TECHNOLOGICAL CHANGES AND SKILLS NEEDS IN THE AGRI-FOOD SECTOR OF NORTH MACEDONIA: BIOCHEMICAL AND MICROBIAL PRODUCTS

SUMMARY REPORT

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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 North Macedonia 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 of North Macedonia. 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.

Very few micro-sized companies in North Macedonia offer biochemical products for agri-food.

TABLE 1. ADMINISTRATIVE DATA ON NUMBER OF COMPANIES, TURNOVER AND EMPLOYEES – BIOCHEMICAL

Year	Number of employees	Number of companies	Income in MKD	Income in EUR (exchange rate 61.5)
C20.1.5 Manufacture of fertilisers and nitrogen compounds				
2019	8	8	24 312 169	395 320
2020	8	8	33 422 060	543 448
2021	8	8	29 196 760	474 744
C20.2 Manufacture of pesticides and other agrochemical products				
2021	5	4	1 691 000	27 496
M72.1.1 Research and experimental development on biotechnology				
2019	9	5	5 098 588	82 904
2020	10	5	5 677 306	92 314
2021	3	7	3 998 472	65 016

Source: Central Registry of the Republic of North Macedonia.

The value of fertilisers and nitrogen compounds imported to North Macedonia in 2021 was nearly EUR 24 million. Significant amounts were imported from Russia (EUR 5.7 million), Bulgaria (EUR 5.1 million), Greece (EUR 3.4 million) and Croatia (EUR 2.5 million).[2] Most of the fertilisers are imported in bulk and packed locally in consultation with the farmers and depending on their needs. During the interviews, it was also indicated that biofertilisers are mostly used also on so-called micro-organic farms, which produce and sell organic products door-to-door, and in some restaurants.

Biofertiliser production in North Macedonia is still marginal in terms of the quantity produced and the companies operating. While there is only one large enterprise that produces chemical fertilisers and similar products, there are several small producers of innovative biochemical and microbial products. Several companies[3] produce biofertilisers with small quantities exported to countries in the region; their use is not monitored or registered.

There are several companies working in the field of biotechnology whose main activity is analysing and testing the quality of water, food, soil and air, and to a lesser extent researching and developing new products, such as biopesticides and enzymes for winemaking.[4] These products are now under testing and expected to be developed and brought onto the market within the next 3 years. Research and experimental development in biotechnology is present among a small number of domestically owned private companies and one public company. During the interview process, it was pointed out that the sector received very limited public funding and that most of the operations are implemented through foreign-funded donations.

Premixes for animal feed are also produced in the country, with a small number of domestically owned companies offering domestically produced and imported products. Premixes for animal feed are

[2] Available here.

[3] Organika Nova is a small family-run company that produces organic microbiological fertilisers, biostimulators and soil improvers produced from manure processed by Californian red worms.

[4] Bioengineering is a domestically owned company that, in 2022, received co-funding from the FITD (Fund for Innovation and Technological Development) for the marketing and sale of North Macedonian indigenous yeasts for the production of local wine.

tailored to meet the specific nutritional requirements of different types of animals, such as poultry, pigs, cattle, bees, goats, sheep and domestic pets. Premixes are usually added to a base feed material, such as grain, to create a finished feed product that is nutritionally enhanced for animals. There is currently no official data available on quantities produced and imported.

A small number of local companies also produce biofuels. Data from the SSO on biofuel imports show that in the past few years, the value of imported biofuels was around EUR 0.5 million annually, while no significant exports are registered. In the absence of national legislation and with the alignment of legislation with EU regulations, the sector remains likely underestimated, with untapped potential for economic development.

At the time of the interviews, the activities of the companies that took part were focused on the local market only. Disruptions in global supply chains[5] in the aftermath of the 2020 pandemic, together with the energy crisis that emerged in the beginning of 2022, prevented most of the companies in the niche from planning new recruitment and investment in the next 1-year period.

SKILLS DEMAND

None of the companies interviewed were actively hiring or looking for new employees. However, some insights on the skills required in the niche could be made based on their current staff profiles. Most current employees of the interviewed companies have completed higher education in agriculture, veterinary science, genetics, biology, chemical engineering or other natural sciences, while some have completed secondary education only. The corresponding occupations in terms of the ESCO Classification include the following:

- 2144.1.2 - agricultural engineers, 2132.1 – agricultural scientists, 2132.2 – agronomists, 2133.11 – soil scientists, 3142.1 – agricultural technicians;
- 2250 – veterinarians, 3240 – veterinary technicians and assistants;
- 2131 – biologists, botanists, zoologists and related professionals, particularly 2131.4.8 – geneticists, and 2131.4.10 – microbiologists;
- 2145.1 – chemical engineers, 2131.4.2 – biochemists, 2145.1.1 – biochemical engineers.

Although current employees of the companies interviewed are generally highly skilled, experienced and specialised in production, many of their skills in the niche are obsolete: modern technologies are not used in the production processes, while modern marketing strategies and channels are not utilised for sales promotion. This is one of the reasons why sales and operations are limited to the domestic market and companies are not internationalising. Therefore, demand for the following occupations is expected to increase in the future:

- genetics engineers, microbiologists and biochemical engineers, whose skills need to be updated frequently because rapid technological advancement is rendering these skills obsolete;

[5] During the interviews, it was revealed that the sanctions introduced by North Macedonia on Russia have forced companies to purchase compounds for fertilisers from Türkiye and Greece, which may decrease their price competitiveness in the future.

- experienced project coordinators, who are needed to coordinate multiannual research programmes among several partners from different countries (ESCO 1219.6 – project managers);
- salespersons with the skills needed to bring products to market abroad (e.g. ESCO 1324.3.2 – import export managers, 3331.2.1 – import export specialists, 2433.6 – technical sales representatives and 3322.1 – commercial sales representatives).

The interviewees also pointed out the need to strengthen research cooperation with research centres from more advanced economies in the field, especially in postgraduate studies, since domestic universities do not offer the necessary skill sets in education and training for the positions where companies plan to hire or outsource.

SKILLS SUPPLY

Vocational education and training

Profiles in VET schools that have curricula related to the production and application of fertilisers, pesticides and nutrition products for animal feed are agrotechnicians, technicians in phytomedicine and technicians in veterinary medicine. However, during the interview process, company representatives expressed concern that the curricula do not offer the right skill set needed in their companies and that there is a need for on-the-job training, which takes 6 to 12 months. Skills shortages were reported in relation to the increased automation of processes, the need for the use of IT tools, the use of e-commerce, the use of sensory components, reading the results, etc. Companies solve the issues of skills shortages in various ways, such as in-house and on-the-job training, supporting employees by sending them to attend courses domestically and abroad, and providing subscriptions to online courses.

Intermediary bodies

Most of the companies interviewed are members of chambers of commerce, from where they receive notifications and information on opportunities for cooperation domestically or abroad. However, business intermediary bodies have not picked up on the sector's potential and do not provide targeted support to companies and their initiatives.

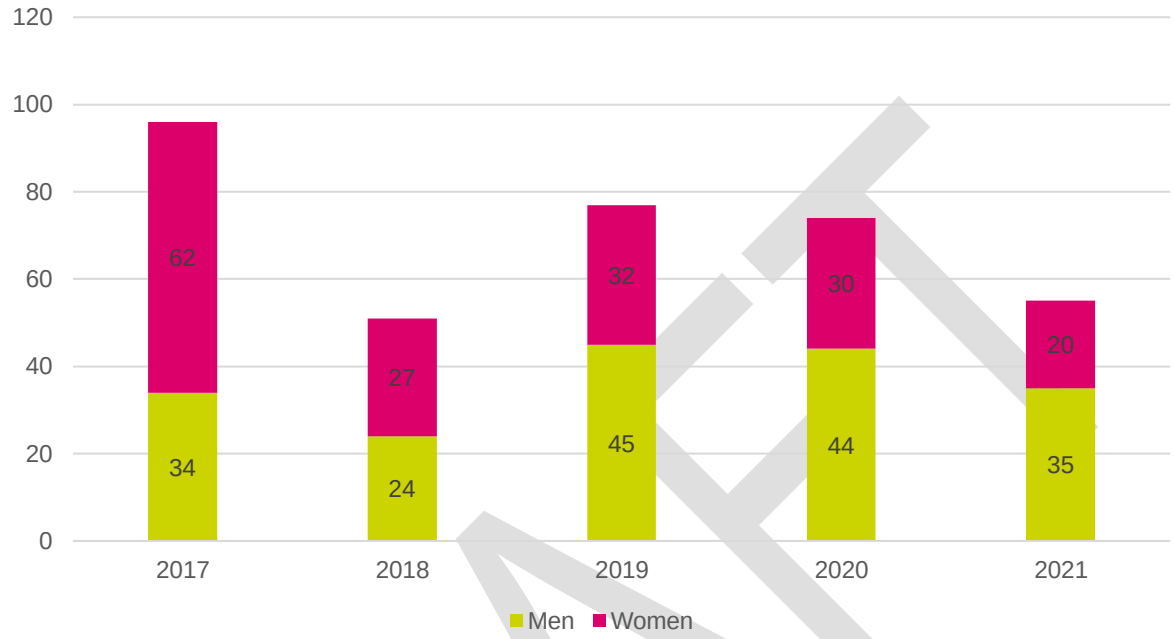
Higher education and research

University-level education in biotechnical sciences, food technology and veterinary medicine, which are relevant to the sector niche, can be obtained at five faculties[6] in the country. However, trends

[6] Faculty of Biotechnical Sciences-UKLO, Faculty of Veterinary Medicine- UKLO, Faculty of Veterinary Medicine- UKIM, Faculty of Food Technology – UT, Faculty of Agricultural and Biotechnical Sciences – UT.

show that interest in the sector has decreased over the last period and only 55 students graduated in 2021 from all five faculties combined.

FIGURE 1: NUMBER OF GRADUATES FROM FACULTIES OF BIOTECHNICAL SCIENCES, FOOD TECHNOLOGY AND VETERINARY MEDICINE, BY SEX



Source: State Statistical Office Makstat, own representation. Available here.

The supply of workers in the biochemical and microbial sectors is characterised by severe deficit, as these sectors are less present in the country and the profiles offered by educational providers are limited and have a small number of graduates. The System of National Accounts, for example, estimates a need of 150 positions for chemical engineers, biologists and veterinarians, which is three times more than the number of graduates in 2021.

Due to the lack of qualified experts in the field domestically, companies often rely on expertise from abroad. Know-how transfer is also achieved through short training visits in more advanced countries such as Israel, Italy, the Netherlands and Germany. Most of the products present in the market (e.g. fertilisers, pesticides, biofuels, enzymes for food production, premixes for animal feed, etc.) are imported from abroad, and usual practice is that the sellers provide training to the local resellers on how to use and sell the products.

Companies in the field of biotechnology encounter shortages of highly specialised staff on the local labour market. Hence, cooperation with research centres (e.g. MASA, the Macedonian Academy of Sciences and Arts) and universities partially solves the issue, as companies engage researchers from research and education institutions on a project-by-project basis. Their occupations include genetics engineers, microbiologists and biochemical engineers. The representative of one of the companies interviewed also mentioned that the company values graduates and researchers who have obtained degrees in western countries.

There are also examples where companies, such as Bioengineering, have signed memorandums of cooperation with universities – specifically with the Faculty of Natural Sciences and Mathematics – on

hiring new graduates with a particular focus on molecular biology. This practice enables students to train with equipment and instruments owned by the companies (bioreactors, testing equipment, instruments for DNA sequencing and similar), which is non-existent or outdated at faculty laboratories.