



Career path of food science and technology professionals: Entry to the world of work

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The entrance in the job market of Food Science and Technology (FST) professionals was examined by a web-based survey conducted in Europe. The results highlight aspects that involve both the higher education and extracurricular qualifications and underline the different needs that education and training must fulfil. The field of higher education degree and gender affected the level of responsibility and the type of activity. FST professionals cover a wide range of tasks which require expertise that cannot be covered entirely by a single degree but these professionals show that are eager to expand their knowledge and skills.

Introduction

The European food and drink (F&D) industry is the largest manufacturing sector in the EU, with a share in turnover of 14.9%. Food and drink enterprises in the EU amount to 287 thousand; they employ 4.25 million people, making the F&D industry the leading employer in the EU manufacturing sector with a share of 15%. The sector is dominated by small- and medium-size companies: their share is 63.4% in F&D industrial employment and 49.3% in turnover of the F&D industry ([FoodDrinkEurope, 2012](#)). Considerable differences in the size of food sector between countries can be evidenced. The countries with the largest employment are Germany, France, Spain, Italy, and Poland with 60% of the EU share ([FoodDrinkEurope, 2012](#)). It should be pinpointed that F&D enterprises have suffered relatively less than enterprises of other economic sectors and contributed to the economy's employment under the present adverse economic conditions. This can be mainly attributed to the fact that a large part of the family budget (~13% in average between EU countries) is consumed in food products and, since they cover basic human needs, that proportion cannot be compressed further significantly ([Mattas & Tsakiridou, 2010](#)).

Although, the European F&D industry is a competitive industry compared to other developed countries, it is losing competitiveness against emerging economies ([Jassi et al. 2013](#)). It is in the lower part of the innovation performance ranking, and is losing relative importance in the global food market. On the other hand, in the next few years it is expected that global food production will have to double due to increase of population ([Feigl, 2011](#)). Along with the growing demand, there is also an increasing requirement for safe, easy to prepare and higher nutritional value products

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(Azabagaoglu & Oraman, 2011). Therefore, there is a challenge for the European F&D industry to re-establish its importance in the world market and invest in innovation in order to produce high quality processed foods, which of course requires more skilled and better trained personnel.

Qualified, knowledge/science-based and appropriately motivated employees may play an important role in improving the status of the European F&D industry. The complexity of food processing is continuously increasing, and the knowledge of many scientific disciplines (e.g. nutrition, safety, environmental studies) is required by the future food scientists and engineers (Dumoulin, 2012). Academic degrees related to food science and technology/engineering present a high diversity in different countries, and also in different universities within the same country, considering sector-specific disciplines and learning outcomes (www.iseki-food.net/curricula/info) due to the different origin and aims of the higher education degrees of this scientific area in Europe. This diversified acquisition of knowledge and competencies reflects the different needs of the national and regional job markets, which are affecting the performances of the graduated as a professional in the F&D industry and in the food sector more in general.

Skills of food professionals must be adequate to support the response of F&D industry to the current challenges. The soft skills (such as personal management skills or team-working and communication skills) and food sector specific skills required by the FST employers were gathered and analysed (Flynn, Wahnström, Popa, Ruiz-Bejarano, & Quintas, 2013). Although the top food sector specific skills were similar, interesting differences were observed among different food employment areas, level of responsibility and geographical region. To identify the improvements in education and training of graduates and professionals that can and must be done to meet the job market expectations, it is useful to map the current state of the employees entering to work market in the food sector, by characterizing their qualifications and job functions, tracing their changes in their career paths, and evidencing the actual differences among European countries.

The objective of the present study was, thus, to depict the state of the initial placement in work of the FSTs of different European countries, by considering more specifically the area of employment, the sector and the type of activity. Furthermore, focus was placed on the identification of the qualifications of the FSTs related to food sector specific skills, and how they affect their placement in work. All the information was achieved by a questionnaire-based survey undertaken in 14 EU Member States and Turkey.

To our knowledge, no similar study, at European level, has been previously performed or published.

Methodology

A web-based questionnaire was prepared and disseminated within 15 EU countries in collaboration with the partners of the TRACK-FAST project (www.track-fast.eu

partners). The survey was carried out partly in 2011 and partly in 2012. The questionnaire was addressed to any professional in the food sector.

Questionnaire structure

The questionnaire was of a 'check-box' design to enable respondents to answer questions by simply checking against statements with which they agreed with. It was composed of four main parts, each comprising a series of questions to achieve the following information:

- 1st: motivation system and self-image of respondents.
- 2nd: actual career paths of respondents, including the characteristic features of their different (consecutive) workplaces (if the respondent worked in more than one), the most important features of their job, qualifications at the entering in the labour market, and qualifications obtained during the different steps of the professional career at different workplaces. In this way it was possible to follow up the career, and the changes of workplaces of respondents, as well as the motivations of change of different workplaces.
- 3rd: working conditions by the food professionals.
- 4th: basic sociological characteristics of respondents.

This paper discusses the results of the second part of the survey and in particular those concerning the entrance to the labour market of the FST professionals, i.e. the first workplace.

Survey procedure

The questionnaire was initially written in English and then translated into different languages, i.e.: French, German, Greek, Hungarian, Italian, Lithuanian, Portuguese, Romanian, Slovenian, Spanish, Swedish and Turkish. It was distributed by using the SurveyMonkey[®] web-based survey tool. The invitation to fill in the web-based questionnaire was distributed through the TRACK_FAST partners to individuals, professional associations and food industry by email or using innovative web based tools including social and professional networks (Facebook, LinkedIn) in the period of February–April 2011. The questionnaire was disseminated in particular in the following countries; Austria, Belgium, England, France, Germany, Greece, Hungary, Italy, Lithuania, Portugal, Romania, Slovenia, Spain, Sweden and Turkey. A second call of the survey was open in April–May 2012.

Statistical analysis of results

Results of the survey were analysed by different subroutines of SPSS software. To obtain a general overview the standard descriptive statistics (e.g. frequency tables, average), analysis of variance (one way analysis with Bonferroni test, SD = 5%) and multivariable methods have been used. Duncan's multiple range test was used to define statistically significant differences at $p < 0.05$.

Profile of the respondents

At the end of the survey, 3007 questionnaires resulted filled in, partially or completely, with the number of responses listed in Table 1. In the evaluation and analysis of the results it was taken into account that not all respondents that started the survey provided all the data as was supposed to. In some cases not all questions were answered including information on country, gender, and/or age. Therefore, the analysis of data was occasionally based on the number of respondents that have answered the specific question, which is presented in the relevant table or figure.

Furthermore, the number of respondents per country presented large variations. The number of answers was higher in countries with regulated professions (Italy and Turkey) and in Spain, where also the collaboration in the dissemination of the survey through professional bodies and social networks was very effective. The number of answers from Greece, Hungary, Lithuania, Portugal, Slovenia, and Sweden can be considered satisfactory, taking into account the population of these countries and the number of employees in the food industry as a percentage of population (0.5–1.2% according to FoodDrinkEurope (2011)). Therefore, the survey allows an insight of the European food professionals, even if some countries with a large food industry (e.g. Germany, France and UK) are not significantly represented as shown by the low ratio of the no answer/no employees (Table 1).

The majority of the respondents of the survey are women. The gender (female/male) ratio in the survey is 1.49 (60% female respondents) that is higher than that in the European Union (1.05), the active-age population (1.15) (Eurostat 2010), and also higher than the reported

by Jassi et al. (2013) for the European F&D industry (43%). Taking into account the EU employment status (that includes people from 15 years and up to 75) in terms of age, the younger generations are over-represented as 75% of the sample is under 40 years and 30% of the respondents are under 30 years. This can be explained by the fact that the computer-literacy is higher among the younger generations of professionals, and they are more open to respond to the questions of such type survey; additionally, the elder generation of food professionals could have limited time or be less attracted to respond to the questionnaires due to their likely more demanding job positions. However, due to the age profile of respondents, most of the information is from the last 10 years and reveals the current status in education and entrance in work.

Area of employment of FSTs, sector and type of activity and the effect of gender

The majority of the respondents (56%) stated that F&D industries and related business activities (retail, consultancy), was/is the area of their first employment. Similar values were reported by the Institute of Food Technologists for its members in USA (IFT, 2011). A high percentage (17%) started the work career in research and education institutions and in other areas, 18% in food service and food distribution and 9% in governmental agencies. The relatively high percentage of respondents starting career in research and education institutions might be attributed to the dissemination approach applied within this survey that was probably more effective to reach employees in this sector than others.

A differentiating factor at the 1st workplace area is the gender, although differences were not impressive. More specifically, the share of female respondents within those working in governmental bodies was 68%, and 64% within those working in education and research, slightly higher compared to the share of female respondents in the survey (60%). On the contrary, male respondents had a higher share in the food industry (46%). Several could be the reasons that affect these results, some of them related to the role of women in the society and the much more family-friendly work conditions related to the public bodies and research-related jobs. On the other side it should be recognised that food companies may prefer to hire male personnel, especially when positions are available in the processing area as their specific technical abilities and physical resistance in handling technical difficulties is more acknowledged. This argument may be further supported by the observations of Cartwright, Edwards, and Wang (2011), who reported gender segregation by area and sector of employment. According to their data, female employees prevail in service-providing industries (54.5% of total employees in the area), while male employees in goods-producing industries (72.7% of total employees in the area). Although their data regard all industry categories of the North American Industrial Classification System

Country	n. respondents that ended the survey	%	Number of respondents/10 ⁵ employees in the food industry ^a
Austria	14	0.5	24
Belgium	40	1.3	45
France	149	5.0	31
Germany	42	1.4	8
Greece	147	4.9	213
Hungary	212	7.0	220
Italy	610	20.3	149
Lithuania	79	2.6	179
Portugal	309	10.3	283
Romania	111	3.7	63
Slovenia	98	3.3	737
Spain	410	13.6	89
Sweden	106	3.5	198
United Kingdom	69	2.3	18
Turkey	477	15.9	416 ^b
unidentified	134	4.4	
TOTAL	3007	100	

^a 2009 data (FoodDrinkEurope, 2011).
^b Gumus, Gunden, and Miran (2005).

(NAICS), i.e. service-providing industries include health care, educational services, and retail trade, while goods-producing industries include construction, mining, and manufacturing, they are indicative of differences in employment related to gender, especially in the goods-producing industries, at which F&D industry belongs to.

Independently on the area, 33% of the respondents began their work in large-scale institutions/companies (more than 250 employees), while 67% of them in small-medium scale ones, being the latter data in agreement with the employment figures reported for European SMEs of 62.8% (FoodDrinkEurope, 2011). More specifically, our results indicate that 31% started work in enterprises with less than 25 employees, 23% in enterprises with 26–100 employees, and 13% in enterprises with 101–250 employees.

In Table 2 the position/role of the respondents at the 1st workplace (expressed as percentage of respondents) is reported. The differences between genders are also presented based on normalised percentages among male and female populations. It could be noticed that, as expected, the majority of the respondents covered subordinate position within a team (under the leadership of another person). Taking into account gender differences, a significantly higher percentage of male respondents having a role as leaders of a company or a group was observed, while female respondents mainly worked under the leadership of others. Male FST professionals are also prevalent in the 1st work position as independent entrepreneurs. Jassi et al. (2013) reports that women are under-represented in managerial and technical level roles.

The distribution of respondents as related to sector and type of activity is presented in Table 3, together with the normalized share of male and female respondents. Each respondent of the questionnaire for this question could select the type of activity irrespective of the sector of

activity. Thus, in Table 3 the data of both sector and type in parallel rows was made for an easier comparison. The first position in the ranking of the sectors in the first workplace is taken by the “Research and development” (ca. 28%) followed by “Quality control” and “Production”. These figures indicate that, in addition to “Research and Education” workplaces that represent around 17% of the answers, a significant number of respondents work as researchers in the R&D departments at the industry. According to Wolff and Reinthaler (2008), researchers in the population increased in almost all countries during 1981–2002, while the European initiative called “More Research for Europe”, which was agreed at the Barcelona summit in 2002, might have further contributed to this increase in Europe. Also, Wolff and Reinthaler (2008) observed a stronger increase of R&D expenditure relative to employment that can be interpreted as an increase in wages of researchers. An increase in wages in turn increases the attractiveness of this profession thereby attracting more young FSTs.

Similarly to the ranking of sectors, around 24% of the respondents claim to have worked as “Researcher”, while 8% in “development” activities (“Product and packaging developers” or “Development engineers”). A high percentage (20%) of respondents started their work career as “Quality managers/Quality control engineers”, as well as “Food technologist/engineers” (21%). The activity of “Food technologists/engineers” can of course be accomplished in various sectors, including “Production”, “Quality control”, “Technical/commercial”, etc. Very few respondents (7%) stated as starting activity “Production managers”, but this is an expected result as this requires additional skills and expertise not easy to be found in graduates at the 1st workplace. The remaining ones that had their first work experience in “Production” (19%) might consider “Food technology/engineering” or other as their type of activity.

As regards the share of male and female respondents in each sector or type of activity, results evidence that a higher percentage of male respondents either had a first workplace in “Production” or worked as “Production managers”. Also, male respondents stated more frequently than female the activity as “Development engineers”. A predominance of male personnel is, additionally, observed in “Environment/safety”, and in “Logistics/distribution” sectors, although the total responses in the latter are few to obtain reliable results. Female respondents prevailed mainly in the “Quality control” sector, and stated activities as “Product & packaging developer”, “Quality manager/Quality control engineer”, “Project manager”. Also they had a significant higher share in “Laboratory manager/technician”.

Qualifications of FST professionals when entering the first job

Although this survey was not stratified, it provides a useful insight into the “school-to-work” transfer, the food

Table 2. Distribution (% of the total of the respondents) of the position/role in the 1st workplace: effect of gender (n = 1754).

Role	% of total	Normalized % of respondents	
		Male	Female
In charge of leading the company	12.2 ^b	65.3	34.7
In charge of leading a group	24.9 ^c	54.9	45.1
Responsible for a scope of activities under the direction of others	44.6 ^d	41.9	58.1
Administrative work	3.4 ^a	46.5	53.5
Advisor helping the company (consultant, specialist)	10.8 ^b	49.1	50.9
Independent entrepreneur	4.1 ^a	62.1	37.9

*Different letters in column (% of total) indicate values are significantly different at $p < 0.05$ (Duncan's multiple range test).

Sector of activity	(% of total respondents n = 1797	Normalized % of respondents		Type of activity	(% of total respondents n = 1627	Normalized % of respondents	
		M	F			M	F
Research and development	28.1	49.1	50.9	Researcher/research assistant	24.4	50.4	49.6
Quality control	26.1	37.2	62.8	Product & packaging developer	4.2	19.5	80.5
Production	19.1	70.1	29.9	Development engineer	3.7	65.0	35.0
Consumer/marketing studies	3.0	51.7	48.3	Quality manager/Quality control engineer	20.1	42.3	57.7
Technical/commercial	3.5	44.8	52.2	Production manager	7.3	69.9	30.8
Environment/safety	2.9	62.3	37.7	Food technologist/engineer	21.3	52.2	47.8
Financial/administrative	3.1	51.4	48.6	Project manager	5.2	47.0	53.0
Logistics/distribution	1.6	86.8	13.2	Laboratory manager/technician	3.9	41.5	58.5
Legal/legislative	1.8	50.9	49.1	Statistician	1.7	52.5	47.8
Other	10.8	42.9	57.1	Inspector/Auditor	2.9	46.8	53.2
				Other	5.3	61.7	38.3

professionals' qualifications and how they influence their first placement in the labour market. Roughly, up to 35% of the respondents do not have a higher education qualification when entering the first workplace and/or didn't answer to this question. Gender did not affect this result.

Among the other 65% that had a higher education degree (Bachelor, Master or PhD), the highest qualification per respondent are the bachelor (29%) and master (28%) degrees, while an 8% of the respondents had PhD degree. These results indicate that the majority of FSTs with a higher education degree had a second or third cycle degree before entering their first job. Even if official data about the employability of MSc graduates and especially PhD degree holders in industry (and in particular in the F&D industry) are not yet available, the authors recognize that this figure is quite high. This result could be rather associated with the relatively high number of respondents that claimed to work in research and educational institutes (17% of total). More than 20% of respondents have carried out at least one extracurricular activity (internships, courses) before entering work.

Food Science and Technology (including Food Engineering) is the preferential degree title among those that

enter in the work market with a 1st level (or BSc) degree (57%), followed by those in "food-related" sciences (e.g. Agriculture, Safety/Hygiene, Chemistry, Nutrition, 27%); the remaining respondents have a BSc degree in disciplines more related to Economics and Management (data not shown). Similar results have been obtained from the respondents having an MSc degree before entering the 1st workplace, with 57% out of them on Food Science and Technology, and 21% in food related sciences. As regards the PhD degree, half of the respondents achieved a 3rd cycle degree in Food Science and Technology. As only 21.3% of the respondents stated to be employed as "Food technologists/engineers" (Table 3), a percentage lower than that of respondents with a specific qualification in the Food Science and Technology/Engineering, this means that the Food Science and Technology/Engineering degree allows to have/cover roles other than those specifically referred to a "Food technologist/engineer" and/or the respondents identify their selves as employed in a different role.

Interesting differences can be noted when the initial higher education qualifications of the respondents are evaluated by country (Table 4). The qualification in the Food Science

Table 4. The higher education qualification of respondents (BSc, MSc and PhD) before entering their 1st workplace: distribution by country (%) – 12 most represented countries shown.

	Belgium	France	Greece	Hungary	Italy	Lithuania	Portugal	Romania	Slovenia	Spain	Sweden	Turkey
Agriculture	17.1	15.3	7.7	12.5	5.9	5.6	5.4	15.4	7.8	38.9	15.4	3.7
Chemistry	11.4	2.1	24.9	4.2	0.9	11.1	4.8	8.7	3.9	3.8	26.2	0.7
Chemical Engineering	11.4	4.7	16.6	3.1	2.2	11.1	1.6	7.4	11.8	3.0	9.2	2.2
Economic Science	8.6	1.1	2.4	15.6	0.9	5.6	1.1	3.4	2.0	1.5	0.0	2.7
Environmental Engineering	2.9	1.1	3.0	0.0	0.4	0.0	1.6	2.0	0.0	0.9	3.1	0.3
Food Science and Technology/Engineering	22.9	34.7	27.2	39.6	72.5	50.0	46.5	31.5	47.1	21.8	21.5	51.8
Nutrition and Health	0.0	10.5	0.6	2.1	3.7	0.0	8.0	4.0	5.9	8.6	7.7	6.8
Safety/Hygiene	2.9	5.8	3.0	1.0	3.9	0.0	5.9	7.4	5.9	6.2	3.1	10.4
Management	5.7	4.2	5.3	4.2	2.6	5.6	3.2	7.4	2.0	6.5	0.0	5.7
Marketing Science/Consumer Behaviour	2.9	5.3	0.0	8.3	1.1	5.6	2.1	4.0	2.0	1.8	0.0	2.7
Sensory Science	5.7	7.9	3.6	1.0	2.4	0.0	1.1	3.4	5.9	0.6	0.0	7.0
Other	8.6	7.4	5.9	8.3	3.5	5.6	18.7	5.4	5.9	6.5	13.9	6.0

and Technology/Engineering area dominates in some countries like Italy and Turkey -where the professions of Food Technologist and Food Engineer, respectively, are regulated by national laws that specifically requires the respective degree to be able to be enrolled in the specific profession and to practice some professional acts (Costa, Možina, & Pittia, 2014) – and is relevant in some others (Lithuania, Portugal, Slovenia, Germany, France and Hungary) where Food Science and Technology academic programmes have a long history. On the contrary, very low percentages of respondents with Food Science and Technology/Engineering qualification have been evidenced in Sweden, Spain, Greece and Belgium, where other higher education qualifications dominate (i.e. Chemistry, Agriculture and Chemical Engineering). This result reflects the different origin of the higher education degrees of the FST professionals across different EU countries. For example, in Spain, Food Science and Technology/Engineering is a relatively young degree (around 25 years). Before, Food Science and Technology/Engineering was (and still is) a specialization of the Agronomic Engineering degree, and this explain why the qualification in Agriculture is the predominant one in Spain.

Data obtained from the questionnaire allowed to collect information also on the qualifications obtained during the

1st workplace and results highlight that 15% of the respondents achieved a higher education degree, and among them, 20% a BSc degree and the remaining 80% a MSc or a PhD ones. It is interesting to note that 7% of the respondents with a BSc degree and 7% of the respondents with a PhD degree at the 1st workplace reported the achievement of another BSc degree, likely in a different field/discipline to improve knowledge, technical, and professional skills to meet the skills requirements of the workplace. On the contrary, merely 1% of the respondents entering with an MSc degree achieved a second BSc degree during the 1st workplace (data not shown). Eventually, respondents with either a BSc or MSc degree studied to obtain MSc or PhD degree, respectively, as expected.

A better understanding of the trend of the distribution of the qualifications can be achieved through data reported in Fig. 1, where the qualifications (from both academia and extracurricular) before entering and during work at 1st workplace are presented. Food Science and Technology/Engineering is the prevailing field of higher education qualification (both at entrance and achieved while working), highlighting the importance of the specific technical knowledge and skills of this multidisciplinary university degree. Additionally, the basic scientific fields (e.g. Agriculture,

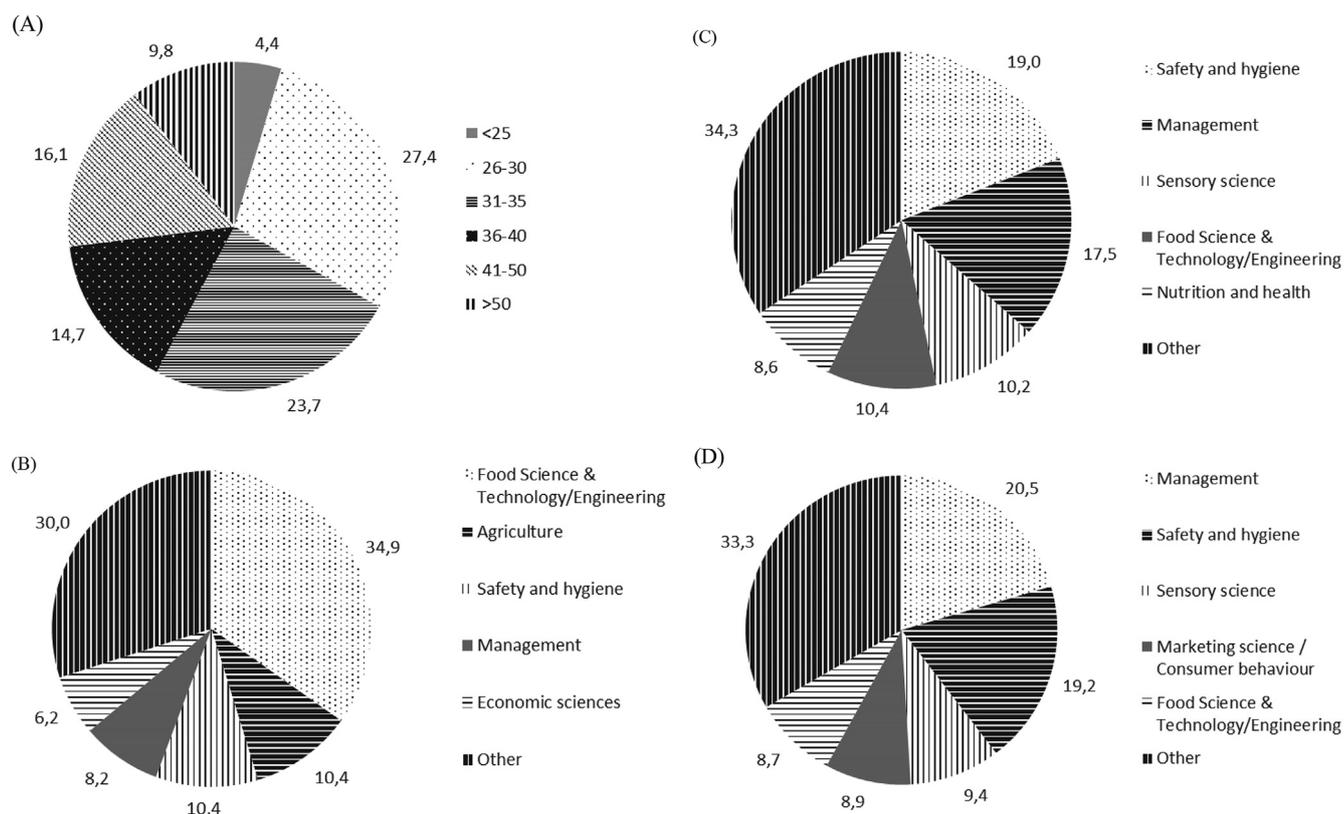


Fig. 1. Qualifications (higher education and extracurricular) before entering 1st workplace and during work at 1st workplace, expressed as % of total qualifications in higher education or extracurricular. **A:** Top 5 scientific fields of the higher education degrees (BSc, MSc, and PhD) obtained before entering the 1st job. **B:** Top 5 scientific fields of the higher education degrees (BSc, MSc, and PhD) obtained during 1st job. **C:** Top 5 scientific fields of the extracurricular activities (internships, courses) carried out before entering the 1st job. **D:** Top 5 scientific fields of the training activities (internal/company, other) carried out during 1st job.

Chemical Engineering) are in the first choice of higher education degrees before entering the 1st workplace, while other fields become also important during working, such as Safety/Hygiene, Management, Economic Sciences and other (Food production, Product design, Supply, Food policy, Food microbiology).

More than 15% of the respondents reported that during their first job they acquired a specific expertise by company/internal training, while 10% by other types of training (private training companies, organisations, professional associations). Company/internal training and other courses (seminars, continuous education programmes) seem a major tool of knowledge and expertise upgrade in specific disciplines/topics and, thus, is used for the improvement of qualification of the respondents. Jassi *et al.* (2013) refers that the F&D industry generally focus their approaches to training and workforce development on adhering to legislative and regulatory requirements as well as those of their key customers such as large retailers.

Safety/hygiene and Management (including Quality and safety) are the most important areas of the extracurricular activities both before entering and during the 1st workplace. Sensory Science and Food Science & Technology/Engineering follow with similar percentages. More specifically, during the 1st workplace the topics of company/internal training contain mostly Management and Safety/Hygiene; similarly, training in other organisations (external training) is focused mainly on Management, and Safety/Hygiene, while Food Science & Technology/Engineering and Nutrition follow. These results highlight the importance given by both the professionals and the employers to these specific technical skills that are not fully accomplished during the higher education but recognised as determinant in the roles covered by the respondents as well as for their career progress.

The recent study of Flynn *et al.* (2013), focused on the ideal and actual skills of food scientist and technologists, showed that employers indicated “Food Safety Management, Food Hygiene & Food Safety Control”, “Quality Management, Quality Assurance & Quality Control”, and “Food Legislation & Control” among the top three most desired food-sector skills, with differences depending on different employment areas and geographical regions of Europe. Our results are thus, in agreement with those presented by Flynn *et al.* (2013) as they highlight that these are the qualifications most likely to be acquired by the FSTs before (as a preferential requisite) or after entering their first job. In the same study, Flynn *et al.* (2013) report that “Quality Management, Quality Assurance & Quality Control” was identified in top three most desired skills for employees at the lowest level of responsibility, which is the level occupied by the majority of the respondents in their 1st workplace as indicated in Table 2. Quality control was indicated as the second most important sector of activity of the FSTs in the present survey (Table 3), justifying thus the relevant qualification required by the employers. It is interesting

also to note that in the study of Flynn *et al.* (2013) “Product Development” was placed in the top position independently of the employment area and geographical region. “Product Development” is one of the main goals, especially in R&D departments of the industry but also in research institutes, and university institutions; therefore, it is well explained why this skill is required by all employers. As aforementioned, R&D ranked first in the sectors occupied in the 1st workplace (Table 3). This further supports the fact that young FSTs should be highly qualified to contribute to research, innovation and product development, and Higher Education will have, thus, to adapt programmes to meet this work market skills need.

An analysis of the relationship between the field of higher education qualifications (BSc, MSc, PhD) at the entry and while working at the 1st workplace was also attempted (data not shown). In some of the cases (e.g. Agriculture, Chemical Engineering, Economic Science, Food Science and Technology/Engineering), the second qualification, achieved at the 1st workplace, is in the same field as the first one. The Food Science and Technology/Engineering qualification is then the second one in the ranking, being selected likely to supplement the technical, missing skills of the specific field of activity. The employees having at the entry of 1st workplace a qualification in Food Science and Technology/Engineering achieve further qualifications in Management as well as in Nutrition, Safety/Hygiene and other food related disciplines that may be of interest for both to undertake a more specialised career and to supplement missed technical knowledge. The respondents having a qualification in the Economic Science prefer, on the other side, to achieve higher education qualification strictly related to the initial degree (Marketing) or to their role and activity (e.g. Environmental Engineering). The respondents having a qualification in one of the other disciplines before the 1st workplace choose mainly a second degree in Food Science and Technology/Engineering and related areas, followed by Management and Marketing.

In Table 5 the results of the level of responsibility at the 1st workplace of FSTs (expressed as % for each higher education scientific field) are reported. As expected, the majority of the respondents covered low responsibility positions, irrespective of the field of qualification. However, it can be noticed that respondents with food-related degrees (Food Science and Technology/Engineering, Nutrition, Safety/Hygiene, Sensory Science), and those with Economics and Marketing degrees, have a higher tendency to be employed as leaders in a company or of a group, in comparison with respondents with more general scientific degrees (Agriculture, Chemistry etc.). The role of advisor consultant or independent entrepreneur was stated by a very low percentage of the respondents, as well as the role of administrative personnel.

Analysing the level of responsibility with the size of the company it was found that almost 75% of the respondents

Table 5. Role of the food professional at the first workplace as a function of the higher education scientific field (data in %, n = 1754).

Higher education qualification scientific field	In charge or leading the company	In charge or leading a group (head of department)	Responsible for a scope of activities under the direction of others	Administrative work	Advisor consultant/ Independent entrepreneur	Total
Agriculture	13.9	21.6	46.6	3.7	14.2	100
Chemical Engineering	10.3	22.8	50.7	4.4	11.8	100
Chemistry	12.5	25.9	53.6	0.0	8.0	100
Economic Sciences	21.4	28.6	41.1	1.8	7.1	100
Environmental Engineering	17.6	23.5	35.3	20.6	2.9	100
Food Science & Technology/ Engineering	17.6	26.0	40.1	3.2	13.1	100
Management	16.4	30.2	38.8	0.9	13.8	100
Marketing Science/ Consumer Behaviour	24.6	29.8	35.1	5.3	5.3	100
Nutrition and Health	18.8	17.4	47.0	2.0	14.8	100
Safety/Hygiene	23.4	25.1	37.1	0.6	13.8	100
Sensory Science	23.8	26.7	39.6	5.0	5.0	100
Other	10.6	21.9	48.8	5.0	13.8	100

that stated of being in charge or leading a company are employed in SMEs and in particular 60% in companies with less than 100 employees. On the contrary, in companies with more than 250 employees, almost 60% of FSTs are responsible for a scope of activities under the direction of others. It is interesting also to note that large companies also have a higher tendency to hire FSTs for administrative tasks, compared to SMEs, as almost 60% of the respondents stating administrative work are employed in large companies.

Trying to correlate the level of responsibility with the degree of higher education studies (BSc, MSc, or PhD) it was interesting to note that 23% of all respondents with a BSc degree were employed in positions with the highest level of responsibility (in charge or leading the company), compared to 8% of those with an MSc degree and 16%

with a PhD degree. This result might be associated with those of the respondents having a PhD or MSc degree that during their 1st job worked as researchers under the leadership of others or leading a group. In charge or leading a group stated the 23%, 28%, and 24% of respondents with a BSc, MSc, and PhD degree, respectively, while 42%, 44%, and 39% stated the third level of responsibility (responsible for a scope of activities under the direction of others). Also, the percentages within the different scientific fields varied a lot. These results indicate that a higher degree of qualification is not correlated with a higher level of responsibility.

The relationship between the field of higher education qualification and the activity type of the respondents is presented in Table 6. Most of the respondents with a Food Science and Technology/Engineering or food related higher

Table 6. Effect of the scientific field of the higher education qualification on the activity type of the respondents at the 1st workplace (data in %, n = 1627).

Activity type	(% of total	Qualification (% of the respondents having the specific activity type)					
		Agriculture	Chem + Chem Eng	FS&T/E	Food related ^a	Economic	Management + Marketing
Research technician/ Researcher	10.3	15.5	20.4	10.3	4.5	9.6	3.8
Research assistant	14.1	14.1	10.7	13.9	15.4	11.5	14.0
Quality manager	10.6	4.6	10.7	10.0	12.2	15.4	15.3
Quality control engineer	9.5	6.7	8.9	10.0	12.0	5.8	12.1
Food technologist/Engineer	21.3	12.4	11.1	26.0	25.5	13.5	20.4
Production manager	7.3	6.0	4.9	7.6	9.0	1.9	5.7
Project manager/leader	5.2	7.1	7.6	3.0	4.8	25.0	9.6
Development engineer	3.7	4.6	8.0	2.6	2.7	3.8	3.8
Product & packaging developer	4.2	7.1	8.4	2.4	2.7	3.8	4.4
Laboratory manager/ technician	3.9	3.5	4.9	5.3	1.3	1.9	2.5
Other ^b	9.9	18.5	4.4	8.9	9.9	7.7	8.3
Total	100	100	100	100	100	100	100

^a Nutrition and Health, Safety/Hygiene, Sensory Science.
^b Biologist, Statistician, Inspector, Auditor, Other.

education degree during their studies are employed as “Food technologists/engineers”; “Research” activities and “Quality management” and “Quality control” activities is the second in the ranking. These data support our previous observation that Food Science and Technology/Engineering degree allows to have or cover also other roles and activities in the career. Respondents with higher education degrees in Agriculture, Chemistry and Chemical Engineering reported a more uniform distribution throughout different activities, with a higher percentage of the latter being employed in quality related activities or as “Development engineers”. The respondents with an Economics degree stated as a main activity the “Project manager/leader” but an unexpected high percentage reported “Research”, “Quality” or “Food technology/engineering” activities. The latter were, surprisingly, also the main activities stated by respondents with a degree in Management or Marketing and Consumer Behaviour.

It is expected that a rather low percentage of the total respondents is employed in development activities (“Product & packaging developer”, “Development engineer”) in the 1st workplace due to the low experience. It is interesting, however, to note that, among the different qualification areas, Chemistry and Chemical Engineering occupy the first place followed by Agriculture.

Taking into account the level of the qualification degree, Laboratory managers, Development engineers, Research technician/Researchers, Project managers/leaders and Laboratory technicians stated at a higher percentage (84%, 63%, 61%, 57% and 57%, respectively) the possession of a MSc or PhD degree, while the respondents occupied in the rest activities stated to have a post graduate degree (MSc or PhD) at a level lower than 50%.

Conclusions

This survey highlights aspects that involve both the higher education and extracurricular qualifications, and the first placement in work of the food professionals and underline the different needs that education and training must fulfil.

The majority of the respondents started working in the industry (ca. 56%) followed by research and education institutions (ca. 17%). The most popular sectors of activity were “Research and development” and “Quality control”. The Food Science and Technology/Engineering degree is the predominant higher education degree to enter into the job market; however also other scientific, food-related qualifications like Agriculture and Nutrition, or process related, as Chemical Engineering were considered suitable to cover positions in the F&D industry.

Differences were found between male and female respondents in the area, sector and type of activities as a higher share of male respondents found their first job in the F&D industry working mainly in the “Production” sector, and covering positions as “Production manager” and “Development engineer”. On the contrary, the majority

of the respondents working in governmental bodies and in education and research institutions were female. With regard to the sector and type of activity, female respondents prevailed mainly in the “Quality control” sector, and in the activities of “Product & packaging developer” and “Quality manager/Quality control engineer”. The gender also affects the level of responsibility, with a higher percentage of leaders of a company or a group being male, while female respondents mainly worked under the leadership of others. From these data it is confirmed that leadership is a skill found or attributed mainly to men probably due to sociological factors, and that is not being intentionally influenced by the specific field of education and training.

A considerable percentage of FSTs continue higher education studies (ca. 15%), or follow internal/company training (ca. 16%) or other courses or seminars (ca. 9%) while working in the 1st job. Food Science and Technology/Engineering still remains the first choice of higher education degrees but its percentage drops significantly (to 35% of all higher education qualifications) and other fields become also important such as Safety and hygiene, Management, Economic sciences and other (Food production, Product design, Supply, Food policy, Food microbiology). Management, and Safety and hygiene remain the main topics in the extracurricular training (amounting to approximately 20% each), while Sensory science, and Marketing science/Consumer behaviour follow (9% each). This indicates that FST professionals cover a wide range of tasks which require additional expertise that cannot be covered entirely by a single degree but also are eager to expand their knowledge and skills.

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