Efficiency analysis of apple and grape producers

A case study of Hungarian SMEs' producing apples and grapes in 2021

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Summary

In recent years, the world has experienced unforeseen events that have greatly affected the population and the economy. It is important to analyze how the agricultural sector has responded to these events and assess its effectiveness as its performance is always vital, in peaceful periods but even more during the highly uncertain period we have been facing these last years. In Hungary, the most significant fruit production is the cultivation of apples. The specificity of apples, compared to other fruits, is that they can be stored and consumed in their original form all year round. Over the years, however, the final use of apple production has changed, as today most of it is intended for industrial processing in Hungary. The grapes are also consumed as a fruit during a short period of the year. However, a minimal proportion of the grapes are consumed freshly, and most of it is used instead to make the products of the winery. Overall, the country's apple and grape fields have been steadily decreasing over the years. The yield is fluctuating for both apples and grapes, however, the grape yield has been steadily decreasing over the past 5 years. How do these two sectors operate in 2021, one year after the start of Covid-19? This research aims to provide a comprehensive picture of the apple and grape growing sector and then to specifically analyze the financial efficiency of Hungarian small and medium-sized enterprises operating in those two sectors in 2021.

Keywords: efficiency, SME, apple producer, grape producer

SIGN : Q12

Introduction

In Hungary, fruit is grown on approximately 79,000 hectares throughout the country, which make up 4.5% of the overall agricultural production in 2021. The yield amount varies each year, with an average of 849,000 tons in both 2012 and 2016. However, in 2020, the yield decreased to 575,000 tons and then increased to 699,300 tons in 2021(HCSO, 2022).

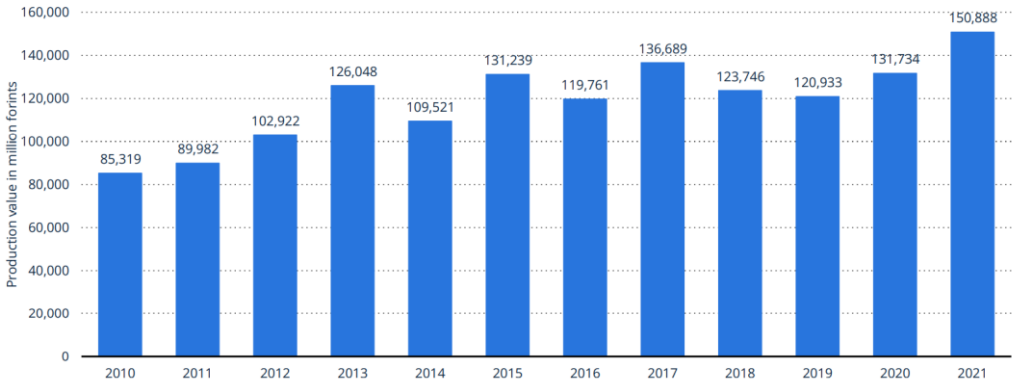

Figure 1.: Production value of fruits in Hungary from 2010 to 2021 (in millions HUF)
Source: (Statista, 2022)

The production value fluctuated over the years, with favorable values in 2013, 2015, 2017, and especially in 2021 compared to other years (Figure 1). The results are not unexpected, as agriculture is characterized by seasonality and exposure to the weather. Ultimately, the extremely significant role of natural factors and the inevitable adaptation to natural conditions make agriculture a special sector.

Apple production

Due to its almost 70% share of domestic fruit production, apple production can be considered a clearly dominant sector, however, in terms of international market competitiveness, it is in a rather difficult situation (Szabó et al, 2021).

Table 1: Apple production between 2018 and 2021 (in thousands of tons)

	2018	**2019**	**2020**	**2021**
World	85 912	87 481	86 443	78 800
EU	13 333	11 585	11 809	12 293
Hungary	679	498	399	511

Source: own editing based on Eurostat and FAO statistics data (2022)

The EU produces nearly 14% of the world's apple crop. At the level of the European Union, especially in 2019 and 2020, the amount of apple production decreased, while in 2019 it was the largest amount of production at the world level. In Hungary, 2020 was the most unfavorable harvest in the last 4 years. Basically, in the period between 2018 and 2021, 4-5% of the EU's apple production volume was grown in Hungary (Table 1.). Within the EU, the largest apple-producing countries include Poland (approx. 30% of production), Italy (19%), France (13%), and Germany (9%). Apple harvest volume similar to Hungary is in Romania and Spain (Eurostat, 2022).

In Hungary, the apple-growing areas have steadily decreased over the years. Hungarian apples are used to represent wealth in the past, such as the "gold of Szabolcs" in Szabolcs-Szatmár-Bereg county, where the climatic conditions were very favorable for apple cultivation (Szűcs 2020). However, the apple trees producing special, unique, and high-quality apples became old and no longer met modern expectations. In addition, today's consumer society prefers large and attractive-looking apples (Ebadi, Simon et al. 2022), and the processing industry buys the cheapest apples.

Thus, the traditional Hungarian apple, which is rather small, variable in shape, and more expensive, has been relegated to the background. A significant part of the apple tree plantations has been cut down, due to their inadequate modernity. Plantations older than 25-30 years were mainly affected by cutting action. As a result, the main part, of apples produced in Hungary (approx. 60-80%) is processed industrially (Szabó, 2016).

Grape production

In Hungary, the amount of grape harvest in 2010 was nearly 295,000 tons, and then there was a variable amount of harvest in the following years, but always in a higher proportion compared to 2010. The highest peak value in recent years was in 2018; since then, there has been a continuous decline. While the yield almost doubled between 2010 and 2018, it decreased by 20% from 2018 to 2021 (HCSO, 2022). The grape harvested area also shows a decrease: on average, between 2012 and 2016, it was close to 71,000 hectares, and by 2020 it reached 60,000 hectares. However, the yield average was variable, and this explains why, despite decreasing crop areas, the highest yield was in 2018, as it was the most favorable yield average (8,070 kg/ha).

Due to the specific nature of grapes (they cannot be stored) and their culture of use, only a minimum proportion (compared to apples) is used for food purposes: 3% of all grapes produced were used for food purposes, and this proportion has continuously decreased over the years (Kiss, G., Demeter 2022).

Table 2: Grape production between 2017 and 2021 (in thousands of tons)

	2018	**2019**	**2020**	**2021**
World	80 044	77 000	78 034	
EU	27 628	24 220	26 001	23 783
Hungary	533	457	435	426

Sources: own editing based on Eurostat, FAO statistics data (2022), and (USDA Foreign Agricultural Service 2021)

In 2020, the total global grape production reached nearly 78,000 tons, which was more than the previous year but less than 2018. The European Union (EU) experienced fluctuating grape harvest volumes in recent years, with a 14% decrease in 2021 compared to 2018. During the examined period, Hungary contributed almost 2% to the EU's grape production (Table 2.). Italy, Spain, and France were the largest grape producers in the EU, accounting for 34%, 26%, and 20% respectively (Eurostat, 2022). In Hungary, the grape harvest surpassed the apple harvest in significance in both 2019 and 2020, whereas in 2018, the apple harvest was more substantial.

Material and method

Efficiency, as defined by Csete et al. (1974), refers to achieving better results with a smaller amount of expenditure. It also means finding the lowest cost procedure to complete a given task or achieving the highest results for a given total cost, as stated by Dancs and Molnár (1997). In general, efficiency is measured by the amount of output per input, which can be calculated using the formula Efficiency = Output / Input, according to Nábrádi and Pető (2009). Measuring efficiency is a

difficult task, which is based on different levels of efficiency indicators (partial, complex, social, corporate, etc.) (Nábrádi et al., 2008).

To conduct the research, secondary data was processed. Initially, statistical data on both global and national economies was analyzed regarding the production of apples and grapes. Following this, the effectiveness of small and medium-sized enterprises producing apples and grapes in Hungary during 2021 was analyzed. Finally, purchase and trader prices were compared in order to gain more precise insight into the factors affecting net sales.

The enterprises were selected based on a list retrieved from the EMIS database. The selection was made on the basis of the main activity of the companies. The main activity was selected according to the Uniform Sectoral Classification System of Activities (TEÁOR), which is a code system used by the Central Statistical Office in Hungary, also indicated in the company register. Thus, the research selected all SMEs operating in Hungary in 2021 and having a main activity with the TEÁOR: Apple production (01.24) or Grape production (01.21).

During our analysis, we used economic efficiency indicators and descriptive statistical methods using the JASP program. We chose our efficiency indicators from the Farm Financial Standards Council's "Legal 21", which is a set of 21 financial ratios that are recommended for measuring the financial viability of farm operations in a standardized way within the agricultural sector (Ahrendsen – Katchova, 2012).

The used indicators are the follow:

Table 3: Used indicators

Indicator name:	Formula:
Return On Assets (ROA) (%)	Operating income/ Total Assets * 100%
Return On Equity (ROE) (%)	Operating income/ Total Equity * 100%
Return On Sales (ROS) (%)	Operating income/ Net Sales* 100%
EBITDA Margin (%)	EBITDA/ Net sales * 100%
Human resources efficiency	Salaries and Employees Benefits / Net sales * 100%
Current liquidity ratio (%)	Current Assets/ Current Liabilities

Source: Ahrendsen – Katchova, 2012

We conducted our research on 48 small and medium-sized enterprises (SMEs). Among them, 28 SMEs were engaged in apple production while 20 SMEs were involved in grape production as their primary activity.

The examined enterprises possess the following additional characteristics:

Table 4: Number of analyzed enterprises by SME category

Category of SME	Number of SMEs producing apples	Number of SMEs producing grapes
micro	6	2
small	22	18
medium	0	0

Source: own calculations based on EMIS data (2022)

In accordance with Hungarian and EU law (Act XXXIV of 2004), the SME form is determined by two main factors. The first factor is the number of employees, whereby companies with 9 or fewer employees are classified as micro, those with 10-49 employees are small, those with 50-249 employees are small-sized, and those with 250 or more employees are medium-sized enterprises. The second factor is monetary value, where companies with annual sales revenue or balance sheet totals of up to €2 million are micro, those with €2-€10 million are small businesses and those with a turnover between €10-€50 million or a balance sheet total between €10-€43 million are medium-sized enterprises. It is important to note that businesses beyond these limits are not considered small or medium-sized (. Enterprises have the freedom to choose which criterion to meet based on their sales revenue and balance sheet amount.

Among the types of SMEs, we can see that in Hungary there is a greater proportion of small businesses, both among apple and grape producers. Larger enterprises, on the other hand, are not at all in the country carrying out these two main activities (Table 3.).

Table 5: Number of analyzed enterprises by region

Location	Number of SMEs producing apples	Number of SMEs producing grapes
Northern Hungary	4	3
Northern Great Plain	11	0
Southern Great Plain	3	3
Central Hungary	3	3
Central Transdanubia	2	3
Western Transdanubia	2	2
Southern Transdanubia	3	6

Source: own calculations based on EMIS data (2022)

The Northern Great Plain region has the largest number of SMEs involved in apple production, while grape production takes place mostly in the Southern Transdanubia region (Table 4.).

Results

Return On Assets

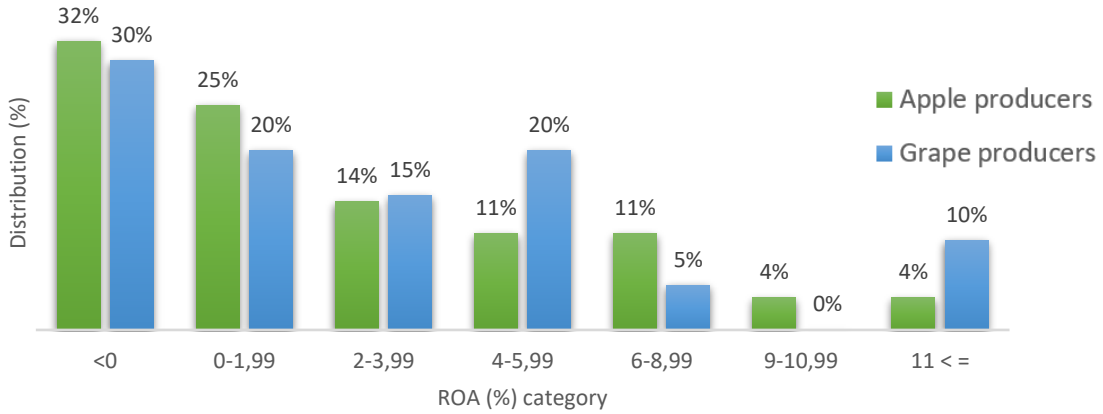

Figure 2: Distribution of apple and grape producers by ROA (%) category in 2021
Source: own calculations based on EMIS data, 2023

A significant number of apple and grape-growing businesses have a negative ROA indicator, which is concerning. This negative indicator can be attributed to both negative operating profit (EBIT) and profit after-tax values. Among the examined enterprises, a quarter of apple producers and a fifth of grape growers fall within the category of a ROA value between 0 and 1.99%. This category is strongly influenced by the low values of operating profit and profit after tax, which range between 0 and 0.03 billion euros.

Therefore, most apple-producing companies with a positive ROA generated a return on assets ratio of less than 2% in 2021. For grape producers, on the other hand, a high proportion of businesses (20%) fall under the ROA indicator between 4 and 5.99%. Companies with a ROA indicator above 5% are efficient in utilizing their assets to generate profits, and this applies to 20% of apple growers and 25% of grape growers. The higher the ROA value, the more efficient the company is in using its resources. It should be noted, however, that the value of the ROA indicator can be influenced by different types of subsidies (Erdős – Szőllősi, 2021). In the case of grape growers, a more significant proportion of businesses exceed the 11% ROA threshold (Figure 2.).

Return On Equity

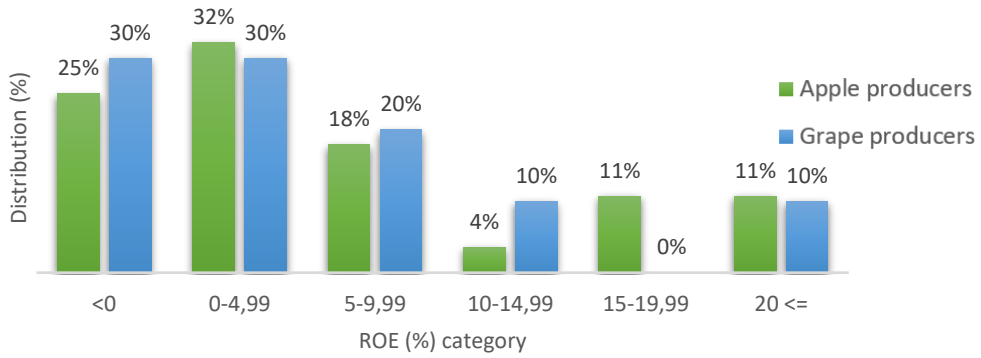

Figure 3: Distribution of apple and grape producers by ROE (%) category in 2021
Source: own calculations based on EMIS data, 2023

The data reveals that a smaller percentage of apple producers exhibit negative indicators than the ROA results. In 2021, only 26% of apple producers and 20% of grape producers were efficient in terms of profit-making ability by equity (with an ROE value above 10%) (Ibendahl, 2018). The majority of the enterprises examined are less efficient. However, there is a noticeable shift towards higher values in categories with less than 10%, compared to the previous results obtained for the ROA indicator (Figure 3.).

Return On Sales

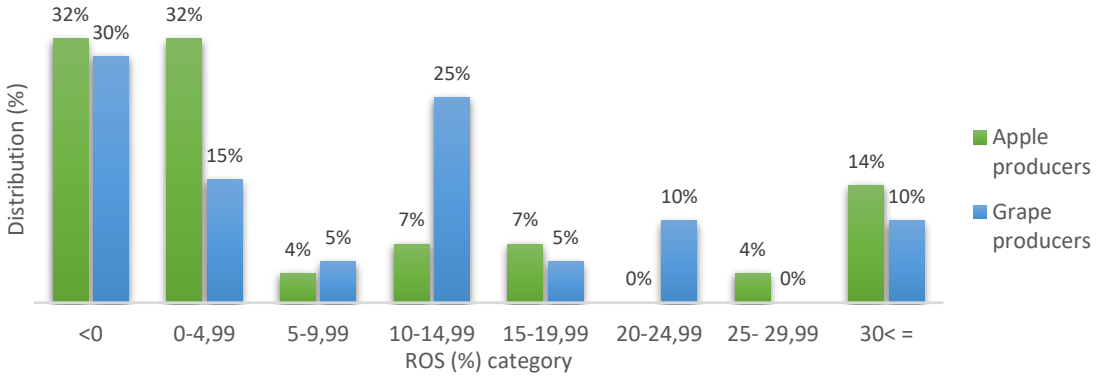

Figure 4: Distribution of apple and grape producers by ROS (%) category in 2021
Source: own calculations based on EMIS data, 2023

Based on our examination of businesses, it was found that roughly one-third of them had negative values as a result of their net profit being negative. However, those businesses with a positive value are already generating profit, and those with a value of 5% or more are considered highly efficient. When analyzing apple producers, over one-third of them had a ROS value exceeding 5%, indicating that they effectively manage their income and generate profit for their enterprise. In the case of grape growers, more than half (55%) of the examined enterprises had a ROS indicator above 5%, demonstrating that a significant proportion of them excel in this aspect (Figure 4.).

Table 6: Descriptive Statistics of ROA, ROE and ROS indicators of Hungarian apple and grape SME producers in 2021

	ROA (%)		ROE (%)		ROS (%)	
	Apple	Grape	Apple	Grape	Apple	Grape
Median	1,24	1,79	3.190	2,855	2,97	9,59
Mean	-0.847	2.104	72.645	3.063	4.620	4.128
Std . Deviation	14.610	6.430	382.421	16.121	36,715	28.110
Range	95.240	28.810	2127.640	84.620	202.920	140,93
Minimum	-49,07	-9,52	-108,75	-40,74	-48,84	-82.070
Maximum	46.170	19.290	2018.890	43,88	154.080	58,86
25th percentile	-5.945	-1.295	-0.648	-2.105	-11,18	-4.207
75th percentile	4.457	4.668	10.020	7,46	14.705	15.280

Source: own calculations based on EMIS database, 2023

In the case of mean ROA, different results are obtained for apple and grape growing. While the mean value of the ROA indicator was negative, i.e. exactly -0.85%, for the enterprises involved in apple production, it was 2.10% in the case of grape growing. The indicator values of the examined enterprises showed a more significant deviation for apple growers. Furthermore, there is a smaller deviation in the ROA indicators for grape growers, which further strengthens their more favorable ROA values compared to apple growers.

While grape growers were more efficient in the case of the previous (ROA) indicator, apple growers show a more favorable result in the case of ROE. This is also shown by the mean ROE indicator, which is significantly higher for apple producers in 2021 (72%) and has a non-negative value. However, this apparently favorable result is distorted by the fact that two apple-growing enterprises, with negative net profit and equity as well, have a significantly positive ROE indicator. Especially the company with a ROE of 2018.89%, forming the maximum value. This explains why a very high degree of dispersion can be seen in the case of apple-producer SMEs, and a large difference in terms of minimum and maximum values, while their values are more stable for grape-producer SMEs.

Contrary to the previously analyzed indicators, in the case of the ROS indicator, the average and standard deviation values are close for both apple and grape-producing sectors. Furthermore, as a positive result, the mean ROS value is reaching the 5% favorable value, considered an efficient sales management. In the case of the minimum and maximum values, we can see that the most unfavorable value was for grape growers, while the highest value was for apple growers in 2021. The percentile values, on the other hand, indicate that although the largest negative value was higher for grape growers, the proportion of negative values is still lower compared to apple growers (Table 5.).

EBITDA margin

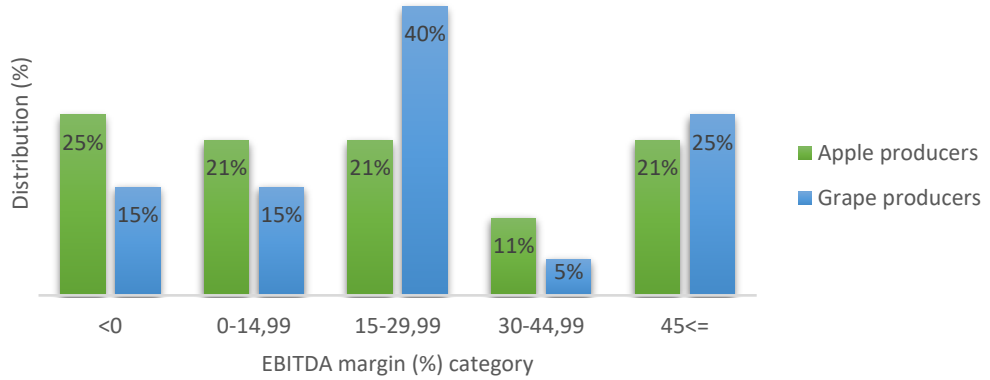

Figure 5: Distribution of apple and grape producers by EBITDA margin (%) category in 2021

Source: own calculations based on EMIS data, 2023

Based on the latest indicators, some of the companies examined had negative values. However, when calculating the EBITDA, depreciation must be added to the operating profit, which means that expenses related to the depreciation of the companies are not taken into account. As a result, there is a lower ratio of negative EBITDA margin values for the examined companies, particularly for grape growers. This indicator is essential when analyzing the efficiency of apple and grape growers as it focuses on the effectiveness of their operations, ignoring factors such as indebtedness, tax obligations, and asset maintenance costs. Nevertheless, it is worth noting that a quarter of the apple growers and 15% of the grape growers were unable to produce even minimal results from their income in 2021.

When it comes to grape growers, the examined SMEs have an EBITDA margin value between 15% and 29.9%, which is a very high ratio indicating efficient sales revenue and cost management. Additionally, a quarter of the enterprises showed a value of more than 45% in 2021, which indicates even more significant efficiency. When comparing the results obtained here with the results obtained at ROS, we can conclude that operational efficiency is more significant when tax and tax obligations are omitted. The favorable development of the EBITDA margin indicator for the investigated companies was primarily due to the omission of high depreciation (Figure 5.).

Human resources

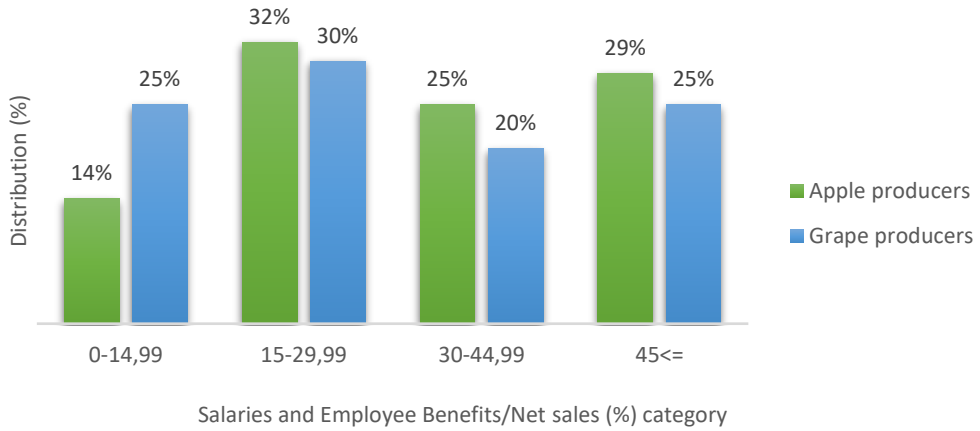

Figure 6: Distribution of apple and grape producers by Salaries and Employees Benefits / Net sales ratio (%) category in 2021

Source: own calculations based on EMIS data, 2023

Companies with a ratio of salaries and employee benefits to sales revenue falling between 15 and 29.99% will not find wage costs as their primary expense. However, for companies exceeding a ratio of 45%, labor demand and related costs become more significant. Conversely, companies with ratios between 0 and 14.99% need not worry about wage costs being their largest expense (Figure 6.).

Liquidity

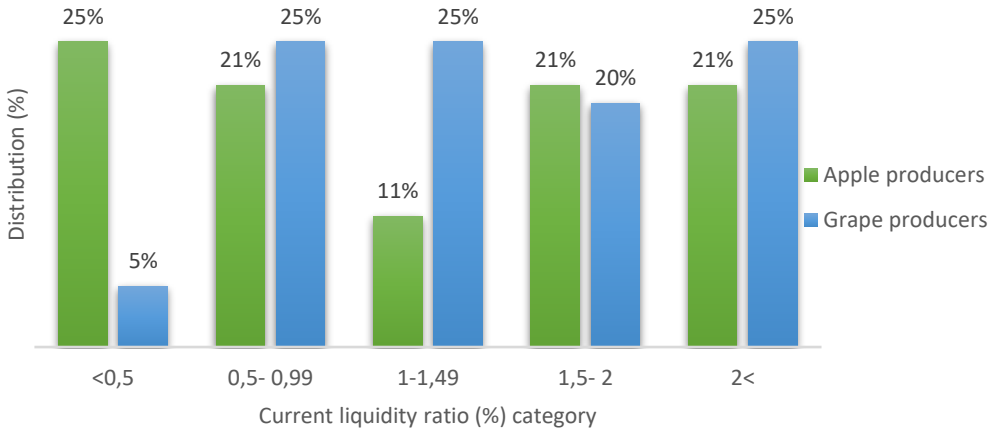

Figure 7: Distribution of apple and grape producers by Current liquidity ratio (%) category in 2021

Source: own calculations based on EMIS data, 2023

A considerable number of apple-producing businesses face the risk of insolvency due to their low liquidity ratio, with almost 50% having a ratio of less than 1%. The proportion of grape-producing enterprises facing the same risk is smaller at 30%, with most having a ratio between 0.5 and 0.99%.

While this is comparatively more favorable, it is still significant that almost a third of grape growers have liquidity problems. Only a small percentage of both apple and grape producers, around 20-25%, have an optimal liquidity ratio of 1.2-1.3. Those with a ratio above 2% have high solvency, but it could also mean that they are not using their resources efficiently (Figure 7.).

Table 7: Descriptive Statistics of EBITDA margin, current liquidity ratio and human resources efficiency indicator of Hungarian apple and grape SME producers in 2021

	EBITDA Margin (%)		Current liquidity ratio (%)		Salaries and Employees Benefits / Net sales (%)	
	Apple	Grape	Apple	Grape	Apple	Grape
Median	19.270	23.485	1.195	1,34	30,76	29.310
Mean	23.534	24.459	1.772	1.925	33.459	33.348
Std . Deviation	40.528	30.427	2.136	1.851	18,569	21.068
Range	203.860	128.490	9.330	7.340	73	76.620
Minimum	-34,59	-52,98	0.150	0.420	2.160	1,72
Maximum	169.270	75.510	9,48	7,76	75.160	78.340
25th percentile	-1,6	5.525	0.520	0.855	21,825	23.185
75th percentile	40.230	39.127	1.813	1.982	45.718	43.175

Source: own calculations based on EMIS database, 2023

The mean value of the EBITDA margin indicator is obviously higher than the ROS indicator. The standard deviation value is minimally higher compared to the standard deviation value obtained for ROS. Businesses with high values pull the average up to a more favorable value, thus the median is given a positive value despite the negative values due to the significant deviation.

Observing the median value of liquidity, we can see that both apple and grape grower SMEs fall exactly into the most favorable value category. The mean is a little above it, which was significantly raised by companies with very high liquidity indicators, as can be seen in maximum values of 9.48 and 7.76 %. Overall, it can be said that grape growers have a better ability than apple growers to finance their short-term obligations, which are the basic conditions for continuous operation with short-term obligations.

On average, almost 33% of the sales revenue of the examined companies is personnel expenses, which indicates other significant costs appearing in agriculture. In contrast to the other indicators, there is a larger deviation in the obtained values for grape-growing enterprises. While there are businesses where the proportion of personal expenses is very minimal (1.72%), there are businesses where it is extremely significant (78.34 %) (Table 6.).

Evolution of apple and grape prices

It is essential to analyze price fluctuations as it provides valuable information about revenue variations for producers. According to HCSO statistical data, the purchase and market average prices of apples in Hungary developed as follows:

Table 8: Average purchase and average selling price of apples in Hungary (2017–2021)

	2017	2018	2019	2020	2021
average purchase price (in forint)	61	26	47	59	37
average selling price (in forint)	254	274	264	…*	397
ratio of the average purchase price to the average market price	4.16	10.54	5.62	…	10.73

*Source: own calculations based on HSBO database, 2022, *no data was collected because of the COVID pandemic*

We can see how significant the traders' profit margin is on agricultural products. Apples can be bought at an extremely low price. In 2018 and 2021 the market resells them at almost 11 times the price they bought it. It is particularly surprising that despite the continuous rise in market prices, the purchase price has decreased significantly in some years (Table 7.).

Table 9: Average purchase and average selling price of grapes in Hungary (2017-2021)

	2017	2018	2019	2020	2021
average purchase price (in forint)	90	86	75	86	96
average selling price (in forint)	**4**96	505	513	…*	710
ratio of the average purchase price to the average market price	5.51	5.87	6.84	…	7.4

*Source: own calculations based on HSBO database, 2022, *no data was collected because of the COVID pandemic*

Both the purchase price and the market price of grapes are higher than those of apples in the period under review. It varies depending on the year, but the profit margin of the traders compared to the producers is very significant for grapes as well, despite the risk and the large amount of costs producers have. It is interesting that the market price rose continuously and increased by 43 % during the five years. However, the purchase price decreased until 2019 and then increased again (Table 8.). In 2020, due to the restrictions and regulations of the Covid-19 epidemic, no data is available, since the Covid-19 epidemic affected not only our daily lives but also our whole economy (Vida-Popovics, 2020). Based on these data, it becomes clear why the agricultural sector cannot remain functional without state and European Union subsidies.

Conclusion

Overall, the country's apple and grape fields have been steadily decreasing over the years. The yield is fluctuating for both apples and grapes, however, the grape yield has been steadily decreasing over the past 5 years.

Of the 48 examined companies, it can be established that in 2021, nearly one-third ended with a negative net result. That's why negative results have been for many of the examined indicators,

such as the ROA, ROE, and ROS indicators. Therefore, almost one-third of both apple and grape growers were not able to manage efficiently that year, with their assets, with their own capital, and with sales revenue, to generate a profit. The EBITDA margin indicator showed that, especially in the case of grape growers, those enterprises received a positive value, if depreciation and tax obligations are not considered, indicating that depreciation is a significant expense for those businesses.

Around 20% of the examined SMEs had an optimal value of ROA and ROE, showing their effective management of assets and equity. It is interesting that the situation is different for the ROS indicator, where 55% of grape growers and 36% of apple growers had an optimal value. From the point of view of liquidity, 70% of grape growers and only 54% of apple growers had short-term solvency in that year.

Considering the analyzed indicators, grape-growing SMEs were mostly more efficient, compared to the apple-growing SMEs. Furthermore, a very significant deviation in the obtained values was observed for apple producers.

Implications and recommendations

Overall, even though 2021 can be considered a favorable year from the point of view of yield production, one-third of the enterprises ended their business year with a loss, which indicates a very significant lack of efficiency. The evolution of purchase and procurement prices from year to year has already highlighted the fact that managing apple production is almost impossible due to the very low purchase prices.

State regulation of a minimum purchase price of agricultural products is formulated as a proposal from us. The minimum price shall be determined by the production costs of producers, with the aim of achieving a balance between the profits of producers and traders.

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