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VALUE ADDED AGRICULTURE IN SERBIA AND ITS IMPACT ON AGRICULTURE EXPORT VALUE: CASE STUDY OF GLOBALG.A.P. FRUIT AND VEGETABLES CERTIFICATION

Abstract: *The aim of the paper is to examine the statistical significance of the impact of GLOBALG.A.P. certification in crop production, as well as the realized value of fruit and vegetable production on the Serbian export value in the fruit and vegetable sector in the period 2010-2021. For the purposes of inference, a multiple linear regression model is applied. It is found that the growth in the number of GLOBALG.A.P. certified producers does not affect export value in the fruit and vegetable sector ($p=0.066$), nor does the increase in certified areas ($p=0.433$). At the same time, the value of fruit and vegetable production has an impact on export value in this sector ($p=0.001$). The results are explained by the still low representation of GLOBALG.A.P. certification in Serbian agriculture, as a result of numerous institutional constraints, as well as financial and administrative obstacles for greater progress in this process.*

Keywords: *standard, food safety, farmers, EU market*

1. Introduction

Effective management of links between agricultural development, empowerment of rural households and communities, preservation of natural resources and environmental protection, all in the context of value-added agriculture (abbr. VAA), is increasingly analyzed in the scientific literature, widely supported in the EU's common agricultural policy and applied in business practices of both developed and underdeveloped countries (Alonso & Northcote, 2013; EU, 2013; Lu, & Dudensing, 2015; FAO, 2018; Piao et al, 2019; EC, 2020; Clark et al., 2021; EU, 2021).

In addition to the traditional understanding, according to which VAA includes processed agricultural products, those whose quality

has been improved or which have been marked or branded, the VAA concept also includes agricultural products and foodstuffs within the framework of various quality schemes (EU quality schemes; national quality schemes, including farm certification schemes; voluntary certification schemes run by private operators), as well as locally and/or traditionally produced foodstuffs placed in short supply chains or by other innovative ways (Goodman, 2003; EU, 2013; Lu, & Dudensing, 2015; Clark et al., 2021).

Numerous authors have proven the positive effect of VAA on the economic empowerment of farmers, trade and export results (on the level of farmers and national economies), the revitalization of local communities and the general maximization of the potential of agriculture in the light of

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sustainable development and the achievement of environmental goals (Crozet et al., 2012; Alonso & Northcote, 2013; Kleemann et al., 2014; Latouche & Chevassus-Lozza 2015; Tran & Goto, 2019; Riamondi et al., 2020). The EU common agricultural policy perceives value added agri-food products as a way of improving competitiveness of the primary agricultural producers in value and supply chains, and also as a tool in building sustainable farming practices (EU, 2013; EC, 2020; EU, 2021).

Implementation and certification of food safety and quality systems in accordance with the certification scheme and the GLOBALG.A.P. standard is part of the VAA concept. In the world, the number of farmers who participate in the voluntary standard and certification scheme for farm production “Global Good Agricultural Practice” (abbr. GLOBALG.A.P.) is constantly growing and thus become part of the VAA concept. Within this certification scheme and standard today there are over 200,000 producers in over 130 countries of the world (GLOBALG.A.P. organization, data obtained on request). This is an internationally known and recognized set of voluntary standards, programs and certification schemes in farm production and handling of fresh agricultural products, which covers “*food safety and traceability; environment (including biodiversity); workers’ health, safety and welfare and animal welfare*” (GLOBALG.A.P. official site).

Bearing in mind the comprehensive requirements of the standard, above all its social and environmental aspects and important elements that regulate food safety, the implementation of this standard fully achieving the set goals of sustainable development, greening of the economy, circular and resource-efficient economy, as well as greater sustainability of food systems (FAO, 2018; EC, 2019; Brohm & Klein, 2020; EC, 2020; EU, 2021). At the same time, its implementation reduces the level of consumer distrust in the regular agri-food

system and meets their growing requirements related to the food risks and food safety (FAO, 2016; European Food Safety Authority, 2019; EC, 2020; Cruz et al, 2021; Niewczas-Dobrowolska, 2022).

The GLOBALG.A.P. standard importance is growing on the international market of agricultural products (especially on the market of EU15 countries), and the harmonization of production according to this standard has also pronounced positive trade and export effects (at the level of farmers, exporters and national economies), both for developed countries and for developing countries (Asfaw et al., 2009; Bain, 2010; Henson et al, 2011; Masood & Brümmer, 2014; FAO, 2016; Andersson, 2019; Laosutsan et al, 2019; Fiankor et al., 2020). Its importance is best described by Masood & Brümmer (2014, p. 15): “*since, private standards directly affects trade, even if adoption of GlobalGAP is voluntary in nature, its compliance could be quasi-mandatory for exporters competing in the international market*”.

Serbia has defined the path to improving the competitiveness of the agricultural and food sector, among other things, through reaching EU standards of quality and food health safety, environmental standards, with greater representation of VAA and improvement of food supply chains (SARD, 2014; NRDP, 2022). Implementation and certification of primary agricultural production in accordance with the GLOBALG.A.P. standard is part of the national quality policy of agricultural and food products and is under the jurisdiction of the Ministry of Agriculture, Forestry and Water Economy of the Republic of Serbia (abbr. MAFW) Sector for Rural Development. This policy includes quality schemes for agricultural and food products and food safety and quality standards and is in the process of constant alignment with current EU regulations and other internationally recognized standards (NPAA, 2022).

MAFW has been providing support to farmers for many years to reimburse part of the costs of the paid certification amount in accordance with various food quality and safety standards (Law on Incentives in Agriculture and Rural Development). As a result of this support, but primarily the demands of foreign (and increasingly domestic) trade chains, as well as the need for better positioning of producers and exporters to the EU market, Serbia is making progress in the implementation and certification of production in accordance with GLOBALG.A.P. since 2010 (SARD, 2014; Bešić et al., 2015; Paraušić & Roljević Nikolić, 2020). The production of fresh fruit (and less vegetables) is mainly certified, mainly through group certification, and the standard bearers in the group certification option are most often fruit and vegetable exporters, more precisely cold stores that gather their subcontractors (Paraušić & Roljević Nikolić, 2020; Paraušić & Grujić Vučkovski, 2023).

It is important to point out that the requirements of the standards and the development of hypermarkets (trade chains) favor the establishment of contractual and long-term cooperation of agricultural producers with exporters and buyers (Wysokiński et al., 2012), which is extremely important for Serbian agriculture, which is characterized by insufficiently organized food supply chains, as well as ineffective integration of farmers in the global food supply chain (Radić-Jean & Mihajlović, 2019; Paraušić & Roljević Nikolić, 2020).

With the above in mind, the authors examine the progress of Serbia in the implementation and certification of crop production according to GLOBALG.A.P. standard, as well as factors that influence, or, more precisely, slow down this process. Using the multiple linear regression model, the impact of the growth in the number of producers and areas under GLOBALG.A.P. certificate (crops base) on the export value of the fruit and vegetable sector from Serbia in the

period 2010-2021 is examined. Additionally, the authors include the value of fruit and vegetable production (abbr. F&V) in the same period as an independent variable, in order to examine its impact on the value of product exports of these two sectors and make a comparison in relation to the impact of GLOBALG.A.P. certification.

As the growth of foreign trade exchange, primarily exports, is a measure without an alternative to stimulate the economic growth of any country (Nikolić, 2005), the research objective is to examine the effects of the investments of agricultural producers so far in the segment of adjusting production according to the GLOBALG.A.P. standard on the export value of the national economy. The results are multifold useful both for public authorities in the process of creating support measures within the rural development policy, as well as for the scientific and academic community, especially in the sector of agriculture and rural development.

2. Material and Methods

For the purposes of analysis, value-added agri-food products are presented as products under voluntary standard for the certification of agricultural products GlobalG.A.P., more precisely under Integrated Farm Assurance (abbr. IFA) Standard.

IFA is GlobalG.A.P.'s flagship and most widely used standard, which covers different topics in farming practices like: food safety; environmental sustainability and biodiversity; workers' health, safety, and welfare; animal health and welfare; legal, management, and traceability; production processes; integrated crop management and integrated pest control; quality management system and Hazard Analysis and Critical Control Points (GLOBALG.A.P., 2022). It is divided into several different scopes and modules (Scheme 1).



Scheme 1. Modular approach to GLOBALG.A.P. IFA standard (GLOBALG.A.P., 2022, p. 5)

MAFW still does not have data on the number of agricultural producers in Serbia that implement and certify production in accordance with GLOBALG.A.P. standard, nor the number of other agricultural producers supported by the measure “Increasing competitiveness in terms of adding value through processing, as well as the introduction and certification of food safety and quality systems, organic products and products with geographical origin on farms” (NRDP, 2022, proposal). Therefore, data on the number of agricultural producers and areas certified under this standard are provided by GLOGALG.A.P. international organization (data obtained on request), which leads the standard and represents a network of partnerships of traders, manufacturers and other participants, based in Germany.

According to GLOBALG.A.P., certification in Serbia is dominantly present in crop production, and 99% of producers under this standard are in the F&V sector. Bearing this in mind, the following section examines the impact of certification in crops base on the export value of Serbia in the F&V sector in the period 2010-2021. The independent variables are (Table 1):

- ✓ Producers under GLOBALG.A.P. IFA certificate (number) and
- ✓ Area under GLOBALG.A.P. IFA certificate (ha).

Additionally, the authors include the value of F&V production in Serbia in the period 2010-2021 as an independent variable, in order to examine its impact on the export value of these two sectors and make a comparison in relation to the impact of GLOBALG.A.P. certification (Table 1).

The authors obtained one segment of data on the implementation of GLOBALG.A.P. standard in Serbia through a semi-structured interview with three consultants on this standard, employed in three different certification companies on the domestic market (Paraušić & Grujić Vučkovski, 2023).

The data is presented and analyzed using descriptive statistics, and a multiple linear regression model is used to examine the impact of independent variables on the dependent variable. The significance of the model is tested using the F-test, and the model is statistically significant at the 0.05 level. Testing the significance of the model coefficients relies on the t-test. The data is processed in the R statistical program.

Table 1. Dependent and independent variables in the multiple linear regression model (Authors' presentation)

Variables	Description
Dependent variable	
Export in F&V sectors from Serbia, value, US\$	Total export value of sectors 07 (Edible vegetables and certain roots and tubers) and 08 (Edible fruit and nuts; peel of citrus fruit or melons). Source: The International Trade Centre (ITC), Trade Map.
Independent variables	
Producers under GLOBALG.A.P. IFA certificate, No, Crops base	The number of producer under certification reflects all individual producers under IFA certificate (a single producer as well as the individual members of a producer group). Source: GLOBALG.A.P. organization, data obtained on request.
Area under GLOBALG.A.P. IFA certificate, ha, Crops base	Uncovered and covered area, certified hectares. Source: GLOBALG.A.P. organization, data obtained on request.
Domestic F&V production, value, US\$	Sum of production value of the following product groups: vegetables and horticultural products, potatoes (including seeds), and fruits. Values converted into US dollars based on the average exchange rate for US dollars of the National Bank of Serbia. Source: Statistical Office of the Republic of Serbia. Economic Accounts for Agriculture.

3. Results and discussion

Independent variables, producers under GLOBALG.A.P. IFA certificate and area under GLOBALG.A.P. IFA certificate (crops base), show a pronounced growth trend in Serbia in the period 2010-2021.

The number of certified producers increased from 78 (2010) to 973 (2021), and the largest number of producers with this standard (1,075) was registered in 2020 (Table 2). Certified areas in crop production from 1,543 ha in 2010 reached 13,051 ha in 2021, with the largest areas (close to 30,000 ha) being certified in 2020 (Table 2). The number of certified producers in the analyzed period grew at an average annual rate of 25.8%, and the certified area at a rate of 21.4% (Table 3).

It is important to emphasize that despite these positive trends, the share of producers who certify production according to the GLOBALG.A.P. IFA standard in the total number of agricultural holders in production types 2, 3 and 6 is extremely low and ranges

from 0.3% in 2012 to 0.6% in 2021 (Table 2). Also, the share of certified areas in the used agricultural land of producers in production types 2, 3 and 6 is low and ranges from 1.1% in 2012 to 2.4% in 2021 (Table 2).

Independent variable, value of F&V production in Serbia in the period 2010-2021, on average, amounted to 1,209 million US\$ and grew on average annually at a rate of 1.9% (Table 3). The coefficient of variation (12.94%) indicates that the variable variability is relatively weak (Table 3).

The export value of the F&V sector from Serbia, as a defined dependent variable, in the analyzed period amounted to an average of 679 million US\$, and the coefficient of variation (27.76%) shows that it has relatively weak variability, but close to moderate (Table 3). The value of the variable in the analyzed period grew at an average annual rate of 9.0%, it being the highest in 2021 (US\$ 1,109 million) (Table 2, Table 3).

Table 2. Producers and area under GLOBALG.A.P. IFA Certification in crop production in Serbia, value of domestic F&V production and export value of F&V from Serbia, 2010-2021 (^a GLOBALG.A.P. organization, data obtained on request. ^b Statistical Office of the Republic of Serbia. ^c The International Trade Centre (ITC), Trade Map. ^d Author's calculation)

	Producers under IFA Certif., No. ^a	Area under IFA Certif., ha ^a	Share of producers under IFA Certif. (%) ^{1, 3, d}	Share of area under IFA Certif. (%) ^{2, 3, d}	F&V production, value US\$, 000 ^b	F&V, export value US\$, 000 ^c
2010	78	1,543.00	-	-	1,306,141	430,785
2011	336	4,448.00	-	-	1,308,674	526,000
2012	280	4,968.00	0.26	1.06	1,081,058	434,487
2013	66	892.92	0.06	0.19	1,268,520	555,999
2014	284	23,285.56	0.26	4.97	1,114,939	643,109
2015	344	20,525.54	0.31	4.38	1,129,028	671,629
2016	442	24,638.89	0.40	5.26	1,163,285	708,295
2017	509	23,749.14	0.46	5.07	1,127,637	770,754
2018	704	24,336.26	0.43	4.55	1,078,312	708,095
2019	1001	24,554.88	0.61	4.59	1,048,713	735,147
2020	1075	29,330.56	0.66	5.49	1,270,219	855,930
2021	973	13,051.20	0.60	2.44	1,608,213	1,109,249

¹ Share of IFA certified producers in the total number of agricultural producers in agricultural production types 2, 3 and 6. ² Share of IFA certified areas in the total area of used agricultural land of producers in types of agricultural production 2, 3 and 6. ³ Type 2 (Specialized farms for vegetable growing, floriculture and other horticulture), type 3 (Specialized farms with permanent crops) and type 6 (Mixed farms for plant production). Period 2012-2017 (Census of Agriculture, 2012). Period 2018-2021 (Farm structure survey, 2018).

Table 3. Descriptive statistics of analyzed variables, 2010-2021 (Authors' presentation)

	Producers under IFA Certif, no. ¹	Area under IFA Certif., ha	F&V production, value, US\$, 000	Export of F&V, value, US\$, 000
Average 2010-2021	508	16,277.00	1,208,728	679,123
Min	66	892.92	1,048,713	430,785
Max	1,075	29,330.56	1,608,213	1,109,249
Std. Deviation	351.94	10,569.16	156,415.83	188,528.34
Coefficient of variation, %	69.32	64.93	12.94	27.76
Compound Annual Growth Rate 2010-21, %	25.8	21.4	1.9	9.0

In order to examine the impact of independent variables on the dependent variable (export value of the F&V sector in Serbia), the authors used a multiple linear regression model (equation 1):

$$\beta^0 B + \beta^2 E + \beta^3 J + \beta^0 = M \quad (1)$$

where M —export value of F&V from Serbia, US\$; B —producers under GLOBALG.A.P. IFA standard (crops base), No; E —area

under GLOBALG.A.P. IFA standard (crops base), ha; J —value of production in F&V sector, US\$, while $\beta_1, \beta_2, \beta_3$ and β_0 are model coefficients.

A working hypothesis is formulated which reads H_1 : the model is statistically significant, against H_0 : the model is not statistically significant. The matrix form of the centralized data values was formed (equation 2),

$$Y^* = X^* \beta^* \varepsilon^* \quad (2)$$

where Y - dependent variable vector, X - independent variables matrix, β - beta vector of coefficients, ε - model error.

The evaluation of the unknown coefficients β_i was performed, where i ranges from 1 to 3 (equation 3), together with β_0 evaluation (equation 4):

$$\beta^* = (X^{*'} X^*)^{-1} X^{*'} Y^* \quad (3)$$

$$b_0 = \bar{Y}_n - b_1 \bar{x}_{1n} - \dots - b_k \bar{x}_{kn} \quad (4)$$

where $\bar{Y}_n, \bar{x}_{1n}, \dots, \bar{x}_{kn}$ are the arithmetic means of the corresponding data.

Based on the R program report, i.e. the evaluation of the coefficients $\beta_1, \beta_2, \beta_3, \beta_0$, the evaluated model is expressed by equation 5:

$$176,345 * B + 1,95 * E + 6,607 * J - 203418,78 = M \quad (5)$$

Other parameters were calculated as well, i.e. the sum of squared errors and the evaluation of the random error variance, as well as the coefficient of determination R^2 , and then the testing of both the coefficients and the model itself started. The variance value is $s^2 = 3972115626$, and the coefficient of determination is $R^2 = 0.9187$, which indicates a strong correlation between the mentioned variables (good connection between the dependent variable and the independent variable).

Then the null hypothesis H_0 - coefficient $\beta_i=0$ (the observed coefficient is not statistically significant) was tested, against the alternative hypothesis H_1 - coefficient $\beta_i \neq 0$ (the coefficient is statistically significant), where the index i ranges from 1 to 3. The testing was performed using t-test, and the realized values of the test statistic for the regression coefficients are given in Table 4. The t-statistic is distributed according to the student's distribution, under the condition that the null hypothesis is correct, with 8 degrees of freedom, and its theoretical value is $t(0.05; 8) = 2.306$.

Since the realized t values for the coefficients β_1 and β_2 are not in the critical area, this leads us to the conclusion that the coefficients β_1 and β_2 are not statistically

significant at the significance level of 0.05 (Table 4). The realized value of the test statistic for the β_3 coefficient is in the critical area ($t_{\beta_3} = 5.192$), so we accept the alternative hypothesis (the β_3 coefficient is statistically significant) at the significance level of 0.05 (Table 4).

Table 4. Realized values of test statistics for regression coefficients (Authors' calculation. Output from the R program)

Coefficients	Estimate	t value	p
(Intercept)	-203418.773	-1.519	0.160
β_1	176.345	2.124	0.066
β_2	1.950	0.826	0.433
β_3	6.607	5.192	0.001

To test the significance of the entire model (H_0 : the model is not statistically significant; H_1 : the model is statistically significant), the F-test was used, and the results show that the model is statistically significant at the 0.05 significance level (Table 5).

Table 5. Values of F statistic and p value (Authors' calculation. Output from the R program)

F	$F(0.05, 3, 8)$	p
30.14	4.066	0.000

Analyzing the period 2010-2021, we can conclude that, while the value of production in the F&V sector has an impact on the export value in this sector ($p=0.001$), GLOBALG.A.P. IFA certification in Serbia still has no effect on the export value of the F&V sector, both when looking at the number of certified producers ($p=0.066$) and when looking at certified areas ($p=0.433$).

Unlike some authors (Asfaw et al., 2009; Bain, 2010; Henson et al, 2011; Masood & Brümmer, 2014; Andersson, 2019; Laosutsan et al, 2019; Fiankor et al., 2020) that consider this standard a catalyst for trade, which positively affects the export results of farmers and national economies, our results on the example of Serbia and the F&V sector could not confirm this. On the other hand, results similar to ours were

confirmed by Schuster & Maertens (2015), who, using the example of the application of private food standards in the Peruvian asparagus sector, found that the standards do not strengthen the export performance of companies that export asparagus (they do not affect the volume, nor the export value of asparagus from Peru). Also, Asom & Ushahembaljrshar (2016) showed that VAA had a positive, but insignificant impact on the growth of the Nigerian economy in both the short and long term.

Absence of statistical confirmation of the impact of GLOBALG.A.P. certification on the export value in the F&V sector from Serbia can largely be explained by the fact that this certification is still not sufficiently implemented in Serbian agriculture. As the implementation and certification of production according to this standard is expensive and requires administrative investment (at the same time, the standard is only valid for one year), production is certified mainly by more economical producers, who have already agreed to place their products on the foreign market, or associated producers (group certification), with exporters' support (Radić-Jean & Mihajlović, 2019; Paraušić & Roljević Nikolić, 2020).

The limitations of greater certification within this certification scheme, but also in the application of other standards in the field of food safety (ISO 22000/FSSC 22000/IFS FOOD/BRC FOOD) in Serbia are numerous. First of all, agricultural producers often do not approach certification as a planned, long-term investment, but as an ad hoc activity, which for them represents only an additional cost of production (Paraušić & Grujić Vučkovski, 2023). Since the standard is comprehensive (concerns food safety, environment, occupational safety and health, social aspects), and to a large extent administrative in nature, in practice the application is limited by the insufficient knowledge of producers and agricultural advisors, as well as the lack of financial resources on the farm for investments and

adjusting production to this standard (Paraušić & Grujić Vučkovski, 2023; NRDP, 2022). In addition, group certification is very difficult to bring to an end, and even more difficult to maintain for many years, because not all members of the group are ready to comply with the requirements, especially when it comes to the use of pesticides, and very often individual members of the group set requirements and conditions for the certificate holder (Paraušić & Grujić Vučkovski, 2023). Last, but not least, the absence of institutional support at the national level should be highlighted, bearing in mind that in Serbia there is still no possibility of certification of integral production, which is a prerequisite for all standards in primary production. This is manifested through the non-enactment or non-application of appropriate laws, which should regulate the adequate registration of pesticides for certain plant species, the management of all types of waste on the farm (lack of cooperation with waste operators), the use and quality of water resources, the work of various product testing laboratories and the like (NPAA, 2022; Paraušić & Grujić Vučkovski, 2023).

Similar limitations in the process of adding value to products and greater certification are also highlighted by other authors, pointing to the high costs for farmers in the processes of adding value to products and the implementation of various quality and food safety standards, as well as the lack of time and knowledge of farmers to engage more in these activities (Henson et al., 2011; Alonso & Northcote, 2013; Bešić, et al., 2015; Radić-Jean & Mihajlović, 2019; Paraušić & Roljević Nikolić, 2020).

In the coming period, in order to encourage greater certification in food production, and thereby enable greater effects on the export performance of Serbian agriculture, it will be necessary to fulfill a number of assumptions. First of all, as in other countries (Lemeilleur, 2013; Holzapfel & Wollni, 2014) in the production certification processes on small scale farmers' households, the key will be

the support of exporters, through contract production, which includes safe purchase of products, as well as advice and professional and financial support of export companies in the process of implementation of standards. In addition, the economic empowerment of agricultural producers (farmers, companies, export companies), the consolidation of holdings and the growth of the marketability of production, as well as the strengthening of awareness and education of farmers about the changes that constantly follow the agricultural sector, are significant factors that can encourage progress in this area (Holzapfel & Wollni, 2014; Grujić et al., 2019; Radić-Jean & Mihajlović, 2019; Paraušić & Roljević Nikolić, 2020; Paraušić & Grujić Vučkovski, 2023). Institutional and systemic solutions regarding the adoption and application of the necessary laws in the food safety system and control are also necessary (Bešić et al., 2015; Smigic et al., 2015; NPAA, 2022; Paraušić & Grujić Vučkovski, 2023).

Bearing in mind that the certification according to GLOBALG.A.P. certification scheme began to be implemented more seriously in Serbia only in 2010, the limitation of the research is a small time series (period 2010-2021), which is why the model may be imprecise, that is, unreliable for future predictions.

For further research, it would be useful to examine the achieved results of Serbia and the challenges faced by producers in the implementation and certification of organic products and products with geographical origin, as well as the effects of the implementation of these standards on export results at the level of individual companies, cooperatives or agricultural farms.

4. Conclusion

Serbia is making progress in the process of implementation of the GLOBALG.A.P. standard, primarily in the fruit and vegetable sector, given that the export of fruit and

vegetables to the EU market is conditioned by this certification. In the period 2010-2021, the number of certified producers in crop production grew at an average annual rate of 25.8%, while certified areas grew at a rate of 21.4%. The dominant production of fresh fruit (less vegetable) is certified, mainly through group certification, and the standard bearers in group certification are usually F&V exporters, more precisely cold stores that gather their subcontractors.

The implementation of the standards is mostly the result of the demands of international trade chains, which set the implementation of the standards as a condition for the entry of domestic products into global food supply chains. Therefore, the majority of domestic producers opt for this standard due to the export possibilities, which imply a safe purchase and a higher selling price on the foreign market, compared to the domestic market. On the other hand, precisely the requirements of standards and the development of hypermarkets (trade chains) favor the establishment of contractual and long-term cooperation of agricultural producers with exporters and buyers, which is extremely important for Serbian agriculture, which is characterized by insufficiently organized food supply chains and inefficient processes of integration of farmers in global food supply chains.

Using a multiple linear regression model, the authors examined the impact of the implementation of GLOBALG.A.P. certification schemes (in F&V sectors) in Serbia, as well as the value of domestic F&V production, on the export results of Serbia in the F&V sectors in the period 2010-2021. It was found that the current certification process in the F&V sectors still has no significant impact on the export value of these two sectors. That is, the export value in the F&V sector is not affected by the growth in the number of GLOBALG.A.P. certified producers ($p=0.066$), nor by increase in certified areas ($p=0.433$). At the same time, the statistical significance of the impact of

the value of F&V production on the export value of these two sectors on the international market was confirmed ($p=0.001$).

The results are explained by the still low representation of GLOBALG.A.P. certification in Serbian agriculture. The reasons for this are numerous, and are present both on the side of institutional restrictions, and on the side of financial, administrative and other obstacles facing agricultural producers in certification

processes. Their mitigation will certainly contribute to Serbia's greater progress in this area and additional improvement of the competitiveness of the F&V sector on the world food market.

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