by graduates from national-level of food training institutions. Since it is difficult to get the contacts of the laureates (undeclared employee), we carried out a convenience probability sampling.

The laureates consulted are laureates of the Institute specialized in agri-food industry Berkane (ISIAO Berkane) class of 2020 and laureates of ISIAO Meknes class of 2019, since these are the only classes, which we have their contacts. The number of laureates for the specialized technician level for the two classes is 52 laureates.

(b) "Student" category:

In 2021, the training institutions that operate in the agri-food industry sector at the national level are:

• Specialized Institute in the Agri-Food Industry belonging to Office of Vocational Training and Employment Promotion (OFPPT): There are 4 training sites in Morocco: Casablanca, Meknes, Beni Mellal and Berkane.
• Faculty of Sciences (Fez, Marrakech, Oujda, Kenitra, Casablanca, Beni Mellal…)

Given the constraints of travel due to the COVID 19 health crisis, we limited ourselves to the Oriental region, and we carried out a probability sampling of convenience, the students consulted are the students of ISIAO Berkane class of 2021.

The number of students for the specialized technician level is 52 students.

(c) "Professional" category:

Given the constraints of travel due to the COVID 19 health crisis, we limited ourselves to the Oriental region, and we carried out a convenience probability sampling. Visits were carried out for companies and public establishments operating in the agri-food industry sector in the cities of Berkane and Oujda. It should be noted that the response rate was 100% for the face-to-face surveys. We also contacted companies with their email addresses electronically.

The number of professionals interviewed is 80.

(d) "Teacher" category:

In 2021, The estimated number of teachers in the agri-food industry sector does not exceed 150 teachers:

• Institute Specialized in the Agri-Food Industry belonging to OFPPT: There are four cities, each with 10 to 15 trainers specializing in the Food Industry.

• Faculty of Sciences (Fez, Marrakech, Oujda, Kenitra, Casablanca, Beni Mellal,): In total, there are an estimated 10 faculties that offer training in the field of agri-food, and each faculty has a department that contains 10 to 15 teachers.

Given the unavailability of contacts for all teachers and given the COVID-19 conditions that limit travel, a probability sampling of convenience was carried out, and it was limited to the Oriental region and the teachers whose contacts are available.

The number of teachers consulted is 40 teachers.

Table 3. Number of Respondents to the Consultation on the List of Generic and Specific Skills

Stakeholders	Sample size	Number of respondents	% of respondents
Teachers or lecturers	40	15	37.50
Graduates	52	26	50.00
Employers	80	20	25.00
Students	52	47	90.83

The consultation received a total of 108 responses. The adequacy of the number of responses was deemed satisfactory.

4. Results and Discussion

4.1 Generic Skills

The survey data reveals strong consensus among respondents regarding the value of generic skills. Nearly all skills listed received average ratings above 3 on a 4-point scale—where 3 signifies "relatively important" and 4 indicates "very important". This validation indicates the necessity of integrating these generic skills into the curriculum when defining a food technology program at the university level (Figure 2).

However, G. 6.3 "Communicate in a foreign language: Spanish" was deemed unimportant by the majority of the responders.

Separately, the skill of effectively communicating both orally and in writing in the regional language (as outlined in G5) was identified by professionals, students, and laureates as an area requiring improvement.

The correlation matrix revealed uniformly high correlation coefficient (r) values, all exceeding 0.85. These findings indicate strong agreement among all four groups on the perceived importance of 23 skills.

Notably, compatibility was slightly lower between students and graduates, while professionals and teachers showed particularly high alignment.

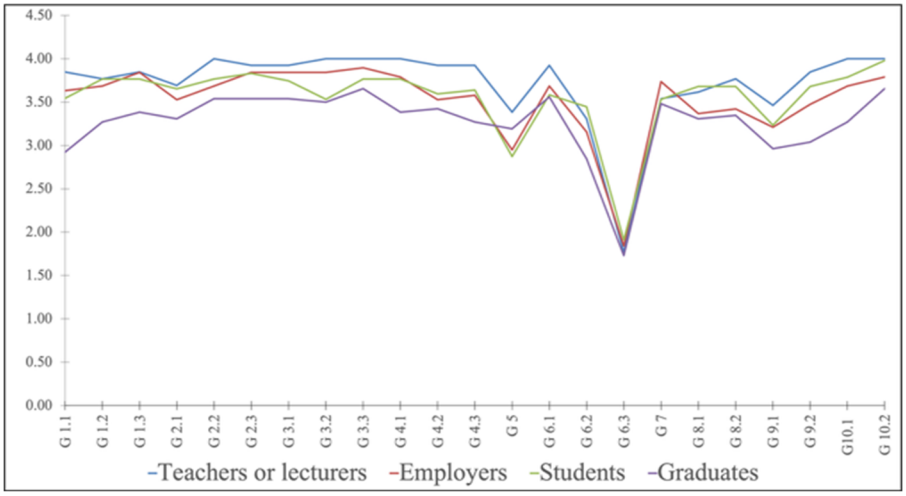

Figure 2. Average Stakeholder Response Scores for Generic Skills

After ranking the skills, the six main generic skills are:

- G 2.2: Ability to apply knowledge in practical situations.
- G 3.3: Work in an interdisciplinary team.
- G 4.1: Ability to learn new knowledge and acquire new skills.
- G 10.2 Commitment to safety procedures at work.
- G 2.3: Ability to plan and manage time.
- G 3.1: Being organized.

4.2 Specifics Skills

The results indicate that all four consulted groups agreed by assigning a score of 3 or higher across eleven skills, as presented in Figure 3. This indicates that approximately 50% of the specified competencies were validated by the responders.

The correlation matrix revealed consistently high correlation coefficient (r) values, all exceeding 0.73. The findings indicate a strong agreement among the four groups concerning the perceived significance of the 20 skills.

However, the level of compatibility was comparatively lower between professionals and laureates, whereas a strong alignment was observed between professionals and students.

After ranking the skills, the nine main specific skills are as follows:

- S 4: Mastering the technologies of food processing.
- S 2.1: Mastering food chemistry.
- S 2.3: Mastering unit operations of food engineering.
- S 3.1: Mastering Quality Management.
- S 3.2: Mastering quality control.
- S 3.3: Knowledge of food legislation and regulations.
- S 2.2: Mastering food microbiology.
- S 1.3: Mastering data analysis and presentation: Informatics tools.
- S 7.1: Mastering production management basics.

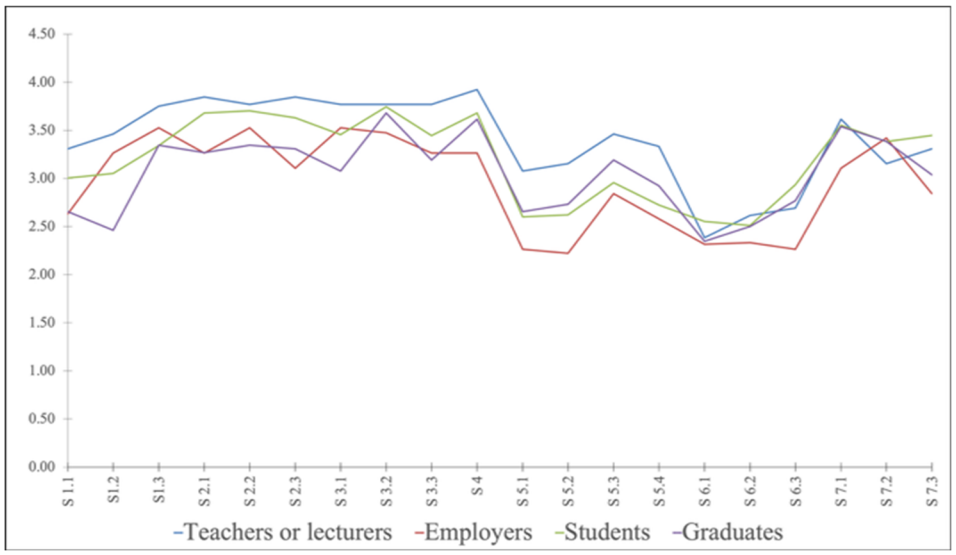

Figure 3. Average Stakeholder Response Scores for Specific Skills

5. Conclusion

According to the consensus reached by the four consulted groups, the aforementioned generic skills hold significant importance. These skills include the ability to apply knowledge in practical situations, work in an interdisciplinary team, plan and manage time, be organized, and be committed to safety procedures at work.

Nevertheless, it was found that the following generic skills were not as significant: the ability to communicate in a foreign language (Spanish and English), communicate orally and in writing in the language of the region, and act ethically. The last-mentioned skill is regarded as a crucial interpersonal ability in the realm of work. This outcome can be explained by the non-inclusion of these skills in the curricula of our higher education institutions and vocational training centers.

To understand what professional ethics is, it is important to first know the meaning of the word “ethics”. According to Shapira (2016), “Ethics is a concept with multiple meanings. Some scholars treat ethics as synonymous withmorality.1For them, ethics, like morality, means the moral rules that govern individual behavior and determine what is right and wrong and what the moral duties of individuals are.2 Others believe that morality and ethics differ from each other for various reasons. 3 They understand ethics as the discipline or study of morality. Ethics according to this view is the philosophy of morality that deals with the big questions of human life: what is justice? What is fairness? What is right and wrong? What rights does a person have? A third approach sees ethics as a type of particular morality. Ethics as particular morality refers to specific standards of behavior that apply to members of a particular group because of their belonging to the group.”

Additionally, Shapira notes “Professional ethics refers to the moral aspects of performing a professional role, that is, to the evaluation of professional conduct as morally appropriate or inappropriate. For example, a professional is morally bound to keep in confidence his or her clients’ personal information when the information has been obtained in the course of practice”.

Therefore, professional ethics is a regulatory system that establishes the principles, missions, and values of a profession. Ethical guidelines applicable to different professional fields specify the guidelines for each employee regarding the activity performed. This is essential for maintaining trust and ensuring the quality of services in each professional field.

Although this concept of professional ethics has a unique nature, the question arises as to what is the most effective pedagogical method to use in initial and continuing training. Jutras (2013) addressed the aspect of evaluating the effectiveness of types of training in professional ethics by stating “Many authors recommend case studies for training in professional ethics and several highlight it based on their classroom experience. Van Hooft (2001), for example, argues that a dialogical approach to case studies provides better learning than the presentation of ethical theories and principles to guide conduct. However, we have identified four studies that have examined the effectiveness of

teaching strategies in this field. Self, Wolinsky, and Baldwin (1989) conducted a three-group study with pre- and post-test measurements of moral reasoning. One group received lecture-based instruction; another, in addition to lecture-based instruction, completed case studies in small groups; and the third had to complete only case studies. The results show that greater effectiveness is achieved by the case method. Cowton and Cummins (2003) conducted a survey of undergraduate and graduate students to determine their satisfaction with the type of training received: a complete ethics course or just one module in a more general course. The results reveal that students are satisfied with both methods, but that a significant difference stems from the authenticity and relevance of the cases studied, as well as the qualifications of the instructors. For his part, Atjonen (2005) conducted a quasi-experimental study to verify the effectiveness of a classroom course and its online version. The materials and methods of both types of course were appreciated by the students, but the analysis of the quality of the discussions shows that it was more sustained in class than in the discussion forum attached to the distance learning formula." He further adds "Moreover, the cases presented always involve ethical issues, because the students are attending an ethics course. If we return to the conception of professional training at university, professional ethics training generally shows that the reality of the professional is multidimensional. It is therefore important that ethical considerations are taken into account in the activities of professional training programs, particularly in the context of projects and internships. We thus return to the need for transversality of ethics training in all professional training."

Based on the results of the survey, which indicate that ethics were ranked as one of the least essential and weakest skills, it can be inferred that the respondents may lack a comprehensive comprehension of ethical principles in a professional setting. The significance of ethics in a professional setting is widely acknowledged, however, there exists a tendency among employees to undervalue its importance. It can be interpreted that their comprehension of ethics and its influence on their vocational pursuits may be incomplete. Thus, it is suggested that comprehensive instruction and elucidation on ethics should be incorporated into training programs.

Furthermore, the survey outcomes regarding the generic skills inventory confirmed the validity of our initial list. On top of that the examination of these outcomes indicates showcase an agreement among the various participants.

A study conducted by Robles (2012) identifies and analyzes the soft skills most sought after by companies, "Executives overwhelmingly indicated that integrity and communication were the top two soft skills needed by employees in today's workplace. All 57 (100%) of the executives indicated that integrity and communication were very important or extremely important. Over three fourths of the respondents (84.2%) indicated that courtesy was an extremely important skill, and over half (71.9% and 61.4%, respectively) reported that responsibility and interpersonal skills were extremely important."

Robles (2012) further states, "This study identified the top 10 soft skills as perceived the most important by business executives: integrity, communication, courtesy, responsibility, social skills, positive attitude, professionalism, flexibility, teamwork, and work ethic.", "Even though all of the soft skills appear very important, not all are perceived by business executives to be equally important. This study found that communication, integrity, and courtesy are the most important interpersonal skills for success."

These results corroborate the results obtained in our study.

Mastering the technologies of food processing, mastering food chemistry and food microbiology, mastering unit operations of food engineering, mastering quality control and management, knowing food legislation and regulations, and mastering production management basics were all deemed as specific, essential skills, necessary for achieving mastery in the field of food production by the four primary stakeholder groups.

Among the studies that focuses on the importance of technical skills in the agri-food industry, is that of Brennan and Keating (2009) which addresses the management of processes, the maintenance of equipment and the mastery of food safety standards and their importance in ensuring the efficiency and quality of production in the agri-food industry.

Moss and McCauley (2014), discuss the importance of technical skills related to quality control, sensory analysis and food safety standards. They state «Few practical approaches will be understood in the form of hazard and its management, importance of safe foods, hygiene and sanitation in food service establishments, food safety management tools like GHPs, GMPs, SSOPs, HACCP, ISO series, TQM, kaizen, risk analysis, accreditation and auditing. Recent concerns related to food laws and standards, recent controversial issues such as food recalls, food frauds and food labelling will also be discussed in the same. Since a collective approach of all these concepts is needed to maintain the quality and safety of the food in a food handling premises, these parameters should be understood in order to acquaint a person dealing with food in professional manner with all the essential food quality

parameters, control systems, food standards, regulations, specifications and to develop an understanding and methodology of instrumental techniques in food analysis used for objective methods of food quality parameters.

Other studies focus on technical skills related to the management of digital technologies. For example, Konfo et al. (2023) support the view that the use of digital technologies in agri-food processing is becoming increasingly important as the industry faces the challenges of increasing demand, resource constraints, and sustainability concerns. The adoption of digital technologies can help to improve efficiency, productivity, and sustainability while also improving food safety and quality (Bahn et al., 2021). For example, IoT sensors are becoming more affordable and accessible, and they can be used to collect real-time data on soil conditions, crop growth, and environmental factors (Muangprathub et al., 2019). As the use of IoT sensors becomes more widespread, farmers and food processors will be able to make more informed decisions about planting, harvesting, and processing, resulting in increased efficiency and reduced waste (Alladi et al., 2020). Also, AI and machine learning can help farmers and food processors make more accurate predictions about crop yields, optimize processing parameters, and detect food safety issues more quickly (Kler et al., 2022). As these technologies become more sophisticated, they will be able to identify patterns and trends that are not visible to the human eye, resulting in improved efficiency and productivity (Baduge et al., 2022). Moreover, blockchain technology can help improve transparency and traceability in the food supply chain, which is becoming increasingly important to consumers. As the cost of implementing blockchain technology decreases, it is likely that more companies will adopt this technology to enhance their supply chain management (Madumidha et al., 2019; Centobelli et al., 2022)

After accreditation of the agri-food sector, this competency framework can then be adopted by other universities at the national and international level in order to identify existing gaps in their current training programs. This initiative could be of particular interest to countries whose training programs have been exploited, such as the United States, Germany, France and Russia. This study may also be of interest to countries with an organization of the agri-food sector similar to that of Morocco, such as Tunisia, Egypt, Algeria and Turkey.

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Authors contributions

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No additional data are available.