Balkan Agro Food Network

Support the opening of the European Research Area by developing a sustainable network in agricultural and food sector in the Western Balkan

Agri-food research
in the Western Balkan Countries:

AGRIFOOD RESEARCH IN BOSNIA AND HERZEGOVINA
National Mapping Report

This publication is part of a project called "Setting up of an agricultural & food research network in the Western Balkan countries", which has been awarded financial support by the European Commission through Contract no. 026361 under the Sixth Framework Programme for Research, Technological Development and Demonstration Activities (2002 to 2006), and its specific programme 'Integrating and Strengthening the European Research Area – Specific measures in support of international co-operation'.

Editor's note

This 'mapping report' is a country-specific synthesis of the statistical information and the survey results available to describe agrifood research in Bosnia and Herzegovina. The main source of information was the web-assisted survey conducted in the BAFN project frame in 2006 and 2007. When relevant, available complementary statistics were also used.

It needs to be stressed that Bosnia and Herzegovina, as a young and small economy, has only few agrifood research capacities. Altogether, a total of 34 research units were identified of which 13 have answered the survey questionnaire. This gives an acceptable yet rather moderate base for most of the statements in this report. It means that although no major deviations would be expected if there were more responses, still, the survey results should be considered more as orientating and not as exact figures.

In providing a more general context to the mapping, GKI Economic Research Co. has relied upon the statements in the *Review Document* prepared by our BAFN project partners: the University of Banja Luka, Faculty of Technologies, the Institute for Genetic Engineering and Biotechnology, and ETAT S.A.

CONTENT

1. Agriculture and agrifood industry

Bosnia and Herzegovina declared independence of Yugoslavia in 1992. Subsequantly a three-year long war followed, which had a dramatic impact on the country's physical infrastructure and economy. Since the Dayton Peace Agreement in late 1995 the production capacity has been mostly restored.

Despite existing political, legal and economic problems, **Bosnia and Herzegovina is rather slowly but steadily going on the bumpy road to be an EU member country**. This is a rational orientation as the EU is Bosnia and Herzegovina's main trading partner, accounting for around 69 % of exports and 60 % of imports (*European Commission, Progress Report* [2007]).

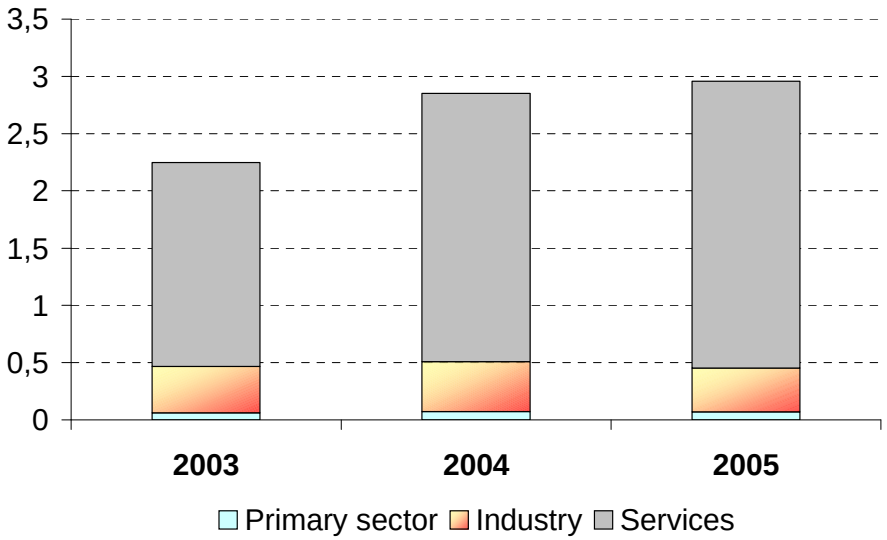
The per capita GDP in Bosnia-Herzegovina today is about 2200 euros, unemployment is slightly below 30%, the foreign trade deficit is deeply in the red causing most of the current account deficit. Overall, unemployment is very high and job creation is hampered by significant structural rigidities, in particular high taxation of labour, distorted wage-setting mechanisms and low labour mobility. Relatively high and poorly targeted social transfers reduce the incentive to actively seek a job. **Economic prospects are not necessarily great** as the substantial international aid to the country is likely to decrease in the future and re-vitalising the overstaffed and outdated industrial structure is quite a challenge. (*Review Document* [2007], *European Commission, Progress Report* [2007])

The current account deficit almost halved to around 11% of GDP from 2005 to 2006, primarily due to a reduction of the trade deficit by around 11 percentage points of GDP. The introduction of VAT in January 2006 led to more accurate reporting of export values and a frontloading of imports. (*European Commission, Progress Report* [2007])

The service-sector accounts for 60%, industry for 24 % and agriculture for 16% of the GDP. No data on employment in agriculture was available. **The food industry has low significance**. Nevertheless, as the *Review Document* [2007] notes, development of the manufacturing industry (equipment or machine parts for primary agriculture production and agrifood industry) is one of the strategic goals, but it requires reorientation of manufacture in existing companies or investments in new factories.

Fig.1

GDP in the three main economic sectors (billion euro)



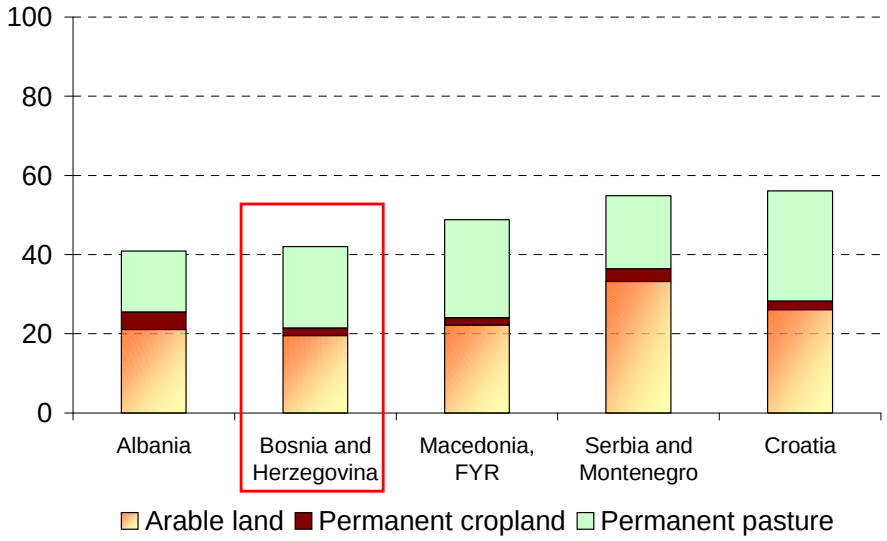
Source: *Review Document* [2007] Note: correct statistical reference will be needed.

The country is traditionally a net importer of agrifood products although the EU allows more than 95 % of its imports (including agricultural produce) to enter the EU duty-and-quota free. Exported goods are base metals, wood and wood products, mineral products and chemicals, while imports mainly include machinery, mineral products, foodstuffs and chemicals (see the *Review Document* [2007]). The export of agricultural products is about US$ 370 million and that of food industry is about US$ 140 million per annum (WTO statistics for2005). Although agriculture is almost all in private hands, farms are small and inefficient.

The natural conditions are not favourable for agriculture, the general landscape is mountainous and relatively dry. **About 42% of the land is used as agricultural land.** Most of the agricultural land is permanent pasture (49%), about 47% is arable land, the rest (4%) is permanent cropland (in 2003, see the WDI 2006 database for Bosnia and Herzegovina).

Fig.2

Agricultural land as a % of land by type



Source: WDI 2006 database

During the disintegration of Yugoslavia, civil fighting in the major agricultural areas **often interrupted harvests** and caused considerable loss of field crops. The 2005 harvest showed already the signs of recovery. The livestock population also fell significantly during the 1990s.

Production of meat fell from 158,000 tons in 1990 to about 100,000 tons in 1993 to 24,000 tons in 1999.

Table 1

Agrifood industry performance indicators: Bosnia and Herzegovina

	1990	1995	2004
Agriculture value added per workers in agriculture (constant 2000 US$)	2 951*	2 751	5 671**
Agriculture value added per sq. km of agricultural land (current US$)	20 466	17 765	37 508
Export of agricultural products (% share of world trade)	n.a.	n.a.	0,04
Export of food products (% share of world trade)	n.a.	n.a.	0,02
Food export per agricultural worker (current 1000 US$)	n.a.	1,1	1,1
Food import per population (current US$)	n.a.	358	314

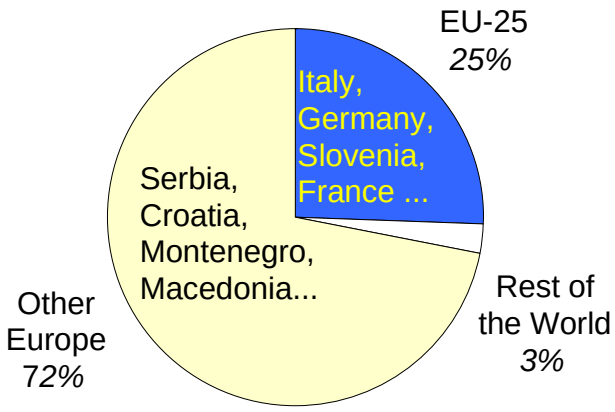
Source: WDI 2006 database, *1992, WTO statistics, **2003

Despite the food industry's low significance, the main exported agrifood products of Bosnia and Herzegovina as identified by the *Review Document* [2007] are the following:

- meat and meat preparations;
- fresh river fish, smoked and dried fish meat;
- milk and dairy products (UHT milk, cheese, spread cream)
- fruit and vegetable;
- sugar and products (highly laevulose syrup, honey);
- fruit tea; and
- dried tobacco

Fig.3

Export products by main trading partners



Source: *Review document* [2007]. Note: correct statistical reference will be needed.

The *Review Document* [2007] mentions that the size of the export markets of agrifood products is **in correlation with the number of emigrants** from Bosnia and Herzegovina.

It has to be mentioned that there is no countrywide agricultural strategy, and the State-level Ministry for Agriculture, Food and Rural Development has not been established either. Entity legal frameworks for agriculture remain not harmonised. (*European Commission, Progress Report* [2007])

2. Agrifood research capacities

2.1. Institutional structure

In Bosnia and Herzegovina **no private business was identified** as an organisation that conducts agrifood research. Probably there are some companies, which undertake such research activities, but the fact that they are presumably few in number as compared with state-owned institutions (especially higher education units) contrasts global agrifood research trends in the developed countries.

Table 2

Number of agrifood research groups identified and response rate to the BAFN survey in March 2008

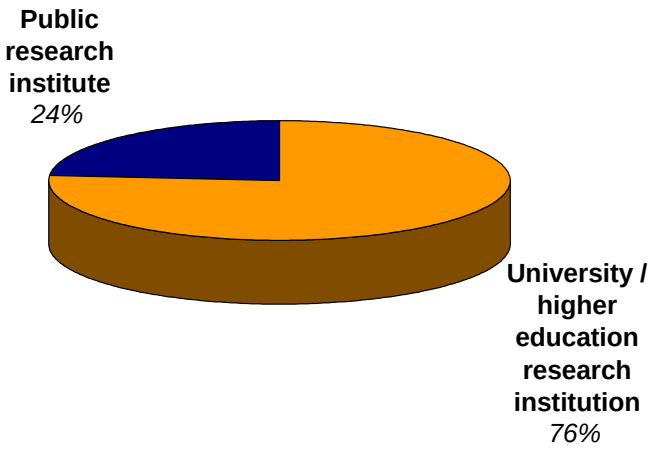
	Number of research groups	Response rate (%)
University / higher education research institution	26	46
Public research institute (e.g. Academy of Science, government research organisation, etc.)	8	13
Private non-profit institution	0	0
Business enterprise	0	0
Other	0	0
Total	34	38

Source: BAFN Survey, March 2008

In Bosnia and Herzegovina the number of agrifood research groups totals 34, of which 76% (26) is in a university or a higher education institution and the remaining 24% is in a public research institute (e.g. Academy of Science, government research organisation, etc.). Thus, **the majority of agrifood research groups belong to higher education research**. The detailed list of organisations can be seen in the Annex.

Fig.4

Agrifood research groups identified by type (%)



Source: BAFN Survey, March 2008

By March 2008 the BAFN Survey questionnaire was responded by 12 university and higher education unity, and only by 1 public agrifood research institute.

2.2. Financing agrifood R&D

Specific **S&T and related institutions have not been set up** or are still not functional. The Federation of Bosnia and Herzegovina, the Republic of Srpska and the self-governing district of Brčko have their own governments, and the cantons within the Federation also have powerful local governments with a strong influence on the S&T sector (Science and Technology Country Report – Bosnia and Herzegovina, see-science.eu, 2007 quoted by the *Review Document* [2007]).

Not surprisingly, **there are no offical R&D statistics**. In Bosnia and Herzegovina the government dominates R&D spending, which is estimated to be very low: around 0.05-0.15% of the GDP (2001 data, quoted by the *Review Document* [2007]). Due to limited R&D funds, it is reported that universities have become purely educational institutions (Uvalic, UNESCO, quoted by *Review Document* [2007]). We should note that most of the agrifood research units are universities.

The *Review Document* [2007] identified the following key S&T policy trends:

- at government level, only the Republic of Srpska could tell to have allocated direct funding for agrifood R&D;
- indirect policies could be the investment tax credits, business awards, access to infrastructures, encouragement for participation in brokerage events or trade fairs etc;
- gradual integration into the European Research Area (ERA), and inclusion into the European Investment Bank's Innovation 2000 Initiative ought to prove useful;
- the Instrument for Pre-Accession Assistance (IPA) during the period 2007-2013 shall partly support S&T infrastructure and related activities

The state of development above assumes very low agrifood R&D spending. By March 2008 13 agrifood research organisations from Bosnia and Herzegovina took part in the BAFN survey. Their response to the question on research budget financing shows that **funds from abroad and government subsidies** are the most important source of financing agrifood R&D in Bosnia and Herzegovina.

2.3. Human resources

Over the last fifteen years, there have been two processes directly affecting the R&D sector: the massive and continuous '**brain-drain**', frequently of top experts who emigrated to seek employment opportunities abroad; and the so-called '**brain-waste**', when specialists left their professions for better paid jobs in the private and/or informal sector of the economy. Both phenomena have had profound implications for the human capital of Western Balkan countries' and especially in Bosnia and Herzegovina. The four-year war **destroyed the country's productive and technological base** and led to significant brain drain, especially of young people (Uvalic, UNESCO quoted by the *Review Document* [2007]).[1]

By March 2008, the 13 respondent agrifood research organisations (38% of the total) reported 143 researchers on a Full Time Equivalent (FTE) basis. Therefore, **the number of researchers in the agrifood sector is estimated at 350-400**. This estimate is in line with the *Review Document* [2007] quote:

[1] A sample covering one third of staff capacity (technical sciences) found that 79% of research engineers, 81% of holders of Masters Degree in science, and 75% of holders of PhDs in science had left the country. After the war, by December 1998, some 25,200 students had returned home, but this figure represented only 7% of the total number of students (for references see the ***Review Document*** [2007]).

Table 3

Total number of researchers in the agrifood sector as estimated for 2006

Agriculture and Veterinary Science	150
Food Science & Technology	129
Natural Resources Management & Agricultural Engineering	25
Rural Economics & Development	10
TOTAL	314

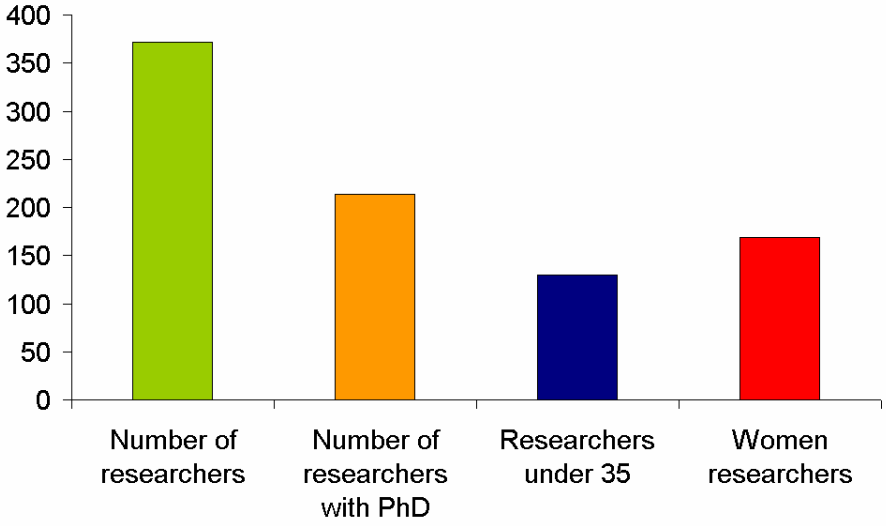
Source: *Review Document* [2007]

11 of the surveyed agrifood research organisations employ less than 15 employees – all of them is a university unit. Only one of the respondents has 21 employees (Laboratory for Plant Biotechnology, Sarajevo), and one employs 93 people (Institute of Technology of Agricultual and Food Products, Sarajevo). 168 employees work in higher education institutions, the remaining 21 in public research institutes.

57% of the agrifood researchers have a Ph.D. degree or higher. Slightly more than one third of the researchers are under 35 and the proportion of women reaches 46%.

Fig.5

Estimated number of agrifood researchers (FTE) in the public sector 2006-2007



Source: BAFN Survey, March 2008

More than 68% of the research personnel in Bosnia and Herzegovina work on three scientific fields:

- economic, social and political aspects;
- food technology, human nutrition and consumer concerns;
- plant breeding and biotechnology.

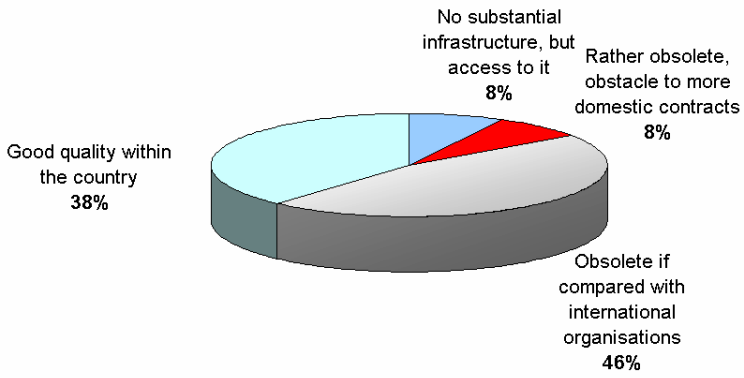
The *Review Document* [2007] also notes that **age discontinuity** is a serious problem in scientific institutions in general and agrifood research units in particular.

2.4. Research infrastructure

In Bosnia and Herzegovina 54% of the research institutions have obsolete research infrastructure, 38% has good quality infrastructure within the country, nevertheless there are no research units with internationally competitive research infrastructure.

Fig.6

Quality of the research infrastructure



Source: BAFN Survey, March 2008

Most of the few agrifood research units in Bosnia and Herzegovina has obsolete and outdated technological infrastructure.

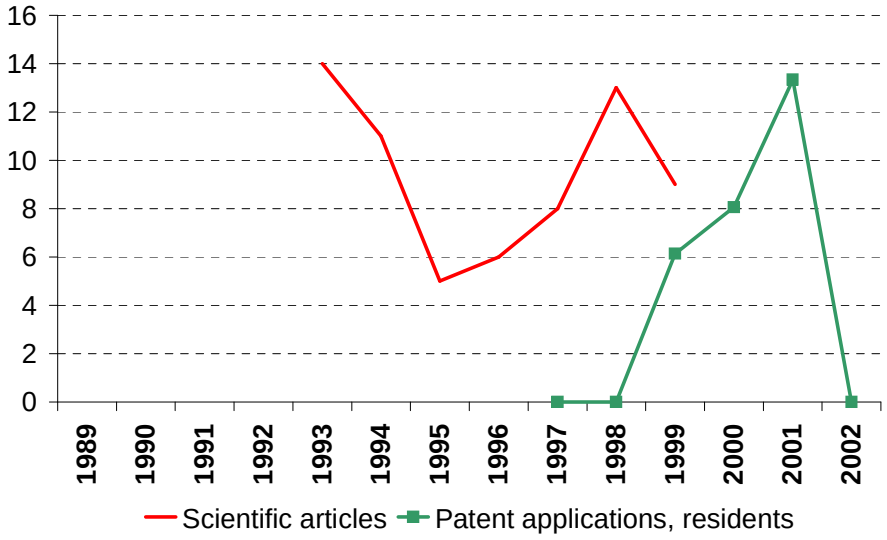
3. Agrifood research performance

3.1. Innovative and scientific output

The political and economic calamity of the 1990's has had a great impact on the scientific and technological productivity of the country. The number of scientific and engineering articles as well as that of patents per population is **hectic and very low** and no development can be seen.

Fig.7

Scientific articles and resident patent applications per million people



Source: WDI 2006 database

Over the last 3 years all agrifood research units published articles, but only 2 commercialized new products and technologies, while no patent applications were filed. These numbers show **limited innovation capabilities** even if compared with the New Member States of the European Union (preliminary results from the *AgriMapping* project).

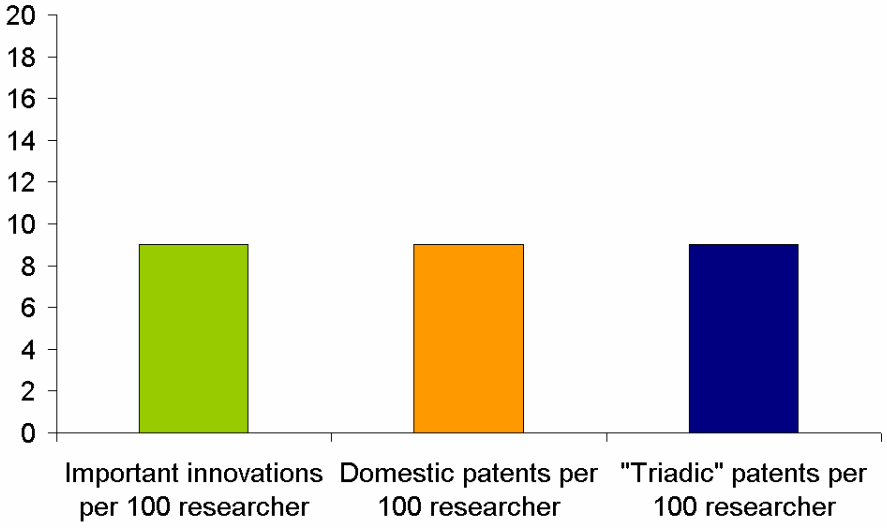
To measure the real innovative impact and relative scientific performance, the BAFN consortium decided to measure the following:

- *Important innovation*: a new product / technology / organisational mode / tool or method had or contributed to an additional turnover of more than EUR 100 thousand or more than 500 people use a new product/technology or it saved life or improved the quality of life substantially. The research organisation's contribution is substantial if at least one third of the new knowledge came from the research organisation.
- *Triadic patents*: patents granted by the EPO (European Patent Office) and/or JPO (Japan Patent Office) and/or the USPTO (United States Patent and Trademark Office).
- *International publications*: publications in journals reviewed by the Institute for Scientific Information

The research units of Bosnia and Herzegovina developed 9 important innovations, patented 9 domestic and 9 Triadic patents per 100 researchers between 2003-2005. With the exception of triadic patents, these numbers are very low as compared with the New Member States of the EU (preliminary results from the *AgriMapping* project).

Fig.8

Innovation indicators



Source: BAFN Survey, March 2008

The **most significant research areas** in the agrifood sector by research activity according to the BAFN Survey (May 2007) are the **economic, social and political aspects and food technology, human nutrition and consumer concerns**.

Table 4

Agrifood research activity by research areas

	Number of important innovations	Number of international patents (EPO, JPO, USPTO)	Number of large projects	Number of articles in international journals	Number of studies and reports*	Number of standards written**
Economic, social and political aspects	0	0	3	0	39	0
Food technology, human nutrition and consumer concerns	0	0	1	0	28	0
Engineering, mechanisation, ICT	0	0	0	0	0	0
Plant breeding and biotechnology	0	0	2	1	0	0
Plant production and protection	0	0	0	0	1	0
Animal production and husbandry	0	0	0	0	2	0
Animal health and welfare	0	0	0	0	0	0
Aquaculture and Fisheries	0	0	0	0	2	0
Forestry and landscape	0	0	0	0	4	0
Management of natural and biological resources	0	0	0	0	10	0
Horizontal issues	0	0	0	0	1	0
Not identified research area	13	13		17		
Total	**13**	**13**	**6**	**18**	**87**	**0**

Source: BAFN Survey, March 2008

* Only reports financed by and / or supplied to national (and international) organisations. The research group is a major contributor to these reports: at least one third of the knowledge should come from the research group.

** Only approved standards. The research group is a major contributor to these reports / standards: at least one third of the knowledge should come from the research

3.2. Research competence

Research competence is shown by two rather different measures:

- the ability to take part in and conduct large *research projects*, in which the total project budget is above EUR 100 thousand and the research organisation's share is at least EUR 20 thousand;
- the ability to *attract foreign researchers* for doing real research work, which is defined with the help of the hosting period (hosting a foreign researcher for more than 6 weeks).

The number of ongoing large research projects[2] was 18 in 2005 in Bosnia and Herzegovina, of which 17 was realized in collaboration with industry, 17 was co-ordinated by the surveyed research organizations and 14 of the projects were organized relating the EU Framework Programme. 14 large projects were completed in 2005, all in collaboration with industry (and all in co-ordination of the research organisation). 13 of the large projects run in the framework of European Union programmes. The rather **high weight of the EU shows that agrifood R&D in Bosnia and Herzegovina mostly means smaller projects**. Large projects per 100 researchers is lower than the average as compared with the New Member States of the EU, with the exception of projects done with industry involvement: they are slightly above the average (preliminary results from the *AgriMapping* project).

Table 5

Number of large agrifood research projects in Bosnia and Herzegovina

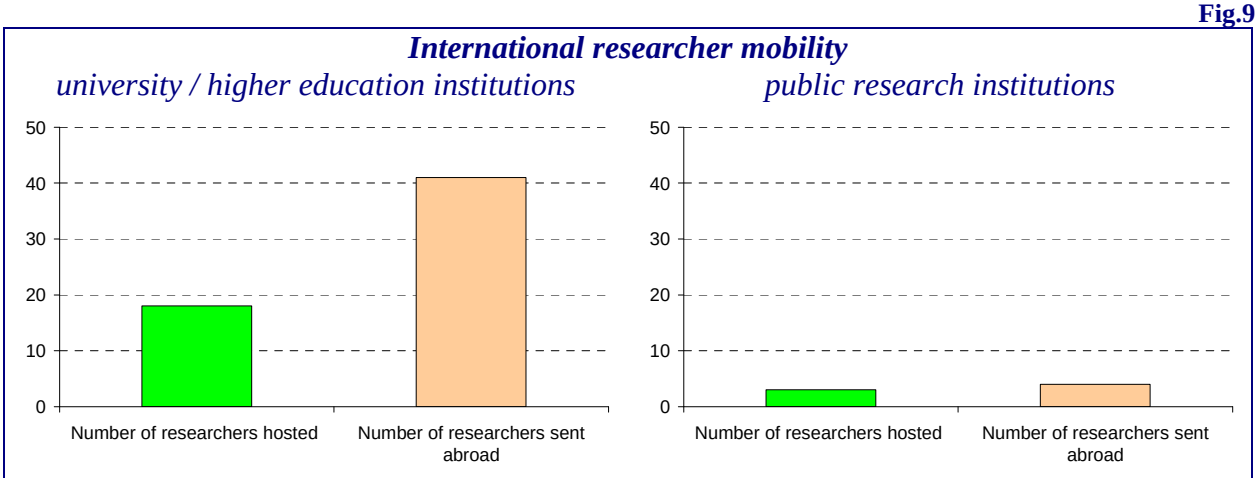
	Ongoing / started in 2005	Completed in 2005
Number of large research projects*	18	14
Of which		
projects in collaboration with industry	17 (94% of total)	14 (100%)
projects in which the organisation co-ordinates	17 (94%)	14 (100%)
European Union Framework Programme projects	14 (78%)	13 (93%)

* the total project budget is above EUR 100 thousand and the organisation's share is at least EUR 20 thousand
Source: BAFN Survey, March 2008

In 2003-2005 the total number of foreign researchers hosted for more than 1,5 months (without those, who came to acquire a Ph.D. degree) in the period 2003-2005 was 21, at the same time the number of researchers sent abroad to do research for at least 1,5 months was 48. Compared to the population of Bosnia and Herzegovina and especially to the number of researchers, **the ability to attract foreign researchers is very poor**.

Fig.9

International researcher mobility



Source: BAFN Survey, March 2008

[2] The total project budget is above EUR 100 thousand and the organisation's share is at least EUR 20 thousand.

Nevertheless, **international researcher mobility is the most intensive on the scientific fields of food technology, human nutrition and consumer concerns** and **horizontal issues.** This finding is in line with the importance of these research areas in terms of human resources and infrastructure.

In relative terms (as a percent of researchers), Bosnia and Herzegovina attracts more foreign researchers than the New Member States of the EU, whereas the country is an above-average sender of its own researchers abroad (preliminary results from the *AgriMapping* project). This shows some dynamics on the few agrifood research fields the country pursues. Nevertheless, there is a strong **general trend of brain-drain** in the agrifood sector.

4. Concluding remarks

Born in war, Bosnia and Herzegovina has had history as a state only for less than two decades. Settling legal and political issues as well as building the basic economic institutions still come before a unified national science and technology policy. The policy institutions of a national innovation system (NIS) are still missing.

The independent country's short history and the war damages also explain why there are only few and rather small agrifood research capacities. Together with Albania, Bosnia and Herzegovina has the smallest agrifood research capacities among the BAFN countries (Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia). The sector is dominated by state-owned institutions. Many university and public research institute capacities lack middle-age researchers, which is a consequence of war and uncertainty. Altogether, the number of researchers in the agrifood sector is estimated at 350-400. Brain drain and brain waste processes are still going on, they are expected to slow down in parallel with economic stabilisation.

Agrifood research capacities are concentrated on scientific fields, which are less technology-intensive (economic aspects and horizontal issues), but some specific competence in food technology, human nutrition and consumer concerns could also be shown. The general state of agrifood research infrastructure is rather poor.

Quality agrifood research in Bosnia and Herzegovina seems to be dependent on the international community. The European Union in general and the Framework Programmes in particular are important initiatives to keep agrifood research above the water surface.

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Nations Encyclopedia

Review document on the current situation for Bosnia and Herzegovina. BAFN working paper 2007. Written By: University of Banja Luka, Faculty of Technologies, Institute for Genetic Engineering and Biotechnology. Information Compiled - Revised by ETAT S.A.

Science and Technology Country Report – Bosnia and Herzegovina, see-science.eu, 2007

World Development Indicators 2006 database

Annex: Agrifood research organisations in Bosnia and Herzegovina

Name	X, if took part in the BAFN survey
Agricultural Institute (crops fruit and vegetables, feed food, pedology)*	
Džemal Bijedić University of Mostar	
The Agromediterranean Faculty	
- Department of Fruit growing and viticulture	
- Department of Vegetable growing and floriculture	
Federal Agricultural Institute of Sarajevo	
Department for animal production and technology	
Department for plant production	
Laboratory for control	
Federal Agromediterranean Institute of Mostar	
Institute for Genetic Engineering and Biotechnology	
Laboratory for Plant biotechnology	**X**
Institute for Health Protection	
University of Banja Luka	
Faculty of Agriculture (Agronomy, Husbandry, Fishing)*	
Faculty of Forestry	
- Department for Forest Ecology	
- Department for Forest Management planning	
- Department for forestry economics and organization	
- Department for Forestry Exploitation	
- Department for Silviculture and Forest Protection	**X**
Faculty of Technology	
- Department for Food Quality and Food Safety	**X**
- Department for Food Science and Food Analysis	**X**
- Department of Biochemistry and Biotechnology	**X**
- Department of Food Technology	**X**
- Department of Microbiology	**X**
University of Bihać	
Faculty of Biotechnology	
- Department for Food production	
- Department of Agriculture	
University of East Sarajevo	
Faculty of Agriculture	
- General Department	
Faculty of Technology	
- Department for General and Inorganic Chemistry	
University of Mostar	
Faculty of Agronomy	
Pan-European University APEIRON – Banja Luka (Sanitary Engineering)*	
University of Sarajevo	
Faculty of Agriculture	
- Department for agricultural economic	
Institute for agricultural economics of food technology	**X**
- Department for Animal production	
Institute for animal husbandry	
- Department of Plant production	
Institute for fruit and grape growing	**X**
Institute for plant protection	**X**
Institute of crop husbandry	
- Department of Technology of agricultural and food products	
Institute of technology of agricultual and food products	**X**
University of Tuzla	
Faculty of Technology	
- Department of Chemical Technology	**X**
- Department of Process Engineering	
Veterinary Institute of Republic of Srpska	
RENESO: Team for renewable and new energy sources	**X**

*Additions in March 2008, after the review of the first version of this report

Source: *Review Document for Bosnia and Herzegovina* [2007]