TECHNOLOGICAL CHANGES AND SKILLS NEEDS IN THE AGRI-FOOD SECTOR IN SERBIA: BIOCHEMICAL AND MICROBIAL PRODUCTS

SUMMARY REPORT

CONTENTS

INTRODUCTION

This summary report[1] forms part of a broader study on the technological changes and skills needs of the Western Balkan agri-food sector, conducted by the European Training Foundation (ETF). The aim of this summary report is to examine the potential of biochemical and microbial products in Serbia from the perspective of skills supply and demand.

The study aims to inform a foresight exercise on technological changes and skills needs in the biochemical and microbial products sector in Serbia. The purpose of the foresight exercise is to identify concrete skills related measures to support the accelerated development of the sector in preparation for the single market.

OVERVIEW

Biochemical and microbial products have the potential to revolutionise the way we cultivate crops, process raw products into foods and beverages, and address the challenges of food quality, safety and preservation and environmental sustainability. The application of biochemistry in agri-food is still in its infancy globally. Its full potential to unlock a greener, more efficient future for agri-food value chains has not yet been reached.

Agricultural biochemistry and microbiology are branches of science that investigate the chemical reactions that take place in plants, animals and microorganisms involved in agriculture, and study different microorganisms. Advancements in these areas have paved the way, for instance, for precision agriculture, which utilises data analysis and biochemistry principles to optimise farming practices. Other important products for agri-food include natural agents to maximise soil fertility and crop yields, products to extend the shelf life of fresh produce, and biofertilisers and biostimulants that promote environmentally friendly farming. Moreover, with increasing energy demands and the imperative to reduce greenhouse-gas emissions, biochemical products such as energy crops and microbial systems are being developed to efficiently convert biomass into renewable fuels.

The area of biochemical and microbial products in the agri-food industry includes manufacturing fertilisers, nitrogen compounds, pesticides and other agrochemical products, as well as research and experimental development in biotechnology. These sectors are classified under the following NACE codes:

- Manufacture of fertilisers and nitrogen compounds (C20.1.5);
- Manufacture of pesticides and other agrochemical products (C20.2);
- Research and experimental development on biotechnology (M72.1.1).

[1] This report was prepared by Pirita Vuorinen, ETF. The contents of this summary report are the sole responsibility of the ETF and do not necessarily reflect the views of the EU institutions.

The biochemical products sector in the Serbian agri-food industry is at an early stage of development. While research progress has been significant, few products have been brought to the market and there is no widespread application of knowledge and innovation.

SKILLS DEMAND

From the perspective of the biochemical and microbial companies interviewed, the most important skills needs are in the fields of biology, microbiology, biotechnology, biochemistry and agriculture. Biochemical engineers and bioengineers are sought after for their expertise in applying engineering principles to biological systems, while microbiologists are needed for ensuring food safety. The following professions were also mentioned as being in demand: agricultural engineers, agronomists, food analysts and food regulatory advisors to ensure compliance and safety. On the one hand, various kinds of technicians were also needed for laboratory work.

Advanced and specialist knowledge is usually in high demand among the companies interviewed. Innovations in this niche are most often initiated on the basis of research conducted at faculties and institutes – the founders of companies in this niche are often employed at higher education institutions.

Based on the ISCO/ESCO classifications, the following occupations are relevant for companies' skills needs. Most of the occupations are classified in the ISCO groups 2 (professionals) or 3 (technicians and associated professionals)

TABLE 1: RELEVANT TECHNICAL OCCUPATIONS IDENTIFIED BY COMPANIES

High-skilled occupations	
• Biochemical engineer (2145.1.1)	• Agronomist (2132.2)
• Bioengineer (2149.5)	• Agricultural technician (3142.1)
• Microbiologist (2131.4.10)	• Bacteriology technician (3141.2.1)
• Agricultural engineer (2144.1.2)	• Food regulatory advisor (3257.2)
• Food analyst (3111.3)	
Low-skilled occupations	
• Machinery operators (ISCO group 8)	• Elementary occupations (ISCO group 9)

The occupations listed in this sector encompass a range of skill levels, which consequently determine the required educational level. For instance, agricultural engineers, microbiologists and agronomists are typically classified under ISCED level 6, while bioengineers and food regulation advisors may fall within the ISCED level-6 to -7 range. On the other hand, food analysts can be found at ISCED level 5 or 6, while the educational level for agricultural technicians and bacteriology technicians typically varies from ISCED level 4 to 5.

The most sought-after low-skilled occupations are machinery operators (ISCO 8) and elementary occupations (ISCO 9) groups, which typically require ISCED level-2 or -3 qualifications.

In terms of business services and related occupations, the interviews revealed that employers face difficulties in attracting staff with specific domain knowledge and in finding individuals with marketing and sales skills. Managers of the companies interviewed have identified these skills as crucial for accelerating market expansion and for candidate employability.

Several specific business occupations are highly relevant for companies' growth and market development. Project managers have a pivotal role in orchestrating and overseeing complex research and development endeavours, making it highly relevant for companies that develop and produce biochemical and microbial products. Similarly, sales managers and sales assistants are sought after to ensure that products are promoted efficiently. Some interviewees cited the occupation of technical sales representative in chemical products. Furthermore, the interviewees regarded import export managers, marketing managers, digital marketing managers, marketing consultants and marketing assistants as instrumental for branding and for expanding the reach of innovative advances in this niche. Finally, some companies expressed the need for legal consultants to ensure compliance with regulatory frameworks and to safeguard intellectual property.

However, the interviewees pointed out that financial conditions pose a significant obstacle when it comes to attracting highly skilled marketers and salespeople. These individuals are often sought after and employed in sectors that offer higher financial incentives, making it challenging for niche industries to compete for their talent.

Based on the ISCO/ESCO classifications, the following occupations can address demand for these skills, as presented in the table below (**Error! Reference source not found.**). Most of the occupations identified are classified in the ISCO groups 1 (managers) or 2 (professionals).

TABLE 2: RELEVANT BUSINESS SUPPORT OCCUPATIONS IDENTIFIED BY COMPANIES

- Project manager (1219.6)
- Sales manager (1221.3.2.1)
- Sales assistant (5223.4)
- Technical sales representative in chemical products (2433.6.2)
- Import export manager in pharmaceutical goods (1324.3.2.28)
- Marketing manager (1221.3.2)
- Marketing consultant (2431.10)
- Marketing assistant (2431.10.3)
- Digital marketing manager (1221.5)
- Legal consultant (2619.7)

Source: Evidence from interviews and ESCO classification of skills, qualifications and occupations.

The needs for specific skills and knowledge in this niche were analysed based on the insights provided by interviews with companies in the niche. Providing financial incentives for professional and highly educated workers stood out as a particular challenge, especially for start-ups and small businesses, which could not offer a competitive salary for the market due to their modest financial resources. In addition to providing competitive salaries, a significant challenge was providing other benefits and incentives for employees. In particular, highly educated workers with specific knowledge and experience seek competitive salaries and stimulus working conditions that companies often found difficult to provide.

Moreover, while the companies were constantly developing new solutions and products, the current regulations on defining and treating microbial and biochemical products prevented these products from being adopted and implemented in the market more quickly. Due to complex EU regulations, the EU was not the main market for companies in this niche, but rather the surrounding countries' markets, as well as the United States.

SKILLS SUPPLY

Vocational education and training

There is currently no vocational education and training offer in Serbia for emerging occupations at the intersection of agri-food and biochemistry, where combined skills from both disciplines are required. Students are mainly educated at either agricultural or chemical schools. Only a very small number of high schools offer more specific training.

There are over 25 schools where students can enrol in general programmes to become a chemical and pharmaceutical technology technician or a chemical laboratory technician. These schools offer educational programmes that combine knowledge in chemistry and pharmaceuticals with technical skills and technologies. Students who choose these educational profiles acquire the specialist knowledge and skills required for work in the chemical and pharmaceutical industry, and they most likely find jobs in other industries rather than within the agri-food sector. However, there are two educational profiles at secondary educational level (not VET) that can be associated with this niche: chemical product manufacturer and biotechnology technician. Six secondary schools provide these profiles, and on average, around 180 students are enrolled in them each year.

TABLE 3: EDUCATIONAL PROFILES OFFERED BY SECONDARY SCHOOLS RELEVANT TO THE BIOCHEMICAL AND MICROBIAL PRODUCTS NICHE

Name of school	Town	Profiles
Chemical-Food Technology School	Belgrade	**Biotechnology technician**
		Chemical product manufacturer
		Chemical laboratory technician
		Chemical technology technician
'Dr Obrad Pejić' Boarding Dairy School	Pirot	**Biotechnology technician**
'Žikica Damjanović' High School	Smederevska Palanka	**Biotechnology technician**
		Chemical and pharmaceutical technology technician
'Pavle Savić' Technical School	Novi Sad	**Biotechnology technician**
		Chemical laboratory technician
		Chemical and pharmaceutical technology technician
'Rajko Bosnić' Agricultural School	Negotin	Chemical product manufacturer
Agricultural-Chemical School	Obrenovac	Chemical and pharmaceutical technology technician
'Sveti Sava' High School	Sombor	
'Božidar Đorđević Kukar' Chemical Technology School	Leskovac	
Chemical-Medical School	Vršac	
'23. Maj' Technical School	Pančevo	
Vocational Chemical and Textile School	Šabac	
'Dragačevo' High School	Lučani	
Food-Chemical School	Niš	
Technological School	Paraćin	
Chemical-Technological School	Kruševac	
'Dr Đorđe Radić' Agricultural-Chemical School	Kraljevo	
'Miloš Crnjanski' Vocational School	Kikinda	
Chemical-Technological School	Subotica	
'Uroš Predić' Chemical-Food-Textile School	Zrenjanin	

Name of school	Town	Profiles
'Mileta Nikolić' Technical School	Aranđelovac	
First Technical School	Kragujevac	
Fifth Belgrade Gymnasium	Belgrade	Students with special abilities in biology and chemistry
'Jovan Jovanović Zmaj' Grammar School	Novi Sad	
'Bora Stanković' Grammar School	Niš	
First Grammar School of Kragujevac	Kragujevac	

Source: Ministry of Education

According to the companies interviewed, despite deficiencies in the educational system, secondary vocational schools provide students with valuable skills and practical knowledge. There is no dedicated cooperation on biochemistry between companies and secondary schools.

Intermediary organisations

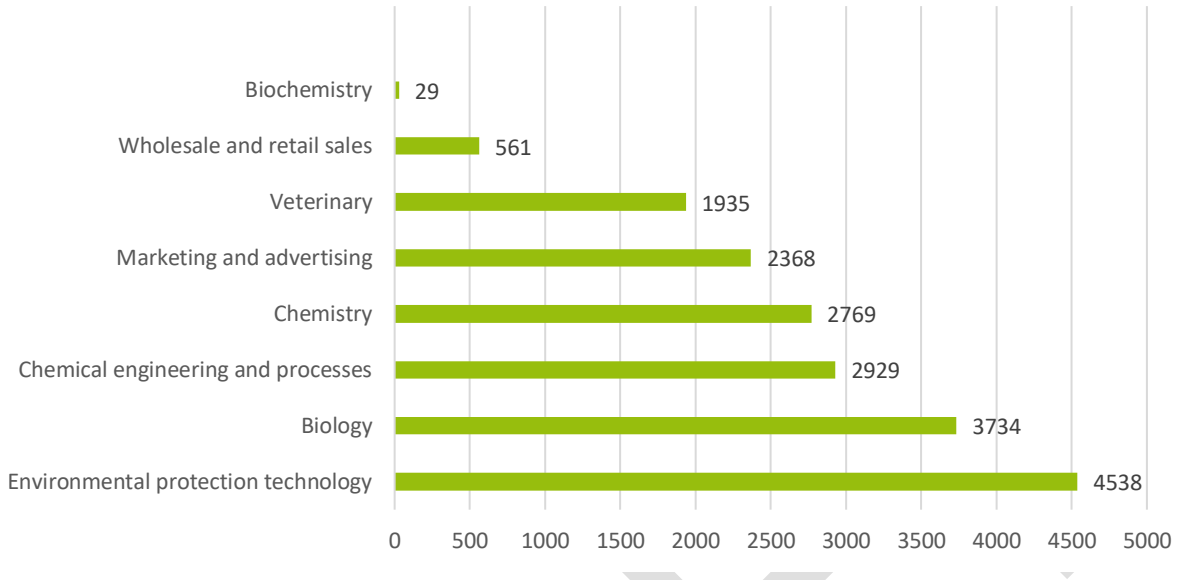
Due to the strong competition in attracting new personnel, companies invest in education and skills development for their employees. According to insights gained from the interviews, employees are trained internally, and usually during the integration process. Training is rarely done through cooperation with business intermediary organisations, such as the Chamber of Commerce. Among the skills acquired through this informal learning method are business development skills such as project management, communication and presentation, and sales skills. There is no specific non-formal training offer for companies developing biochemical products for agri-food.

Higher education and research

In addition to four agricultural faculties in Serbia, there are several higher education institutions that potentially generate knowledge relevant to biochemistry for agri-food. These include the Faculty of Chemistry, the Faculty of Technology and Metallurgy, the Faculty of Biology, the Faculty of Veterinary Medicine and the Faculty of Physical Chemistry in Belgrade, the Faculty of Technology (University of Niš), and the Faculty of Biofarming (Megatrend University). Faculties in the field of economics, administration, management and marketing are also important generators of knowledge for this and other niches. The figure below shows the number of students enrolled in higher education in each educational field important to the market niche of biochemical and microbial products.

The data shows that the greatest interest in education is in the field of environmental protection technology. In 2021, over 4 500 students enrolled in studies in this field. Other popular educational fields related to biochemistry for agri-food are biology (over 3 700 students), chemistry, chemical engineering and processes (over 2 900) and veterinary science (over 2 300). At the same time, only 29 students were enrolled for biotechnology in 2021. However, the small number of students in this field is also conditioned by limited capacity – it is a matter of specific domain knowledge and only a small number of students enrol in this department each year.

FIGURE 1: NUMBER OF STUDENTS ENROLLED IN 2021/2022 (ISCED CLASSIFICATION)



Source: Statistical Office of the Republic of Serbia.

From a gender perspective, women were more represented in all the aforementioned educational fields. Women were especially well represented in scientific fields such as chemical engineering (75%), chemistry (77%), biology (78%) and biochemistry (79%). In addition, in the fields of marketing and advertising and wholesale and retail sales, women make up 68% and 63% of the total number of students respectively.

Despite a notable interest among students in pursuing education in fields relevant to this niche, entrepreneurs and employers highlight the inadequacy of the higher education system and its inability to adapt educational programmes to meet market demands. Within the higher education system, there is a need to foster the development of additional skills among students, including managerial, sales and marketing skills. Sought-after employees are those who have expertise in biochemistry for agri-food and are proficient in conducting market research, understanding market trends and implementing effective sales strategies.