

Profile of currently employed European food scientists and technologists: Education, experience and skills

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Abstract

The food and drink (F&D) sector in Europe ranks low in innovation and the European F&D industry has been losing importance in the global market. The food professionals, i.e., food scientists and technologists (FSTs), may not be meeting the varied demands of the sector. Here, education, experience and skills of current FSTs were identified and compared geographic regions and employment areas. Between 2009 and 2012, 287 questionnaires representing over 4000 FSTs were collected from employers in 16 countries. Analyses showed that more than 80% of FSTs have a university degree; but only in *Industry* in the *Central* European region are most degrees in food science/technology. More than half of FSTs, and almost 60% in the *South*, have less than 10 years' experience. The most common FST job title is *Quality Manager*, but with several variations based on region and employment area. Among skills, the most common is *Communicating*; found in over 90% of FSTs in all regions and employment areas. *Food Safety* is the most common of the food sector-specific skills, present in more than 75% of FSTs, yet there are differences in food sector skills based on employment area. Overall, these data suggest similarities among currently employed food professionals throughout Europe; they are young and highly educated, but also differences, especially in their food sector-specific skills. An understanding of the current FST should contribute to the improvement of FST training and thus benefit the European food sector.

Keywords: Food Scientist; Food Technologist; Education; Training; Skills; Soft Skills

1 Introduction

The food and drink (F&D) sector is one of the most varied in terms of diversity of employment: industry of all sizes and specialities, research institutes, government regulatory agencies

and other, non-traditional enterprises, all employ professional food scientists and technologists (FSTs). The F&D industry, despite being the single largest manufacturing sector in the EU, has been in the lower part of the innovation performance ranking and has been losing relative

importance in the global food market. One of the reasons for the decline may be technological changes in F&D employment areas and a lack of corresponding training of FST professionals. Another could be the difficulty in forecasting skill needs for a rapidly changing sector which recently shifted from a product-centred industry to a customer-centred market. In either case, one of the first steps in providing industry and other F&D employers with the professionals they need is to identify the profile of the current employee. Efforts to identify the current FST have generally been undertaken on a national scale. In the UK, for example, a food manufacturing study divided FST skills into three broad categories (Personal Attributes, Basic and Generic Skills, Vocational Skills) and reported a severe shortage in Personal Attributes but gave no information on worker education or experience (Dench, Hillage, Reilly, & Kodz, 2000). This study considered less than 50 food industries. A later UK study on skills for agriculture and food looked at high level skills in different employment areas and reported shortages for “niche skills” including plant pathology and flavour science, yet “broader areas of expertise” such as informatics and science communication did not show shortages (Beddington, 2010). These authors pointed out the difficulties arising from the many gaps and lack of consistency within the UK data, they warned that problems could be masked and conclusions confused. An Irish study on food sector employees examined profiles only of those working for Industry; slightly more than half were reported to have no university degree, there was no breakdown of degree type and all FSTs were considered as having a “professional occupation” with no further enumeration of their skills (Expert Group on Future Skills Needs (EGFSN), 2008). These examples attest to the fragmentation of available data about the F&D sector employee and the difficulties even within a single country of comparing data from different national sources. Additionally, while levels of education and years of experience may be easily comparable, very different skill categories have been used making Europe-wide comparisons and conclusions even more difficult.

The terms “skill”, “knowledge” and “competence” have been individually defined by educa-

tional institutions and by the European Commission (European Commission, 2008) but their common use may overlap and a clear distinction is not easy, especially for the non-specialist. Thus, here, for simplicity, the term “skill” is used with the acceptance that it sometimes may be referring more to knowledge or to competency. Recent work on skill requirements for successful employment has pointed to the importance of soft skills; also called personal attributes, character traits or generic, key, transferable or generalizable skills. These are skills such as communication or team work; they are used in a wide variety of contexts and their mastery is associated with success in many fields (Dearing, 1996). Nonetheless, they are often overlooked, especially in more scientific and technical lines of work. In order to clearly differentiate, the questionnaire asked specifically about the soft skills present in FSTs and separately about their food sector-specific skills.

Here, the profile of the current FST in 16 European countries and five employment areas was analysed using a questionnaire directed to FST managers or human resources departments. It was therefore not a self-evaluation, but an employers’ view of their employees. The aim was to define the currently employed European FST and to determine if differences exist based on geographic region and/or employment area. To our knowledge, no such study of the European FST exists.

This work is a part of the Track.Fast project, which seeks to increase innovation in the European F&D sector by

1. identification of training and career requirements of future European FSTs, and
2. implementation of a European strategy to recruit the next generation of FST leaders.

The first step in the project, identification and definition of personal skill requirements, includes this profile of the current FST, a definition of the “ideal” FST (Flynn, Wahnström, Popa, Ruiz-Bejarano, & Quintas, 2013), and where and when s/he should be trained (manuscript in preparation). Other parts of the project include

1. Developments for the regulation of food science and technology professions in Europe;

2. Establishment of a framework for continual professional training and career development for the FST professional (visit: www.foodcareers.eu); and
3. Motivation of young people to enter and pursue a career in food science and technology in Europe (visit www.foodgalaxy.org).

2 Materials and Methods

2.1 Questionnaires

The questionnaire was prepared by a team of three food sector professionals: a university professor, an industry association representative and a research consortium representative. It was nine pages with 24 questions and divided into three sections: organization profile, FST academic and career status and competencies and skills desired in FSTs. A data protection notice and informed consent were prepared alongside the questionnaire and a statement guaranteeing confidentiality was included on the first page.

In the organization profile, demographic data were collected including geographical location, number of total and FST employees and employment area (*Industry, Government, Research* or *Other*, e.g., distribution or retail). In FST academic and career status, questions concerned the currently employed FSTs at that organization, including highest degree and specialty; years of work experience; skills possessed and employer satisfaction. In competencies and skills desired in FSTs, the questions concerned ideal skills and job titles. Questions were a mixture of choices from a list and open answers and statistical analyses were performed accordingly. The questionnaire was developed in English and then translated into French, German, Greek, Hungarian, Italian, Lithuanian, Portuguese, Romanian, Slovenian, Spanish, Swedish and Turkish by Track_Fast partners in those countries.

Questionnaires were distributed by email in December 2009 to 302 representative FST employers in 15 countries; a list prepared by Track_Fast partners from those countries and aided by an internet-based investigation. In February 2010, questionnaire collection was closed with a total

of 109 responses representing at least 2172 FSTs from 15 countries and this data was analysed for an internal Track_Fast report (Ruiz, Flynn, Echim, & Lindbom, 2010). Following both internal and external expert reviews, the questionnaire was shortened to 10 questions while maintaining the categories described above. The questionnaire was re-distributed to participants at 16 brainstorming workshops on ideal skills organized by Track_Fast in 2010 and 2011 (see Flynn et al., 2013) and further or repeatedly distributed to contacts of the 16 Track_Fast partners. An additional 178 questionnaires were collected. In May 2012, questionnaire collection was closed with a total of 287 responses representing at least 4069 FSTs from 16 countries.

2.2 Data Organisation and Analysis

All data were entered into an electronic spreadsheet by one researcher and checked for accuracy by another. Comments were translated to English by the local partner. Questionnaires with missing or conflicting information were eliminated from the analysis. Responses to each question were analysed for relationships with

1. geographical region as provided by the Track_Fast partner who distributed the questionnaire and
2. employment area as identified by the response to question 1.

Question 2 on organisation size was used to separate industry responses into two employment areas: *SME*, defined as fewer than 250 employees and *Large Enterprise*. The 16 participating countries were grouped into four regions as shown in Table 1.

Questions 7, 8 and 11 concerning university degree and certifications were analysed together such that total employees could be calculated and then percentages with different degrees. For questions concerning skills and job titles (13, 14 and 23), multiple responses were possible and thus totals for each response were divided by total responses using an Excel[®] pivot table so that the top three choices could be identified

for each employment area and geographical region. For questions 13 and 14, regarding soft and food-specific skills, three researchers together assigned each choice to a specific skill using the list found in *Knowledge and Skills Requirements for Careers in the Food Industry* (Ho, Lindbom, & Wahnström, 2011). These are the same skill classifications recently used for identifying most desired FST skills (Flynn et al., 2013) and they are shown in Table 2. The observed values for skills in the current FST were compared with expected values using a chi square test with $p < 0.05$ required for significance. Expected was defined as the same percentages of FSTs with the same skills in all geographic regions and employment areas.

Table 1: Organisation of 16 participating countries into 4 geographic regions

Central	East	North	South
Austria	Hungary	Belgium	Greece
France	Lithuania	Netherlands	Italy
Germany	Romania	Sweden	Portugal
Slovenia	Turkey	UK	Spain

3 Results and discussion

3.1 Questionnaires

Between December 2009 and May 2012, 287 questionnaires were collected from the 16 partner countries of the TrackFast project; 6 of these questionnaires could not be used either because of missing or contradictory information. Finally, 281 questionnaires representing approximately 4000 FSTs were analysed. It is necessary to say “approximately”, because the number of FSTs was never asked directly. The information came from 3 questions (Q2. How many FSTs are there in your company/organisation (approximate number)?, Q3. How many FSTs in your organisation have a degree? and 4. How many of your staff work as FSTs, but have no degree? combined and Q6. How much work experience do the FSTs in your organisation have? Indicate approx. how many have each of the following years of experience). These three methods of obtaining number of FSTs per respondent did not always

give identical results. In Table 3, the most conservative i.e., the lowest numbers are reported.

The distribution of responses by region, employment area and size of the company are presented in Table 3. It can be seen that countries in the East (Hungary, Lithuania, Romania and Turkey) had the highest participation, 99 questionnaires representing over 1100 FSTs, with 72 responses from Industry. In this regard, it is interesting to note that the F&D industry in these Eastern countries is much less productive, as estimated by the ratio between net sales and number of employees (Food Drink Europe, 2012) than the participating North, Central or Southern European countries. This, together with recent EU membership, perhaps motivated F&D employers to contribute to the study.

3.2 Education and Experience

In each geographical region, more than 80% of professionals working as FSTs had a university degree (BSc, MSc or PhD) (Fig. 1A). The number of those with degrees specifically in Food Science and Technology was near 50% in the *North*, *South* and *East* while for *Central* Europe, this value was lower: 38%. This was unexpectedly low in a region that includes Germany and France, which together represent more than 40% of food industry net sales in countries considered here (Food Drink Europe, 2012). However, looking only at industry (*Large Enterprise* and *SME*), one sees that the *Central* region had the highest percentage of FST degrees, 86% (Fig. 1B), suggesting that professionals with the knowledge and competences acquired from an FST degree may contribute to the competitiveness of the food industry in this region.

Overall, *SME* had a lower number of FSTs with university degrees than *Large Enterprises*, yet those with degrees in FST were in a higher percentage in SMEs. Perhaps the multidisciplinary nature of this degree (Oliveira & Medina, 1997) fits the requirement of multiple functions performed by the professionals in an SME. These results may also be influenced by the probable high number of professionals with FST degrees working as consultants (categorized as industry in this study) - many micro and small companies

Table 2: Assignment of questionnaire choice to published list of soft and food sector-specific skills.

SOFT SKILLS	Questionnaire Choice	Skill from Ho et al. (2011)
	Communication, oral	Communicating
	Communication, written	
	Presentation Skills	
	English Language	
	Other Languages	
	Computer Literacy	Managing Information & Computer Literacy
	Project Management	Participating in Projects & Tasks
	Group Worker	Working with Others
	Group Leader	Providing Leadership
	Financial Skills	Finance & Resource Management
	Statistics/Mathematical Skills	Using Numbers
	Marketing/Consumer Knowledge	Sales & Marketing
FOOD SECTOR-SPECIFIC SKILLS	Laboratory Research	Research
	Research & Development	Product Development
	Packaging	
	Production	Production Management / Operations
	Quality Management	Quality Management, Quality Assurance & Quality Control
	Engineering	Engineering Maintenance
	Food Safety	Food Safety Management, Food Hygiene & Food Safety Control
	Food Legislation	Food Legislation & Control
	Environmental Issues	Health, Safety & the Environment
	Logistics	Transportation
	Consumer Science	Consumer & Nutritional Sciences
	Market Trends	

Table 3: Distribution of returned questionnaires by region, employment area and size of the organization. Most conservative estimate of number of FSTs represented is indicated in parentheses

Region	Employment Area		Size (employees)	
Central	55 (717)	Large Enterprise 47 (1332)	1 to 25	80 (373)
		SME 154 (879)		
East	99 (1126)	Government 21 (449)	25 to 100	93 (1163)
North	66 (1329)	Research and Academia 33 (876)	100 to 250	42 (588)
South	61 (897)	Other (ex. Retail, Catering) 26 (506)	More than 250	66 (1945)

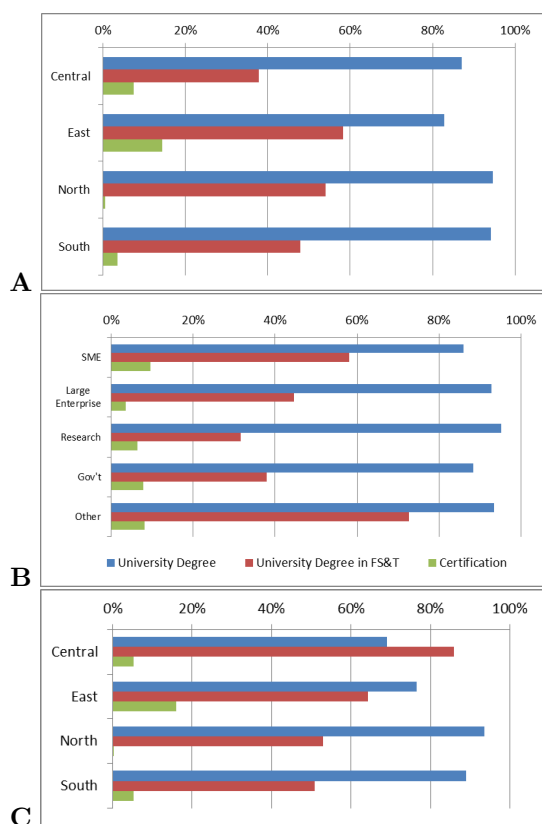


Figure 1: Education of current food scientists / food technologists. Per cent of total FSTs considered (7756) with a university degree (blue bar), per cent of FSTs with a university degree whose degree is in food science or food technology (red bar) and per cent of total FSTs with a certification instead of or in addition to a degree (green bar). A. Per cent in four geographic regions and B. in five employment areas. C. Per cent of total FSTs employed by Industry, SME and Lg Enterprise (3902), with university degree, FST degree and/or certification as above in four geographic regions.

outsource food safety control to small consultancies in their region and this has been a traditional career path for FST graduates. For *Other* employers (e.g., food distribution and catering), there was also a high percentage with a degree in FST. This may reflect needs in these employment areas regarding food safety - driven by leg-

islation, and needs regarding innovation - driven by consumer demand.

Regarding certification, the number of professionals with this was very low, suggesting that either certification in food-related subjects is not valued by employers or that few are available. Certifications were found mostly in the *East* and were often from a local authority or university, suggesting a region-dependent view. Certifications held by FSTs included those in Quality Management from an independent reference laboratory in Romania, Ecological Production from a certification institute (ICEA) in Italy and “certification courses” from universities in The Netherlands and Lithuania. Certification in Hazard Analysis and Critical Control Point (HACCP) was the only certification mentioned in more than one country; Italy, Slovenia and Turkey. A recent search on a UK site however found 18 jobs for Food Scientists, none of which asked for any food-specific certifications (New Scientist, 2012). The question of certification for food professionals is being addressed by another part of this same European project (Track.Fast) and some conclusions on this topic should soon be available.

Figure 2 shows the distribution of degrees in FST by Bachelor, Master or Doctoral across region and employment. Most FST degrees were Bachelor’s in all regions, yet there was also variation. For example, the highest percentage of professionals with a Master Degree in FST was found in the North, perhaps related to the high competitiveness and development of industry in this region. Similarly, employers here were the only ones who mentioned *Product Development* as one of the top three desired FST skills (Flynn et al., 2013), a skill introduced primarily during studies leading to an MSc. As for the distribution of FST degrees by employment area, as expected *Research* had the highest number of PhDs, followed by *Government*, *SME*, *Large Enterprise* and *Other*. Within *Industry*, *SME* had a higher proportion of professionals with a Master’s, while for *Large Enterprise* a Bachelor diploma seemed sufficient for most positions. This can be a result of a phenomenon of scale: Large industries tend to have larger, concentrated centres for research and development and smaller, more distributed production

sites – sites where a Bachelor can perform tasks based on procedure manuals which were developed centrally by Masters and Doctorates.

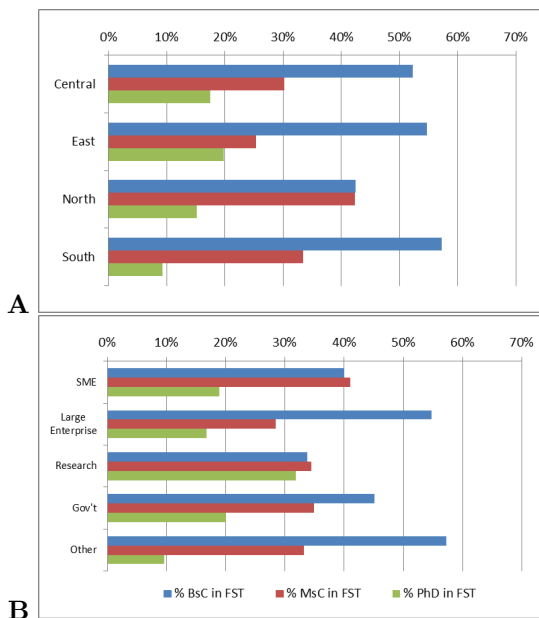


Figure 2: University degrees in Food Science or Food Technology. Per cent of total FSTs with a university degree in Food Science or Food Technology (3231) whose highest degree is a Bachelor (blue bar), a Master (red bar) or a PhD (green bar). A. Per cent in four geographic regions and B. in five employment areas.

The importance of a degree in FST can be evaluated by the satisfaction of employers with the new graduates they hire. To this question, the vast majority, 97% of respondents, were either “somewhat satisfied” or “very satisfied”. Only 3% (7) were “Not at all satisfied, new employees with practical experience are better than those with diplomas” and these respondents represented only 32 FSTs. These results clearly show that the level of education in Food Science and Technology in European universities is satisfactory and graduates acquire a good understanding of the basic principles needed for success in the F&D workplace. The need for further training after graduation is only natural: The F&D sector has very different specificities, e.g. dairy industry is very different from bakery pro-

duction and government regulators different from distributors.

It can be seen in Table 4 that the number of working FSTs has not changed much in the last 10 years: 28% have less than 5 years’ work experience, nearly equal to the 27% with 5 to 10 years’ experience. The exceptions were the *South* region and the employment area *Other*. The high percentage of new graduates working in the *South* may reflect job growth, which was the highest among the European regions in this study (Table 5). In *Other* employment, the high proportion may relate to recent consumer trends: The increase of ready-to-go meals in supermarkets and self-serve restaurants brings a new need for FST professionals in this market. It is also noteworthy that around 50% of FSTs have more than ten years’ experience. This is a relatively low number as this is an interval which continues until the end of working life (circa 40 years). Two factors may influence the relative “youth” of the FST workforce shown here:

1. an increase in the need for FST professionals in the last decade and/or
2. careers of FST professionals tend to progress to more managerial roles,

i.e., no longer considered a Food Scientist or Food Technologist, after 10 or so years into working life.

Table 5: Variation in number of employees in the F&D industry in the European countries in this study from 2006 to 2010 (calculations based on FDE reports 2008, 2009 and 2011)

Region	Variation in number of jobs
Central	+6%
East	-10%
North	-1%
South	+11%

(Turkey data not available. UK data not considered due to changes in euro-pound conversion rate and UK classification of industry in 2008. Netherlands and Lithuania 2010 data not available - estimated on the average of 2006 to 2009 data.)

Table 4: Number of years of work experience of food scientists / food technologists in four geographic regions and five employment areas

		5 years or less	6 - 10 years	More than 10 years
Total (n=4069 FSTs)		28%	27%	46%
Region	Central	34%	23%	52%
	East	37%	26%	47%
	North	28%	28%	51%
	South	53%	27%	39%
Employment Area	SME	39%	25%	47%
	Large Enterprise	38%	28%	44%
	Government	31%	20%	56%
	Research and Academia	35%	21%	53%
	Other (ex. Retail, Catering)	69%	31%	28%

Table 6: Job titles of Food Scientists / Food Technologists. Variation in job titles in different employment areas

Job title	% of respondents with an employee with this title (n=281)				
	Lg enterpr	SME	Gov'ment	Research	Other
Quality manager	66	52	14	39	42
Food Technician / engineer	66	45	33	48	19
Production manager	49	44	5	3	15
Quality control engineer	47	33	10	27	19
Product developer	55	34	0	24	23
Research technician / researcher	32	8	14	82	23
Project manager / leader	34	25	14	64	12
Other	15	14	86	18	31
Number of job titles / respondent	5.4	3.6	2.7	6.0	2.9

3.3 Skills, Competencies and Knowledge

The number one soft skill overall was *Communicating*, 94% of currently employed FSTs had this skill. *Communicating* includes writing, reading and presenting information, listening and understanding instructions and ability to speak other languages (usually English). *Communicating* was the number one skill in each employment area and each geographical region (Fig. 3). The prevalence of communication skills may be related to globalisation in food trends and market development resulting in an increased number of business and industry contacts beyond national borders and a need for improved communication skills (e.g., languages). Additionally, the growth in techno-

logical challenges and structural complexity in the F&D workplace has likely led to an increased need for improved internal communications. Other FST soft skills appeared unevenly distributed among the regions. *Participating in Projects and Tasks* was, for example, among the top 3 only in the *Central* region, where 67% of FSTs had the skill. In the *North* and *South*, 68 and 66% of FSTs had this skill, respectively (though not in the top 3); yet in the *East* only 40% were considered adept at *Participating in Projects and Tasks*. The other two most common soft skills were *Working With Others*, approximately 75% of FSTs had the skill except in the *East* where only 61% had it, and *Managing Information & Computer Literacy*, as many as 85% of FSTs in the *East* had the skill yet as few as 65% in *Central* Europe. Together, these data

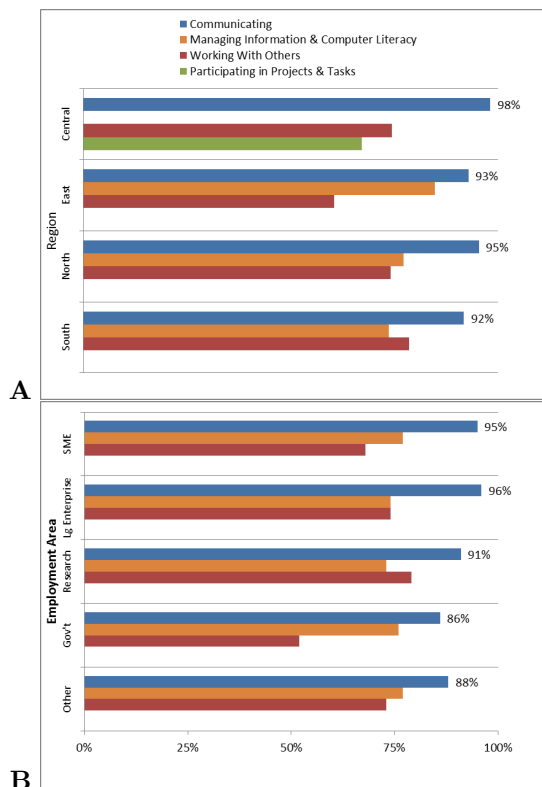


Figure 3: Soft skills in current food scientists and food technologists. Employers (281) indicated which of a list of nine soft skills were found in the “average FST” in their organisation. A. Top three skills in four geographic regions and B. in five employment areas.

suggest a different distribution of soft skills in the FST in the countries of the Eastern region, although statistical significance was not reached. This may be related to newer EU membership for these countries and preceding cultural separation which fostered independent workplace patterns. There were no apparent differences in the distribution of soft skills by employment area: *Communicating*, *Managing Information & Computer Literacy* and *Working with Others* were the top skills everywhere. This might reflect increasing similarities in F&D employment areas, both in terms of internal structure and external relations. The growing complexity of knowledge-based work throughout the F&D sector may also

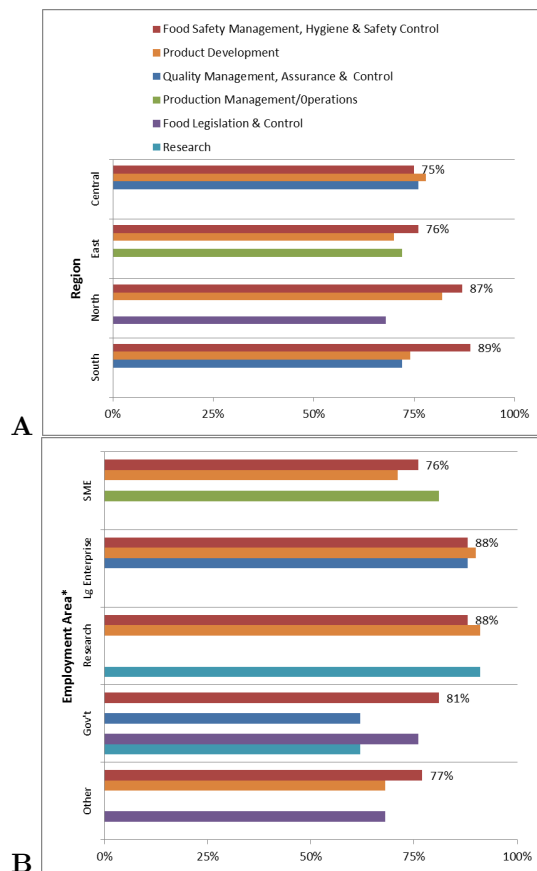


Figure 4: Food sector-specific skills in current food scientists and food technologists. Employers (253) indicated which of a list of 11 food sector-specific skills were found in the “average FST” in their organization.

contribute to *Working with Others* and *Participating in Projects and Tasks* ranking in high positions. It is interesting to note that *Communicating* is intimately related to and clearly necessary for success in these other high-ranking skills. A recent study on forestry science graduates showed that communication skills are correlated with income, yet not self-evaluated as among the most important soft skills (Rekola, 2012), suggesting that employers and employees may have different views of this skill. Among the food-specific skills, knowledge and competences, the number one overall was *Food Safety Management, Food Hygiene & Food Safety*

Control, 80% of FSTs overall and as many as 89% in the *South* had this skill. This was the only skill among the top three in all geographical regions and employment areas (Fig. 4). Regionally, *Product Development* was also among the top three and though food-specific skills appeared to vary by region, the differences did not reach statistical significance. In the *East*, *Production Management & Operations skills* appeared common, 72% of FSTs, perhaps related to the relative youth of the F&D industry, reported by Halliday (2009) to be a good investment location for F&D operations. In the *North*, 68% of average FSTs were skilled in *Legislation*, exemplified by a recent UK job posting for a Food Technologist with knowledge of “labelling legislation” (Greenbank & Kirk Recruiters, 2012). More research will be necessary to see if these differences are valid.

In the different employment areas, there were statistically significant differences in FST skills ($p < 0.05$). The only skill in the top 3 for all 5 areas was *Food Safety Management, Food Hygiene & Food Safety Control*, clearly demonstrating that safe food is valued by all employers (Fig. 4). For *SME*, *Production Management & Operations* was the number one skill, 81% of FSTs had it. Since *Production* skills were also prevalent in the *East*, it might be that most *SME* responses were from the *East* and/or most *East* responses were *SMEs*. In fact there were responses from 62 *SMEs* in the *East* (40% of the total 154 *SME* responses and 63% of the 99 *East* responses) suggesting that being an *SME* is more closely associated with production skills than with having an *East* location. *SMEs* would be expected to focus on *Production* independent of their location; indeed such a focus was reported to be a necessary part of the success formula for agri-food *SMEs* in Latin America (Requier-Desjardins, Boucher, & Cerdan, 2003), and in a small operation, this skill would be necessary for the *SME*. It is also interesting here to compare *SMEs* to *Large Enterprises* where many fewer FSTs, only 68%, have *Production Management & Operations* skills. This may be explained by the division of labour in *Large Enterprises*, where most management and operations tasks are likely taken over by employees trained in Business. *Food Legislation & Control* was among the top

3 food sector-specific skills in *Government* and *Other*, where FSTs may be writing and enforcing food-related legislation. As this skill was also more prevalent in the *North*, perhaps *Government* and *Other* samples contained a high number of respondents from the *North* and/or vice versa. In fact, most *Government* responses came from *Central* and *East*, most *Other* responses from the *South* and most *Northern* responses from *Large Enterprise* leading us to believe that having an FST with *Legislation* skills is independently associated both with a Northern location and with a *Government* or *Other* employment area.

In the *Research* employment area, *Research* was the most common skill, 91% of FSTs; among *Government* employers, *Research* was among the top 3 skills, but only 61% had this skill. It is perhaps surprising that *Research* was not among the top in *Large Enterprise* (56%), as they are likely leaders in developing new products and packaging and research skills would seem necessary in their FSTs. However this might be due to the phenomenon of scale as hypothesized above for number of PhDs: in a large enterprise there are few central locations which have the highly trained personnel who do the research which is then used by the more numerous distribution centres where the lesser trained professionals are working. Finally, *Quality Management, Quality Assurance & Quality Control* was found among the top skills in *Government* and *Large Enterprise* but not in *SMEs*. Here, the day-to-day demands of *Food Safety* and *Production* necessary for business survival perhaps favour having FSTs with these skills, moving *Quality* to a lower priority.

The most common overall job titles in our study were *Quality Manager* and *Food Technician / Food Engineer*. These titles were 1st or 2nd in all geographic regions (data not shown) but not in all employment areas. *Quality Manager* was the most common title in industry (*Large Enterprise* and *SME*) and *Other* employers; an FST with this title was found in as many as 66% of *Large Enterprise* respondents, but rather uncommon in *Government*, at 14% (Table 6). Since 201 of 281 respondents were from industry, this likely contributes to the prevalence of this title overall, but does not explain the variations based on employ-

ment area. *Production Manager* was among the top job titles in SMEs, supporting the finding above that *Production Management/Operation Skills* are the most common food sector-specific skills in SMEs. Although Table 6 suggests more *Production Managers* in *Large Enterprise*, it is important to note the higher number of job titles per respondent in *Large Enterprise*. In *Research*, a *Research Technician / Researcher* was found in 82% of responding organisations, yet this title was uncommon elsewhere. In *Government*, job title choices were not representative and most respondents had employees with *Other* titles, examples were *Advisor*, *Secretary* and *Department Head*, indicating that the FST in *Government* employment has a rather different job than FSTs elsewhere.

4 Conclusions

The data presented here outline the profile of the currently employed European Food Scientist / Food Technologist in different geographic regions and different employment areas. While the number of questionnaires analysed (281) is likely not a significant representation of the European F&D sector, this study did represent several thousand FSTs from varied geographic regions and employment areas and is a starting point for understanding the current status of staff in the F&D sector across Europe. In short, the average European FST has a university degree, with about half having a degree specifically in Food Science / Food Technology. Those with a degree in FST tend to have a Bachelor's, though in some geographic regions and employment areas a Master's is the norm. The current FST is unlikely to have any food-related Certifications. Most employers are satisfied with graduates in FST, perhaps a result of long-term European initiatives like the ISEKI project, which aim at harmonization of curricula and monitoring the quality of food studies (<https://www.iseki-food.net/>). FSTs are "young", about half have less than 10 years of work experience.

The same soft skills are found in FSTs working in all geographic regions and all employment areas, with *Communicating* skills the most common. Our recent report on skills in the "ideal" FST

showed *Communicating* as the most desired skill overall (Flynn et al., 2013), suggesting that at some level FST employers have what they want. Yet when asked to 'design the ideal FST', many more soft skills were mentioned, both variety of skills and number of times, than were food skills. It seems FST training is on the right track in providing the soft skills employers need, but has not yet reached the depth nor breadth of soft skills required. Other reports have come to similar conclusions about the need for soft skills. A recent study by CEFIC (The European Chemical Industry Council) reported that high level industry representatives listed Communication as the number 2 personal skill required for scientists and the number 1 personal skill for engineers (CEDEFOP, 2009). The Canadian Stem Cell Network offered a workshop and published a follow up article on the importance of soft skills for scientists (Rancourt, 2009). More recently, the Australian Association of Engineering Education heard a report on integrating soft skills, including communication, into university engineering courses (Armstrong & Baillie, 2012).

Food sector-specific skills vary with employment area with three different number one skills in the five areas considered: *Product Development*, *Production* and *Food Safety*. Yet employers want other skills as well, e.g., *Food Legislation* (Flynn et al., 2013). Additionally, food skills viewed as important by policy makers and perhaps also by the general public, e.g. sustainability and environmental issues on the one hand and nutrition and healthy diet on the other, were not commonly found in current FSTs. While the data here show that FSTs working in different areas of employment have different food-specific skills, the ideal is subtle but important differences depending on both region and employment area for both food and soft skills (ibid.).

These results clearly indicate a need for further attention to skills in the FST workforce. Qualification and training of F&D professionals is necessary for innovation, yet it has recently been noted that F&D does not make the necessary investment in its workforce (European Technology Platform, Food for Life, 2012). Knowledge of the training needed comes from understanding what employers have and what they want. A regular repetition of this study would provide such

knowledge and allow understanding of trends in F&D employee skills. Taken together with other work from the Track.Fast project, these results can contribute to improving the profile of the European food scientist and thus to improving the competitiveness of the food & drink sector.

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