APSTRACT

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# THE PLACE OF AMORTIZATION AMONG COSTS, AS WELL AS EFFECT OF DIFFERENT DEPRECATION CALCULATION METHODS ON MANAGEMENT FROM BUSINESS ECONOMIC AND FINANCIAL VIEW OF POINT

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**Abstract:** *Due to the accelerated inflation in the past year, the attention focused on the risk of replacement of assets. It is a well-known fact that after the wear and tear of the fixed assets, their replacement is a serious task for the companies. During the functioning, the fixed asset provides resources (financial) on two branches, respectively it will pay off. One direction is the amortization, which reduces the profit as a cost, but does not involve (cash flow) expenses. The other direction of return is the profit, which provides the necessary amount for the development after having payed the taxes. The source of the profit sector increases in value in the event of an increase in inflation, since the source of amortization continuously generated during the period of operation has been devaluing by the end of the functioning period. In our article, we try to present the place of amortization (depreciation) among costs, based on several aspects. After that, we will present the different description methods based on their characteristics, giving priority to what their use means for the entrepreneur. We support this with the help of model calculations. We present what mean the amortization accounting methods assuming that management is without inflation or between inflationary conditions. Based on this, we try to formulate proposals on how state intervention how could help businesses in inflationary economic conditions beyond that it would be more permissive in the choice of description method. Following the business economics approach to the question, we will examine the effect of amortization on tax base and the income, taking into consideration financial and accounting aspects. Considering that the use of the fixed assets and thus the expected return period takes several years, we must attention to the careful planning of the amount of replacement costs. When determining the required capital value, we cannot ignore the time factor, the time value of money. The required value of capital accumulation supplementing amortization per period is determined using the annuity method. In our article, we demonstrate what kind of loss inflation causes and to what extent it is necessary to create a source from the generated profit. Dealing with the topic can be considered relevant for two reasons: on the one hand, it is justified by the high inflation experienced in 2022-2023, and, on the other hand, we are missing taking into consideration the time value of money in the Hungarian accounting and planning system.*

***Keywords:*** *costs, amortization; amortization methods; time value of money*
(JEL Code: G30; M40)

## INTRODUCTION

### *Amortization among company's costs*

The depreciation expense (amortization), as its name suggests, is included among the costs of production. Amortization is the gradual transfer of value from the fixed assets to manufactured products in order to accumulate funds their replacement. (LEMISHOVSKA 2017; BOYKO et al., 2019) This means that amortization involves allocating the depreciable value of an asset. (SIRBULESKU et al., 2021)

during its intended useful life Costs can be grouped according to several criteria, and amortization can be classified into several groups accordingly. The simplest case is to examine whether the cost in question causes a cash flow within the enterprise, or not. This way, it can be clearly established that,

unlike other costs that generate an actual cash flow, amortization is a cost for which this is not the case, that is, it does not generate a cash flow when it is incurred. In a further classification of costs, if we try to separate them based on the form in which they are presented, amortization is supposedly found among elementary costs for the two groups of non-current assets: intangibles and tangible assets. (However, there is a significant exception among tangible assets, farmland, for which no depreciation is charged, because the land does not depreciate in value but increases in value over time, which, together with the land rent, ensures that investing money in farmland is a good investment. (POSTA. 2022))

At the same time, amortization costs are also included in the composite costs, as amortization is also charged on the cost of auxiliary service, the cost of specific tangible assets and the high value assets included in overheads, which means that amortization is expected to be present in these composite costs.

However, when costs are grouped by accountability, the amortization charge is included in direct costs, if it is the cost of depreciation of an asset that is clearly attributable to a sector or activity. In this case, amortization will therefore be included in the cost of the auxiliary service or specialised tangible asset of the sector, as described above, whereas, if the asset is used for general activity (management of the enterprise), the amortization cost of this asset will be included in the indirect, or general expenses. When costs are grouped according to their relationship with the volume of production, the amortization cost is included in fixed costs, i.e., it is a cost which does not vary up to a certain limit even if the volume of production changes. In fact, the most typical fixed cost in this respect is the cost of depreciation, which is of the same value over a period of 1 year, assuming depreciation on a pro rata temporise basis.

However, it is very important to note that, even if we cannot influence it for a year on the whole (since the amortization rate clearly determines its level), it is very much possible to influence it specifically, and this possibility lies in the use of available capacities, in increasing utilisation. Accordingly, the least amount of this fixed annual cost per unit of product or service will be obtained if we make the best use of our existing assets and produce as many products and services with them as possible. However, within fixed costs, the amortization cost is also known as a step cost, because if the production exceeds a certain limit, the cost rises by one ‘step’. Therefore, for one asset, the annual amortization rate (assuming depreciation on a pro rata basis) is constant, but once we need another asset of the same type, the amortization rate “steps up” and the same happens in each subsequent case the same asset is put into production. Another feature of the amortization cost is the so-called ‘cost rigidity’ or, in other words, ‘remanence’, which occurs when assets become surplus due to the reduction or possible cessation of production, while the fixed cost of the asset that becomes surplus (the amortization cost that has not yet been written off or accounted for) remains and continues to be charged to the business.

To avoid this, we have to try to get rid of the asset, but this cannot be easily accomplished, especially in the case of a special asset. In view of the fact that the activity for which the asset was needed no longer generates income for us, the same is very likely to be the case for other businesses, so nobody will want to buy this asset. As can be seen, amortization can be presented in several different ways, depending on how we look at costs. (PFAU and POSTA, 2011)

In addition to the above, it can be stated that the value of tangible and intangible assets is constantly declining due to physical (and moral) wear and tear and technological obsolescence, while the value of assets is gradually being transferred into the value of the produced goods and services. The financial accounting of this process is carried out within the depreciation - amortization - system. The amortization system ensures that the one-off capital investment is accounted for as a continuous cost and that it is recovered. (PFAU and NÁBRÁDI, 2007) Thus, amortization is both a cost to the entrepreneur and a return on their capital, which means that parallel to the wear of the assets, the depreciation system increases the cost of production, while the capital thus depreciated becomes free and available for reuse. This can create the possibility for the entrepreneur to replace the asset in accordance with its original purpose or to use the amount depreciated for other purposes, e.g., to develop other activities or to expand production. Therefore, the basic function is replacement, but depending on the entrepreneur’s choice, the amount accounted for (and set aside) can also be used as a resource for other activities. (CHIKÁN 2010) Amortization is thus a means of creating the conditions for simple replacement, creating the basis for buying another asset of the same type years later instead of the asset that has been worn out. However, depending on whether we are operating under inflation conditions or not, amortization may or may not be able to fulfil this function. It also plays an important role in the implementation of technological development. Typically, as regards the source of new purchases, a major part of the investments is financed from the amount accumulated under depreciation.

In the sample calculation, in case of the funds lost due to inflation, we do not calculate with the residual value. We see it as more transparent if the value of the resulting source over the years is the same as the total value of the asset. When calculating the return, we assume that the asset can be sold at a price equal with the residual value. We wish to present the studied problem within this framework, since the purpose of the two calculations is slightly different.

## *Amortization methods*

In fact, the correct development of the amortization system involves two processes - the accounting of one-off capital investment in instalments and the temporal linking of replacement. Impairment of fixed assets due to physical and moral obsolescence (capital depreciation) should be determined and accounted for as depreciation. However, the true extent of wear and tear on an asset is very difficult to determine. The time – e.g., in the case of the physical wear and tear of a machine - depends not only on the technical standard of production, but also on the degree of use over time, its circumstances, the user, etc. Moral obsolescence occurs when there is a more modern, more economically productive newer asset of the same type on the market, and the old asset must be withdrawn

from production because it is no longer competitive. It happens often that the moral wear and tear of assets occurs more quickly than their physical wear and tear (most often in the case of machinery). Different amortization systems - depreciation methods - can be used to account for wear and tear in connection with use. First and foremost, a distinction must be made between amortization systems on a time basis and on a performance basis. (CSETE et al 1974)

In the former, the use of an asset is expressed in years and the amortization rate is determined in proportion to this, while in the latter, it is calculated on the basis of service life, e.g., the total number of operating hours, and thus the annual depreciation depends on the extent of use, i.e., the number of operating hours. In the case of pro rata temporis accounting, depreciation is determined according to the period of use, its value is constant for a year and depending on the annual use of the asset, it varies per unit of output. In the case of performance-based depreciation, the amount of depreciation per unit of output is always the same, but its value per year varies according to the utilisation of the asset. Of the two systems, pro-rata depreciation is the sole dominant.

There are also several forms of the pro rata temporise amortization systems. These include linear, degressive and progressive amortization. When the linear method of amortization is used, the annual depreciation is determined based on the depreciable value of the assets and the useful life of the assets. (ERTSEY and NÁBRÁDI 2003) Using this method, the same amount of depreciation is charged for each year of use, that is, the same value of the assets is recovered. The rate of depreciation is expressed as a percentage, which is a constant for linear depreciation. The basis of depreciation is typically the gross value of the asset (or the gross value minus the residual value). The amount to be amortised or depreciated is then obtained by deducing the residual value (if any) of the asset from the cost of the asset (the gross value) and multiplying the gross value that can be depreciated by the annual depreciation rate. (MAGDA et al. 1998) The aforementioned linear depreciation system is therefore a very simple method that is easy to use, to keep records of, to review and to plan. It is the most widely used and practically the sole dominant depreciation method in current practice. However, one of its disadvantages is the fact that its constant annual amount does not take into account the real time use of the assets. Within pro rata temporise depreciation, the use of the degressive amortization method as opposed to the linear method means that a higher value is recognised in the initial period of the use of the assets - accelerating the depreciation - while the amount of depreciation becomes less and less as the period of use progresses. There are several options for degressive depreciation. The simplest degressive method is to apply decreasing depreciation rates to the basic characteristics of the assets in use.

Another method is when the net value of the assets (gross value - amortization = net value) is used as the basis for depreciation. (Using the same amortization rate on the basis the of decreasing net value, the annual amount of amortization becomes smaller over time.) The third method is the aggregation of years method, which is also a degressive method. The essence of this method is to add up the years of projected use for the asset (determining the number of units) and then divide the value to be amortized by the number of units to determine the amount of amortization per unit. As the last step, the amortization per unit multiplied by the number of units is charged for each year of use in reverse order. (For example, if we want to use the asset for seven years, we will have 7+6+5+4+3+2+1=28 units, which divided by the depreciable value of the asset gives us the amortization per unit. Finally, for the first year, 7 units, for the second year 6 units, for the third year 5 units, for the fourth year 4 units, for the fifth year 3 units, for the sixth year 2 units and for the seventh year only 1 unit of amortization are calculated.) All the variations of the degressive amortization methods are characterised by the fact that the return on capital employed is concentrated in the first half of the useful life of the asset. Although the higher value increases costs at the beginning, this part of the capital is returned to the entrepreneur sooner. If economic policy aims at a rapid growth in production and a rapid spread of newer technology, this form of depreciation method can be a good public policy regulator. On the whole, the degressive method of depreciation can be an incentive for technological development, and it is clear that it is in the interests of the entrepreneur (or the enterprise) to use this method of depreciation.

Staying still with the pro rata temporise method, when using the progressive amortization method – which slows down depreciation – the amount of depreciation charged is initially lower and then increases over time. Once it has been established that the degressive method of depreciation is in the interest of the entrepreneur and serves technological improvement, it can be clearly concluded that the progressive method of depreciation is not justified. However, there are some cases, e.g., fruit or grape cultures where the yields are more modest in the first years of production, or at the beginning of the production of a new product when other costs of production are higher. Therefore, in these cases it may be justified to initially set the amortization cost at a more modest rate and then increase it. (NÁBRÁDI, PUPOS and TAKÁCSNÉ GYÖRGY 2008) (Since amortization also appears as a cost, it does make a difference when and against what level of production the higher costs are accounted. For the plantation crops mentioned above, yields are not yet realized or are very low at the beginning of production, compared to later periods. It is therefore not justifiable to increase costs with amortization very much at the beginning of production, since there is nothing to offset them against. However, when production ramps up, the increased costs have a significant income-reducing effect, which has a significant impact on tax liability as well. The subsequent higher accounting of costs thus results in tax savings for the entrepreneur in these cases.)

As shown, the accounting of depreciation has a significant impact on the technical and technological development of the business. The use of the linear amortization system is mainly justified where the technical obsolescence and moral wear and tear of assets is low, e.g., in the case of buildings. Where the tools and machinery rapidly evolve technologically and old technology becomes obsolete quickly, the increase in the development of production requires a more rapid depreciation

of assets, and it is therefore reasonable to depreciate the assets put into production in the initial phase of their use. Although this means that production costs increase at the expense of income - thus the state's income from taxes is lower -, it does result in an overall increase in production. If most of the value of the old assets is depreciated in the initial period of their use, the lower depreciation costs that remain in the second part of the period of use will encourage the entrepreneur to discard the economically obsolete assets and put newer, technically more valuable, more modern assets into production. Overall, the application of the degressive method of depreciation may accelerate technical development, while in other cases a given technology may become conserved in production to a greater or lesser extent, which is not desirable.

It is a very big problem for businesses that under inflationary conditions, when the depreciation rate does not follow inflation, public regulation practice leads to a situation where the amortization value over time does not cover either the necessary capital reallocation rate or the corresponding increase in the cost of production, thus generating a tax-free resource. As a result, the real value of the previously accumulated capital is reduced and, if the value of depreciation becomes lower and the profits correspondingly higher, the entrepreneur will yet again pay tax on profits that derive from profits already taxed. This shortcoming can be remedied by revaluing assets from time to time in line with the inflation rate and increasing the amortization value accordingly. In this way, the profit reflects the real situation and does not include inflationary elements. However, the accounting system is regulated by the State. Unfortunately, this practice is very rarely used by public bodies and ex post corrections are made only occasionally. In an economic situation where the inflation rate is significant, solving this problem is a much more important issue than in countries where inflation is only 1-3% per year. Depreciation, as a cost factor, varies according to the need for fixed tangible assets in production. In line with the above, in comparison with the real situation, the accountable amortization is generally modest and lower. The amortization system also has a tax policy function, which manifests in the fact that amortization is opposed to income.

The higher amortization compared to the value of the asset is, the sooner and to a greater extent the entrepreneur can recover the capital – for which tax has already been paid – tax-free and reinvest it. Deductible amortization is a factor that reduces income and the tax base, thus the amortization rate has a major impact on the tax revenue of the State, which is why every country has a law regulating the order, time and years of amortization deduction. It is evident that in the long run it is in the interest of every country to increase the level of additional investment through its tax policies, and therefore they allow for a faster depreciation than the rate of wear and tear. Accordingly, in our country, depreciation is also faster than the actual rate of wear and tear: in the case of machinery and equipment it is 4-8 years, while the amortization period for buildings and structures is no longer than 15-25 years. However, excessively high depreciation rates - and consequently a significant increase in annual amortization costs - are not characteristic of regulation, as this would lead to a significant reduction in state revenue (taxes), which is not the state's aim. However, the typical method is linear depreciation, which, as we have seen, is not really conducive to businesses and to the rapid modernisation of technology.

## MATERIALS AND METHODS

After presenting the location and role of amortization among costs, we dealt with the creating of the amortization system and the calculation methods of amortization. Then, with the help of model calculations, we examined what the linear, degressive, progressive depreciation method means for the entrepreneur in the case of an asset worth 10 million HUF in relation to 10 years and 5 years. In addition, we also try to shed light on what kind of capital loss is caused with inflation for this same asset compared to the case without inflation. We will also show with examples that the loss due to inflation makes it necessary to supplement the funds. For this, we use the role of the time value of money. We present how much more money must be provided from the profit in order to have the amount needed to replace the asset available after 10 years.

## RESULT AND DISCUSTIONS

### *Comparison of amortization methods*

In support of what has been said so far, in the following we will use model calculations to examine what the linear, the degressive and the progressive depreciation methods mean for the entrepreneur for an asset worth HUF 10 million over 10 years and 5 years. In addition, we will also try to find out how much the capital loss is for the same asset with or without inflation. Table 1 shows that since we assume a case without inflation, the entrepreneur obtains their money without loss for all three pro-rata temporise depreciation methods. It is also obvious that for the entrepreneur the degressive case is the most favourable, since they have 85% of the capital value available halfway through the accounting period (10 years), so they can reinvest it in production relatively quickly, and modernise with the use of a possible new technology. In comparison, the linear depreciation method is slightly worse: the entrepreneur realises 50% of the capital halfway through the accounting period. Yet, the worst – quite understandably - is the progressive depreciation method, where only 15% is realised within 5 years, which is very unlikely to be enough to generate a return on capital.

Now we regard to an average 10% inflation to calculate of amortization. Then, in all three cases, a much less favourable situation is created.

Even with the previously most favourable degressive depreciation method, there is a capital loss of 25.2%, which is 38.6% with linear depreciation, while the "result" of progressive depreciation causes the entrepreneur to lose 51% of the total invested capital value.

If we examine where the return on capital is at the halfway point of the term, it can be concluded that even in this situation the values have got worse, since in the case of degressive

description, only 67.3% of the capital has now been returned, while looking at linear and progressive accounting, these the values show 37.9 and 10.7%, respectively. Especially the latter value is very deplorable, however - considering that the occurrence of inflation is not rare and the value of 10% cannot be considered very outlier, it is thought-provoking for entrepreneurs. It is not too motivating to buy an asset worth 10 million so that after 5 years only about a third or a tenth of the invested capital is returned. In such cases, the entrepreneur most likely does not want to invest capital in the assets, only if they are absolutely necessary for production, but even then ones will definitely look for the possibility of minimizing the magnitude of the capital loss. The calculations were also performed for a shorter useful life of 5 years which are shown in Tables 3 and 4. Of course, without inflation (table 3), we are not talking about capital loss here either, but because the amortization period has been shortened, the entrepreneur will obviously get capital invested in tangible asset back sooner compared to the 10-year period.

Then, in the case of the most favourable degressive depreciation method, the return on capital will be 75% in the middle of the term, in the linear case it will be 50%, while in the case of progressive depreciation it will be 25%. The point, however, is that the entrepreneur will definitely get access to capital faster and, accordingly, they can manage their new investments sooner, which is considered as desirable. If the previous calculation is made under inflationary conditions and it is compared with the 10-year period, it can be seen

**1. Table: Effect of 10-year linear, degressive, progressive amortization on asset with a gross value of 10 million HUF, without inflation**

| **Year** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | Linear depreciation | | | | | | | | | | |
| amortization % | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 100 |
| amortization HUF K | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 10000 |
| amortization present value, HUF K | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 10000 |
| accumulated description, HUF K | 1000 | 2000 | 3000 | 4000 | 5000 | 6000 | 7000 | 8000 | 9000 | 10000 | - |
| Loss from inflation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Name** | Degressive depreciation | | | | | | | | | | |
| amortization % | 25 | 22 | 15 | 13 | 10 | 5 | 4 | 3 | 2 | 1 | 100 |
| amortization HUF K | 2500 | 2200 | 1500 | 1300 | 1000 | 500 | 400 | 300 | 200 | 100 | 10000 |
| amortization present value, HUF K | 2500 | 2200 | 1500 | 1300 | 1000 | 500 | 400 | 300 | 200 | 100 | 10000 |
| accumulated description, HUF K | 2500 | 4700 | 6200 | 7500 | 8500 | 9000 | 9400 | 9700 | 9900 | 10000 | - |
| Loss from inflation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Name** | Progressive description | | | | | | | | | | |
| amortization % | 1 | 2 | 3 | 4 | 5 | 10 | 13 | 15 | 22 | 25 | 100 |
| amortization HUF K | 100 | 200 | 300 | 400 | 500 | 1000 | 1300 | 1500 | 2200 | 2500 | 10000 |
| amortization present value, HUF K | 100 | 200 | 300 | 400 | 500 | 1000 | 1300 | 1500 | 2200 | 2500 | 10000 |
| accumulated description, HUF K | 100 | 300 | 600 | 1000 | 1500 | 2500 | 3800 | 5300 | 7500 | 10000 | - |
| Loss from inflation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Source: own calculation*

that the loss of capital is reduced in all three cases. (Table 4) The least is 18.4% for degressive depreciation (which is still significant), 24.2% for linear depreciation, while 29.9% of the capital for the progressive depreciation method is the value that is simply lost to the entrepreneur due to inflation. At the half of 5-year useful life, in the case of degressive depreciation 64.1% of the capital is returned, 42.2% with linear depreciation, and 20.3% with progressive depreciation. It is compared to the 10-year period, at the degressive method is reduced by a few per cent but the case of linear and progressive descriptions improved by 5 and 10%.

Based on the tables, what can be suggested regarding the amortization period and the future development of the amortization percent if we want to keep the interests of the entrepreneur in mind? In any case, it would be advisable to reduce the amortization period, since the sooner the entrepreneur gets the value of the invested capital, the sooner they can modernize their assets.

It is even more important, however, that the amount of capital loss should be minimized when accounting for amortization under rising inflationary conditions. Moreover, its entire value should be disappeared, since it cannot be con-

**2. Table: Effect of 10-year linear, degressive, progressive amortization on asset with a gross value of 10 million HUF, with 10% inflation**

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name** | Linear depreciation | | | | | | | | | | |
| amortization % | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 100 |
| amortization HUF K | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 10000 |
| amortization present value, HUF K | 909,1 | 826,4 | 751,3 | 683,0 | 620,9 | 564,5 | 513,2 | 466,5 | 424,1 | 385,5 | 6144,5 |
| accumulated description, HUF K | 909,1 | 1735,5 | 2486,8 | 3169,8 | 3790,7 | 4355,2 | 4868,4 | 5334,9 | 5759,0 | 6144,5 | - |
| Loss from inflation HUF K | 90,9 | 173,6 | 248,7 | 317,0 | 379,1 | 435,5 | 486,8 | 533,5 | 575,9 | 614,5 | 3855,5 |
| **Name** | Degressive depreciation | | | | | | | | | | |
| amortization % | 25 | 22 | 15 | 13 | 10 | 5 | 4 | 3 | 2 | 1 | 100 |
| amortization HUF K | 2500 | 2200 | 1500 | 1300 | 1000 | 500 | 400 | 300 | 200 | 100 | 10000 |
| amortization present value, HUF K | 2272,8 | 1818,1 | 1127,0 | 887,9 | 620,9 | 282,3 | 205,3 | 140,0 | 84,8 | 38,6 | 7477,7 |
| accumulated description, HUF K | 2272,8 | 4090,9 | 5217,9 | 6105,8 | 6726,7 | 7009,0 | 7214,3 | 7354,3 | 7439,1 | 7477,7 | - |
| Loss from inflation HUF K | 227,2 | 381,9 | 373,0 | 412,1 | 379,1 | 217,7 | 194,7 | 160,0 | 115,2 | 61,4 | 2522,3 |
| **Name** | Progressive description | | | | | | | | | | |
| amortization % | 1 | 2 | 3 | 4 | 5 | 10 | 13 | 15 | 22 | 25 | 100 |
| amortization HUF K | 100 | 200 | 300 | 400 | 500 | 1000 | 1300 | 1500 | 2200 | 2500 | 10000 |
| amortization present value, HUF K | 90,9 | 165,3 | 225,4 | 273,2 | 310,5 | 564,5 | 667,2 | 699,8 | 933,0 | 963,8 | 4893,6 |
| accumulated description, HUF K | 90,9 | 256,2 | 481,6 | 754,8 | 1065,3 | 1629,8 | 2297,0 | 2996,8 | 3929,8 | 4893,6 | - |
| Loss from inflation HUF K | 9,1 | 34,7 | 74,6 | 126,8 | 189,5 | 435,5 | 632,8 | 800,2 | 1267,0 | 1536,2 | 5106,4 |

*Source: own calculation*

sidered a normal case if the present value of the amortized capital does not reach the present value of the invested capital at the end of the amortization period. It can be seen that in the 10-year amortization period, even in the most favourable case, 25.2% of the value of the invested capital was lost for the entrepreneur (and the extreme 51% occurred at the progressive method). Although at the 5-year depreciation period, the capital loss was reduced to 18% in the best case, but even then it could reach a value of around 30% (which is still considered very unfavourable compared to the desirable 0%).

**3. Table: Effect of 5-year linear, degressive, progressive amortization on asset with a gross value of 10 million HUF, without inflation**

| Year | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|
| **Name** | Linear depreciation | | | | | |
| amortization % | 20 | 20 | 20 | 20 | 20 | 100 |
| amortization HUF K | 2000 | 2000 | 2000 | 2000 | 2000 | 10000 |
| amortization present value, HUF K | 2000 | 2000 | 2000 | 2000 | 2000 | 10000 |
| accumulated description, HUF K | 2000 | 4000 | 6000 | 8000 | 10000 | - |
| Loss from inflation HUF K | 0 | 0 | 0 | 0 | 0 | 0 |
| **Name** | Degressive depreciation | | | | | |
| amortization % | 35 | 30 | 20 | 10 | 5 | 100 |
| amortization HUF K | 3500 | 3000 | 2000 | 1000 | 500 | 10000 |
| amortization present value, HUF K | 3500 | 3000 | 2000 | 1000 | 500 | 10000 |
| accumulated description, HUF K | 3500 | 6500 | 8500 | 9500 | 10000 | - |
| Loss from inflation HUF K | 0 | 0 | 0 | 0 | 0 | 0 |
| **Name** | Progressive description | | | | | |
| amortization % | 5 | 10 | 20 | 30 | 35 | 100 |
| amortization HUF K | 500 | 1000 | 2000 | 3000 | 3500 | 10000 |
| amortization present value, HUF K | 500 | 1000 | 2000 | 3000 | 3500 | 10000 |
| accumulated description, HUF K | 500 | 1500 | 3500 | 6500 | 10000 | - |
| Loss from inflation HUF K | 0 | 0 | 0 | 0 | 0 | 0 |

*Source: own calculation*

These tendencies should be stopped at the state level definitely. This can be solved in the simplest way if the assets to be depreciated are revalued every year in line with the rate of inflation, and thus, by logically, the annual value of the amortization is also raised to a higher level.

Then we could say that the entrepreneur "are at their money", since in this case the capital-loss would be not. As long as this is not happened with aspect to assets, each year of inflation causes loss for entrepreneurs. On the one hand, due to the capital loss which was presented, and on the other hand, if it is not possible to increase the costs sufficiently with amortization, then this increases the income before tax of the enterprise, which entails that they have to pay higher tax. This

**4. Table: Effect of 5-year linear, degressive, progressive amortization on asset with a gross value of 10 million HUF, with 10% inflation**

| Year | 1 | 2 | 3 | 4 | 5 | Total |
|---|---|---|---|---|---|---|
| **Name** | Linear depreciation | | | | | |
| amortization % | 20 | 20 | 20 | 20 | 20 | 100 |
| amortization HUF K | 2000 | 2000 | 2000 | 2000 | 2000 | 10000 |
| amortization present value, HUF K | 1818,2 | 1652,8 | 1502,6 | 1366,0 | 1241,8 | 7581,4 |
| accumulated description, HUF K | 1818,2 | 3471,0 | 4973,6 | 6339,6 | 7581,4 | - |
| Loss from inflation HUF K | 181,8 | 347,2 | 497,4 | 634,0 | 758,2 | 2418,6 |
| **Name** | Degressive depreciation | | | | | |
| amortization % | 35 | 30 | 20 | 10 | 5 | 100 |
| amortization HUF K | 3500 | 3000 | 2000 | 1000 | 500 | 10000 |
| amortization present value, HUF K | 3181,9 | 2479,2 | 1502,6 | 683,0 | 310,5 | 8157,2 |
| accumulated description, HUF K | 3181,9 | 5661,1 | 7163,7 | 7846,7 | 8157,2 | - |
| Loss from inflation HUF K | 318,1 | 520,8 | 497,4 | 317,0 | 189,5 | 1842,8 |
| **Name** | Progressive description | | | | | |
| amortization % | 5 | 10 | 20 | 30 | 35 | 100 |
| amortization HUF K | 500 | 1000 | 2000 | 3000 | 3500 | 10000 |
| amortization present value, HUF K | 454,6 | 826,4 | 1502,6 | 2049,0 | 2173,2 | 7005,8 |
| accumulated description, HUF K | 454,6 | 1281,0 | 2783,6 | 4832,6 | 7005,8 | - |
| Loss from inflation HUF K | 45,4 | 173,6 | 497,4 | 951,0 | 1326,8 | 2994,2 |

*Source: own calculation*

is completely unreasonable, since in this case it is not a real increase in income, but only an "accounting problem", which resulted from the failure to increase the amortization costs to a higher level (corresponding to reality). Based on the previous, it can be concluded that the development of enterprises is significantly hindered from these two directions.

The previous calculations show that inflation makes it more difficult to replace the asset and clearly requires the supplementation of resources arising in the amortization branch from profit after tax.

In the following analysis, the time value of money, the need to supplement the sources generated in the amortization branch and the determination of the amount of savings required will be discussed in detail. (SZABÓ AND PÁLINKÓ 2004)

## *The role of the time value of money:*

In our article, we addressed the issue of loss due to inflation, which results from the time value of money. It is well known in economic circles that money has a time value, generated by two factors. On the one hand, inflation causes the purchasing value to decrease after a certain time period; and on the other hand, we attach importance to the fact that money, for example an interest-bearing deposit, is able to produce income and increase its own initial amount over time. (BÉLYÁCZ, 2006) In the case of an asset that has been used for several years, this is something that we must pay attention to, if only because of the amount that has to be paid out during replacement. Let us take an example, where we consider how much money needs to be generated each year during the useful life of an asset in order to replace it at the end of its useful life. The calculation compares the linear accounting model and the degressive accounting method and their effects. It is treated as an economic necessity that the operating asset must generate its own depreciation expense and the profit needed to replace it. From this angle, it is concluded that the sources needed to replace fixed assets are generated from two sources:

a. Amortization, which is to be charged as an expense and reduces the profit for the year but does not result in an outflow of cash. This can be understood as a return in nominal value.
b. The replacement of the asset at the end of its useful life requires a higher amount than what it was procured for, and therefore has to be supplemented by operating profit, counterbalancing the effect of inflation.

The replacement source must be generated and "accumulated" over the operational life of the asset.

The question is at what point in time and how much depreciation should be accounted, since according to the Accounting Act, the actual market value should appear in the balance sheet, which is the difference between the cost value and the recorded depreciation expense. (We disregard the value adjustment because it has no effect on costs or profit.) (Act C of 2000). Another question is the amount needed from profit to supplement amortization already accounted for - and recovered during operation - to have the amount needed for replacement at the end of the operating period. The above question is answered by an example below, in which two amortization methods are compared and the effects of the difference are also examined.

## *Example:*

An enterprise purchases a machine with a cost value of HUF 11,000,000 and plans to use it for 10 years. The expected inflation rate for machinery is 10% per year over the period considered. The residual value of the machine is HUF 1,000,000, which can be realised through sale after scrapping. Our question is how much money is needed to supplement the amortization source on the profit side annually if we plan to replace the asset at the end of its useful life with another machine of the same type. Let us examine the situation if the company uses a linear depreciation rate and also the situation if it uses the sum-of-the-years method.

**5. Table: Calculation for linear amortization.**

| Year / Name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amortization, HUF K | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 10000 |
| Profit Source, HUF K | 728 | 728 | 728 | 728 | 728 | 728 | 728 | 728 | 728 | 728 | 7280 |
| Total Source, HUF K | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 17280 |
| Interest rate factor | 2,3579 | 2,1436 | 1,9487 | 1,771 | 1,4641 | 1,6105 | 1,331 | 1,210 | 1,10 | 1,00 | |
| Future value by year, HUF K | 4075 | 3704 | 3367 | 3061 | 2783 | 2530 | 2300 | 2091 | 1901 | 1728 | 27540 |

*Note: The profit branch source is understood as profit after tax. HUF K = HUF thousand*
*Source: own calculation.*

**6. Table: Calculation for annuity method.**

| Year / Name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Amortization, HUF K | 1818 | 1636 | 1455 | 1723 | 1091 | 909 | 727 | 545 | 364 | 182 | 10000 |
| Profit Source, HUF K | -90 | 92 | 273 | 455 | 637 | 819 | 1001 | 1183 | 1364 | 1546 | 7280 |
| Total Source, HUF K | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 1728 | 17280 |
| Interest rate factor | 2,3579 | 2,1436 | 1,9487 | 1,771 | 1,4641 | 1,6105 | 1,331 | 1,210 | 1,10 | 1,00 | |
| Future value by year, HUF K | 4075 | 3704 | 3367 | 3061 | 2783 | 2530 | 2300 | 2091 | 1901 | 1728 | 27540 |

*Note: The profit branch source is understood as profit after tax.*
*Source: own calculation.*

*Solution:*

a. Resources to replace the asset in 10 years.
   The machine has been bought for HUF 11,000,000 and an annual inflation rate of 10% is assumed, the future value at the end of 10 years is 11,000,000 * (1+0.1)10 = 11,000,000 *2.594= 28,534,000 HUF. The result of the calculation shows that by the end of year 10, HUF 28,534,000 must be available to replace the asset at the prices of that year. The amount will be made up of two parts, on the one hand, the HUF 1,000,000 from the sale after scrapping and on the other hand, the funds generated during the operation.
   Our question is, to have HUF 27,534,000 available at the end of the 10 years (28,534,000-1,000,000), how much of money should we reserve each year? We expect to "save" at a steady rate as we accumulate the resource.
b. The value of the required amount is determined using the annuity method. It is worth taking a look at annuitisation and its role in our example. By annuitisation we mean cash flows of equal amounts, that is we aim to determine how many HUF per year need to be "set aside" - from amortization and profit - in order to have the required HUF 27,534,000 at the end of year 10. For the calculation we assume that the amount of money set aside at the end of the first year will continue to accrue interest for nine years, the amount set aside at the end of the second year for eight years and so on. The annuity factor is 15.9374. The amount of money needed per year is therefore 27,534,000/15.9374= HUF 1,728,000 / year.
c. The required depreciation expense and the additional profit savings are shown in the tables:

The table 5 shows that in the case of linear depreciation, the enterprise must provide a resource of HUF 728 thousand from its profit after tax each year in addition to the depreciation expense to be able to replace the asset. In the case of degressive depreciation, it is assumed that the asset is subject to a higher rate of technical wear and tear and a higher rate of moral obsolescence in the first years of use. (Table 6) Under this assumption, we must apply the declining balance method of depreciation in accordance with the Accounting Act, because the balance sheet should show the lower net value. (Act C of 2000) If the same amount of resources is generated each year for the duration of operation in the calculation, even some losses can be tolerated in the first years, in addition to depreciation.

The asset must be recovered in its operational time, that is, it must generate the resources needed to replace it. The calculation shall take into account that, due to inflation, we will only be able to replace the machine for a higher amount at the end of its useful life compared to when it was originally purchased, and therefore profit is needed. It is another fact that, during the years of use, assets wear and tear to varying extents, both technically and in terms of obsolescence, therefore the fair annual amortization rate also varies. We may conclude that the use of an accounting method other than linear depreciation is justifiable. The asset is expected to recover its costs and to generate a profit during its life. The minimum rate of expected results is the amount needed to supplement the amortization source in order to replace the asset at the end of its useful life.

Depending on the timing of the depreciation of the asset, a different amount of profit after tax should be generated in addition to the accounted amortization.

Based on these calculations, we can conclude that in the case of the linear depreciation method the same rate of wear and tear is assumed, and the same rate of profit source is needed. If the degressive method is used, the amount of depreciation is higher in the first years and even a minimal loss can be tolerated in the first years of the operation of the specific asset. (The amortization recovery will be faster.) This shows that specifying the depreciation methods and rates is of great importance, as it is not natural for an activity to be loss-making in the initial period and then to increase in profit during the rest of the operation.

Summing up our ideas, we may come to an interesting conclusion. The accounted amortization must be synchronised with the wear and tear of the asset in order to show a fair asset value and a fair cost in the annual accounts. To be able to buy a new

machine as a replacement for the worn-out one, profit is needed. Thinking in terms of the life cycle of machinery, fair value is a priority, whereas recognised result and the generated source are secondary from an accounting point of view.

However, from a management point of view, the generation of the necessary resource should be targeted, as it is the basis for maintaining the operation.

In addition to the above, it should be noted that the Corporate Tax Act adheres to standards in determining the tax base and therefore the tax payable and the profit after tax. In determining the tax payable, the corporate tax base is determined by considering only depreciation calculated using linear depreciation expense rates laid down by the Act. The tax base thus differs from the actual result generated, so that deferred tax or advance tax may arise, affecting the amount of profit after tax. (LXXXI of 1966 Act)

It is clear that the valuation of tangible assets, their impact on operations or profitability are influenced by a number of factors, thereby making it difficult to obtain a fair valuation of assets in all respects.

This raises the question of how the State can encourage the necessary savings, alongside the responsibility of the entrepreneur. The answer is difficult and complex. On the one hand, it can play a role in bringing down inflation by supporting the efforts of the Central Bank, however, the real toolbox of the government lies in the subsidy system and the tax system. Our recommendations are set out below at a conceptual level only.

It is a fact in economics that inflation increases government revenues. We suggest that the inflationary budget revenue should be used to provide a normative subsidy to entrepreneurs who make investments, depending on the lifetime of the asset being replaced. This subsidy could mitigate the loss due to the time factor.

Another idea is to subsidise savings, in such a way that the investment savings generated using the above calculations and placed in government bonds, are supplemented normatively from the state budget.

In this article, we have dealt with the accounting of non-current assets as an expense, how to determine their balance sheet value, how to expense them and how to secure the savings needed to replace them. We hope that we have succeeded in highlighting a real problem and in stimulating the reader's interest as well. In our next article, we will use model calculations to show the possible forms of public intervention - that we propose.

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# THE PROFIT EFFICIENCY OF MORINGA OLEIFERA PRODUCTION IN OSUN STATE, NIGERIA

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**Abstract:** *The Moringa plant has nutritional value and numerous medicinal benefits. However, the profit efficiency of moringa production is yet to be investigated. This study, therefore, investigated the profit efficiency of Moringa oleifera production. A multistage sampling procedure was used for selecting 150 respondents for the study. The data were analyzed using descriptive statistics, budgetary analysis, and stochastic frontier production function. The descriptive statistics revealed that many of the respondents were male (53%), married (85%), and had formal education (87%). The results further revealed average values of 45 years for age, 7 people for household size, and 0.3 ha for farm size. Moringa production had a cost-benefit ratio of ₦5.857, profit margin of ₦0.182, expense structure ratio of ₦0.107, a net return on investment of ₦4.857, rate of return of ₦5.482, and profitability ratio of ₦0.981. Results obtained from the stochastic frontier model showed that moringa farmers had an average profit efficiency of 19% in their production. The empirical results from the frontier model showed that the price of family labour, seed, pesticide, hired labour, and transport significantly influence the profit efficiency of moringa farmers. However, years of education and farm size were the major sources of profit inefficiencies among moringa farmers. This study concludes that Moringa Oleifera production is highly profitable, but producers have been unable to maximize its profit efficiency. Therefore, this study recommended that producers should improve on adding value to moringa products and extend their distribution channels considering the cost incurred on transportation.*

***Keywords:*** *Profit, Efficiency, Moringa Oleifera, Production, Osun State.*

## INTRODUCTION

Researchers have put in a lot of effort over the years to comprehend and pinpoint the plant's many advantages. Studies discovered that a specific tree had the solutions. One of the most beneficial trees in the world is called the "miracle tree," Moringa oleifera (Mann et al., 2003; Ojo et al., 2016). Almost every component has some sort of beneficial quality or can be used as food. The moringa tree has been used by humans for a variety of purposes, including food, domestic use, animal feed, plant manure, biopesticides, and ornamental plants. Omotesho et al. (2013) claim that because of the moringa tree's edible qualities and evidence of its value for human nutrition and health, people have long ingested it. The drumsticks are mature pods that have had the flesh removed; the fruits are boiled and eaten whole; the young, tender pods, which resemble string beans, are cooked and eaten whole or sliced; and the soft seeds from the immature drumsticks are boiled and eaten like fresh peas (Livestrong, 2012). In some states in northwest Nigeria, moringa producers use both manual and automated methods to extract the oils from the plant and turn it into salad dressings, sauces, soups, teabags, edible powders, juice, and soaps. Moreover, moringa seeds can be used as a flocculant to clear water and as a source of Ben oil, a non-drying and extremely stable oil. This oil, which was once used for lubricating watches and other delicate machinery, is clear, sweet, and odorless, almost never going rancid. It is edible and is becoming increasingly popular in the cosmetics industry. Leaves and young branches are used as fodder. Moringa may also be used in fish and poultry feeds.

Researchers and pharmaceutical corporations are interested in it because of its potential and variety of uses. As a result, the demand for moringa and related products is rising. There is a global demand for moringa, particularly in industrialized nations like the United States and Japan. Just 3.8% and 7.3%, respectively, of the demand for moringa oil in the United States and the European Union, could be satisfied (Bernavides et al., 2008). In order to increase the supply of moringa

and satisfy the demand, additional workers must be put on the line. Both local communities and the world market would gain from it. Also, because moringa seed oil is used in the cosmetics industry and is seen as a more affordable alternative source of biodiesel, demand is expected to increase (Animashaun and Toye, 2014). Thankfully, Nigeria has a competitive advantage over other African nations because moringa is only grown in a few countries that are located in tropical and subtropical zones. Tapping into this opportunity, the federal government may produce over $500 billion in annual revenue from moringa and thousands of new jobs (FAO, 2011). Despite this, it is quite unfortunate that the level of moringa production among farmers in Nigeria is generally low (Omotosho et al., 2013). This is a major concern and the factors influencing the low production, have been traced to some socio-economic factors such as age, level of farmer's income, level of education, and so on. However, the rate of moringa production within the country could gradually increase with the idea of profit accruing to its production (Ojo et al., 2016).

However, intending farmers are concerned about the returns of moringa. Asking the question, how efficient is Moringa oleifera in yielding profit? This is because profit is the driving force of any farmer into business (Maudos et al., 2002). Profit is the difference between income and costs. There are essentially two types of profit concepts. These are the earnings in accounting and business. Only explicit costs are taken into account when calculating accounting profit, however, both implicit and explicit costs are taken into account when calculating economic profit (Kolawole, 2006). No matter how practical a business may be, Thompson (2005) and Overton (2007) contend that the question of economic profit should be thoroughly investigated before beginning. But, effective use of the resources at hand is required to achieve maximum profit. The price of inputs is one of the key elements affecting how profitable moringa production is. Efficiency is the comparison of what is actually produced with what can be achieved with the same consumption of resources such as money, time, labor, etc. Since the objective of every moringa producer is to minimize cost production and maximize profit, which conforms to the rule of production economics. Profit efficiency refers to a farmer's capacity to produce with the highest possible profit while spending the least amount possible on fixed production costs and variable inputs (Azeez et al., 2013). Be that as it may, not much effort has been put into investigating the profit efficiency of moringa production. In several kinds of literature, studies have been carried out on the technical efficiency of moringa (Azeez et al., 2013; Tafesse et al., 2020), production performance (Danso-Abbeam et al., 2021), production and marketing (Islam et al., 2021), Profitability of moringa (Ojo et al., 2016). Several studies on moringa have also been conducted in Nigeria, but little focus has been placed on measuring profit efficiency. Based on the above information, this study is motivated by a number of pertinent questions: what are the socio-economic characteristics of moringa producers? What are the costs and returns to moringa production? And what are the factors determining the profit efficiency of Moringa oleifera production?

We proposed a hypothesis that several socio-economic characteristics of moringa producers affect how profitable they are. These qualities are examined in relation to moringa in order to offer a rational perspective based on empirical evidence on the potential costs and benefits of growing Moringa oleifera. Knowledge of these can help shed light on how to lessen poverty and food insecurity in Nigeria. This study is required to add to the body of knowledge on crop profit efficiency studies, particularly those that focus on the production of moringa, with the secondary goal of enhancing the welfare of moringa farmers in Nigeria. Last but not least, it will give government organizations and developmental organizations additional knowledge to improve regulations and assess the profitability of moringa. As a result, the findings would be helpful in formulating appropriate strategies for the increase of moringa production in the region and the economy as a whole. The results would also offer pertinent information for more research on moringa production.

## MATERIALS AND METHODS

### *Area of study*

This study was carried out in Osun State, an inland State in the Southwestern geopolitical zone of Nigeria. Osun State is located in the Tropical western region of Nigeria. It is bounded in the north by Kwara State, in the east partly by Ekiti State and partly by Ondo State, in the south by Ogun State, and in the west by Oyo State. According to the 2006 census reports by National Population Commission in Nigeria, the population of Osun State stood at about 4.14 million consisting of the Yoruba ethnic group. The State has two distinct climatic seasons. The State experience raining season, with about three months of the dry season. The wet season commences from April to October, and the dry season operates between November and March (Oluwasola et al., 2016). Osun state has natural vegetation comprised of moist evergreen and semi-evergreen forests and secondary forests, with mean annual rainfall ranging between 1400 to 2000mm. Mean annual temperature ranges between 26oc to 27°c. The state's soil and climatic condition are suitable for cultivating a wide range of crops. The State was selected because farming is predominant in this area, and they major in the production of permanent crops.

### *Sampling procedure*

Primary data were used for this study. Following Ojo et al. (2016), the multi-stage sampling procedure was used to select respondents for the study. In the first stage, five Local Government Areas (LGAs) were purposively selected based on the predominance of moringa farmers in the LGAs. In the second stage, two villages were randomly selected from each LGA. In the third stage, 15 moringa producers were randomly selected in each village. A total of 150 respondents were interviewed.

### *Analytical techniques*

The study employed descriptive statistics, farm budgetary technique, and the Stochastic frontier model to analyze the data collected.

### *Descriptive statistics*

Descriptive statistics such as frequency, percentage, and mean were used to describe the socio-economic characteristics of moringa producers in the study area.

### *Budgetary analysis*

Budgetary analysis was used to estimate the cost and return on the moringa enterprise. Basically, it involves the estimation of total revenue and total cost from the same production period. The difference between the two parameters is the measure of net profit or net return for that period.

The technique is expressed as:

$$TC = TFC + TVC \quad (1)$$
$$TR = P \times Q \quad (2)$$
$$GM = TR - TVC \quad (3)$$
$$\pi = GM - TFC \quad (4)$$
$$\pi = TR - TC \quad (5)$$

Where $\pi$ = profit on moringa production; TR = Total Revenue; TFC = Total fixed cost; TVC = Total Variable Cost; TC = Total Cost; GM = Gross Margin

### *Gross margin analysis*

Gross margin analysis is the difference between gross farm income and total variable cost (Mohammed et al., 2011). Normally, it is used to determine the potential profitability (Samm, 2009; Kehinde, 2021).

The gross margin analysis was estimated from costs and returns in moringa production.

Following Mohammed et al. (2011), Adeyemo et al. (2020), Kehinde (2021), and Oluponna et al. (2022), the gross margin model is expressed as follows:

$$GM = TR - TVC \quad (6)$$

Where; GM = Gross margin (₦/ha); TR = Total revenue or the total value of output from the moringa enterprise (₦/ha). It is the product of the average output per hectare multiplied by the market price. The price used was the market price of the year 2017; TVC = Total variable cost or the cost used up in producing moringa (N/ha). This includes the cost of inputs such as seed cost, agrochemicals (herbicides and insecticides), labour cost (family labour and hired labour), and other miscellaneous expenses.

The formula is given as:

$$GMi \; iYi - Ci \quad (7)$$

Where; GMi = Gross margin of producer per hectare I; Pi = price per kg of moringa leaf and seed of producer I; Yi = Total quantity in kg of moringa leaf and seed of producer I; Ci = Total variable costs incurred producer I; i…n = Total number of moringa producers

Subsequently, a net return was obtained from the gross margin.

$$\text{Net returns} = GM - TFC \quad (8)$$

where, TFC = Total fixed cost

### *Profitability and efficiency ratio*

The following ratios were calculated to understand how profitable moringa production is.

$$\text{Operating expense ratio} = TVC/GR \quad (9)$$
$$\text{Net return on investment/ Return Per Naira outlay} = NI/TC \quad (10)$$
$$\text{Benefit Cost Ratio (BCR)} = TR/TC \quad (11)$$
$$\text{Expense Structure Ratio} = TFC/TVC \quad (12)$$
$$\text{Profitability Index or profit margin} = NI/GR \quad (13)$$

Where, GR is Gross Revenue; NI is Net Income; TC is Total Cost

### *Stochastic frontier production function*

**Theoretical model**

The Stochastic frontier approach (SFA) was used to determine the profit efficiency of Moringa oleifera production and the factors affecting profit efficiency in moringa production. The frontier production function shows the maximum amount of output obtained from the given inputs, thus representing maximum efficiency (Tijani, 2006; Kehinde and Olatidoye, 2019). This method is still the most widely used for estimating efficiency, and more especially, profit efficiency (Akite et al., 2022). It has been extensively utilized in determining how profitable a crop grower is (Saysay et al., 2016; Wongnaa et al., 2019; Jonah et al., 2020). SFA is helpful since it has two error components that are cumulative in nature and enables hypothesis testing. One element of the error takes into consideration the statistical noise connected to data measurements, while the other element measures departures from the frontier connected to production inefficiency. So, a producer's incentive for operating at the frontier is profit efficiency (Akite et al., 2022). On the other hand, a profit frontier is the highest possible profit function (le et al., 2020). The stochastic profit technique also takes into account the fact that any mistakes made when making production decisions result in lower sales or profits for the company. The profit lost from failing to operate on the frontier would be referred to in this context as profit inefficiency, which can then be expressed as a linear function of the explana-

tory variables describing farm characteristics (Battese and Coelli, 1995). This approach was chosen for estimating profit efficiency because of its ability to estimate farm-specific efficiency levels and sources of inefficiency in a single-step procedure using the Maximum Likelihood Estimation (MLE) method. The stochastic profit frontier model is therefore specified as:

$$\pi_i = f\left(p_{ij}, Z_{kj}\right)\exp.e_i \quad (14)$$

Where,
$\pi_i$= normalized profit of the $j^{th}$ farm calculation as gross revenue minus the variable inputs divided by farm-specific output price, p
$p_{ij}$= price of $j^{th}$ variable input encountered by the $i^{th}$ farm divided by the out price
$Z_{kj}$= level of the $k^{th}$ fixed factor in the $i^{th}$ farm
$e_i$ =error term
$i \ldots\ldots n$=number of farmers in the sample

Furthermore, Rahman (2003) postulated that the error term behaves consistently with the frontier concept and is composed of two random parts as specified in equation (15).

$$e_i = V_i - U_i \quad (15)$$

$V_i$= symmetric error term presumed to be independently and identically distributed, it is two-sided in nature representing random effects, measurement errors, and statistical noise.
$U_i$ =one-sided error term representing the inefficiency of the farm.
The inefficiency Ui is thus expressed as in equation (16).

$$U_i = \delta_0 + \sum \delta_1 z_{di} \quad (16)$$

$z_{di}$= (1 x m) vector of farm-specific variables varying across respondents and not over time.
$\delta_0$= (m x 1) vector of unknown coefficients of farm-specific variables.
The inefficiency Ui is non-negative demonstrating a profit deficit from its maximum possible value that will be provided by the stochastic frontier. Since the MLE method was employed in estimating stochastic profit frontier and inefficiencies simultaneously, it is thus expressed in variance parameters as in equations (17) and (18)

$$\sigma^2 = \sigma_v^2 + \sigma_\mu^2 \quad (17)$$

$$\gamma = \frac{\sigma_\mu^2}{\sigma_\mu^2} + \sigma_\upsilon^2 \quad (18)$$

**Empirical model**

The explicit Cobb-Douglas functional form for the moringa farmers in the study area is therefore specified as follows:

$$\ln\pi i = \ln\beta 0 + \ln\beta 1 X1i + \ln\beta 2 X2i + \ln\beta 3 X3i + \ln\beta 4 X4i + \ln\beta 5 X5i + (Vi - Ui) \quad (19)$$

Where
$\pi$i = normalized profit computed as total revenue less variable cost divided by firm-specific moringa price; X1 = cost of family labour; X2 = cost of hired labour; X3 = transport cost; X4 = seed cost; X5 = pesticide cost

**Inefficiency model**

The inefficiency model (Ui) is defined as

$$Ui = \delta 0 + \delta 1 W1i + \delta 2 W2i + \delta 3 W3i + \delta 4 W4i + \delta 5 W5i + \delta 6 W6i + \delta 7 W7i + \zeta i \quad (20)$$

Where Wi is the socioeconomic variables included in the model to indicate their possible influence on the profit efficiencies of the moringa farmers (determinant of profit efficiency).

Where,
W1 = Gender; W2 = Age; W3 = Level of education; W4 = Household size; W5 = Moringa farming experience; W6 = Moringa farm size; W7 = Record keeping (dummy variable)

## RESULTS AND DISCUSSION

### *Socio-economic characteristics of moringa farmers*

The socioeconomic characteristics of the respondents were presented in Table 1. About 55.3% of moringa producers were male. This shows that in the study area, moringa production is predominantly a male-dominated enterprise. The average age of the respondent was 44.92 (±13.68) years. This is an indication that moringa production is mainly done by young people who are active and within their productive age group. This corresponds to the findings of Nenna, (2016). The majority (85.3%) of respondents were married. This shows that most of the respondents are responsible for their families. This conforms with Azeez et al. (2013). Most (86.7%) of the respondent were educated. This implies that the farmers tend to embrace a new innovation or technology that will improve their efficiency and the use of resources (Adewuyi et al., 2013). All the sampled producers had an average farm size of 0.30 (±0.08) hectares. It implies that the study area is dominated by small-scale farmers. The majority (80.7%) of respondents operate moringa on a part-time basis. This suggests that most respondents do not fully concentrate on moringa production. The majority (86.7%) of respondents' financial capital source is from personal savings. It also suggests that producers may face financial constraints by not having easy access to other sources of funds. The average farming experience was 19.93 (±13.15) years. This suggests that the farmers have many years of farming experience. The majority (67.3%) of respondents had access to extension services This implies information about new technologies in cocoa production will be properly disseminated among the farmers. This could be ascribed to the fact that extension services keep farmers abreast of new farm technologies (Alao et al., 2020; Adeyemo et al., 2020). The mean household size of about 7.00 (±3.09). This implies that households are excessively large, which could serve as a cheap source of farm labour for the farmers (Anigbogu et al., 2015).

**5. Table: Calculation for linear amortization.**

| Variables | Moringa Farmers |
|---|---|
| Age (years) | 44.92(±13.68) |
| Male (%) | 55.3 |
| Married (%) | 85.3 |
| Formal education (%) | 86.7 |
| Household size (#) | 7.00 (±3.08) |
| Personal saving | 86.7 |
| Farm size (ha) | 0.30(±0.08) |
| Formal education (%) | 86.7 |
| Years of farming experience | 19.93(±13.15) |
| Extension visit (%) | 67.3 |
| Part-time (%) | 80.7 |

*Source: Field survey, 2017*

## *Profitability of moringa enterprise*

Table 2 presents the profitability of the moringa enterprise. However, the total cost (TC) was determined by the addition of both the variable cost and the fixed cost, and it summed up to ₦55,709.0471. The variable cost took the larger percentage of about 90.4% of the total cost incurred in moringa production, while the fixed cost calculated using the depreciated value was 9.63% of the total cost. In addition, of all the various costs incurred in production, hired labour took the largest percentage which accounted for about 48.35% of the total cost. This confirms that Moringa oleifera production is an employer of labour as stated by Ojo et al. (2016). The mean depreciated value of ₦807.87 spent on processing equipment was 1.48% of the total cost. This is an indication that most producers of moringa spend less on processing. This could imply that most farmers are reluctant to add value to Moringa oleifera production. About 3.67% of the total cost was spent on the seed. This low percentage was attributed to the fact that most moringa producers in Osun State received free improved seeds from non-governmental agricultural agencies such as Youth Initiative for Sustainable Agriculture, Women Farmers Advancement Network, and OFFER centre in Iwo, Osun State, among others. Pesticide application was 4.11% of the total cost, which signifies that producers do not commonly apply pesticides or do not apply them in large quantities. The cost incurred on using capital signifies the cost spent in running capital equipment on the farm. This includes fueling, leasing, repair of damages, etc. This cost takes about 19.49% of the total cost This is an indication that moringa oleifera production is labour intensive, not capital-intensive. The average gross margin realized was ₦275,958.819. An average Net farm income (NFI) value of ₦270,591.2529 was realized in the study area. A positive NFI shows that an enterprise is profitable and worth continuous execution. Since the net profit of moringa production was positive, therefore producers generate profit and should continuously involve themselves in its production.

**Table 2: Budgetary Analysis of Moringa oleifera production in Osun State, Nigeria.**

| S/N | ITEM | MEAN AMOUNT (N) | PERCENTAGE |
|---|---|---|---|
| **A** | **Total Revenue** | **326,300.3** | |
| | **Variable cost** | | |
| | Family labour | 5,110.667 | 9.17 |
| | Hired labour | 26,938 | 48.35 |
| | Transport cost | 3,095.667 | 5.56 |
| | Seed cost | 2045.147 | 3.67 |
| | Pesticide | 2,292 | 4.11 |
| | Cost incurred on the use of capital | 10,860 | 19.49 |
| **B** | **Total Variable Cost/ha (TVC)** | **50,341.481** | **90.37** |
| **C** | **Gross margin (TR-TVC)** | **275,958.819** | |
| | **Fixed cost** | | |
| | Rent on land | 3,941.747 | 7.08 |
| | Depreciated value on implement | 617.9524 | 1.11 |
| | Depreciated value of processing equipment | 807.8667 | 1.45 |
| **D** | **Total fixed cost** | **5,367.5661** | **9.63** |
| E | Total Cost/ha (TC) = (TFC+TVC) | 55,709.0471 | |
| **F** | **Net Income (NI) = (GM-TFC)** | **270,591.2529** | |

*Source: Field survey, 2017; Notes: N = Naira (Nigerian currency)*

As shown in Table 3, the return to moringa production in Osun State was approximately ₦5.48 which is greater than 1, and the benefit-cost ratio was ₦5.857. This shows that the moringa enterprise in the study area is well managed. The study further suggests that the business of moringa production is viable and profitable. This is in line with the study carried out by Ojo et al. (2016). Moringa producers operate at a profit margin of 82.9% in Osun State. This indicates that for every ₦1 income received, ₦0.829 of profit is generated. The net return on investment of the enterprise was ₦4.86. This indicates that for every ₦1 spent on total cost, ₦4.86 is generated as profit. This shows that moringa production has a huge return on investment. The operating expenses ratio was 0.182. This indicates that for every ₦1 received from the gross margin, ₦0.182 was spent on total variable cost. The enterprise expense ratio was 0.1066. This ratio indicates that there is less fixed cost than variable cost. The profitability index for this enterprise was ₦0.98. This confirms that moringa production is a profitable venture in Osun state.

**Table 3: Profitability ratios estimated in Moringa oleifera production in Osun State.**

| S/N | Profitability ratios | Calculated value |
|---|---|---|
| 1 | Benefit-cost ratio | 5.857 |
| 2 | Profit margin | 0.829 (82.9%) |
| 3 | Operating expense ratio | 0.182 |
| 4 | Expense structure ratio | 0.107 |
| 5 | Net return on investment | 4.857 |
| 6 | Rate of return | 5.482 |
| 7 | Profitability index | 0.981 |

*Source: Field survey, 2017; Notes: N = Naira (Nigerian currency)*

## *Stochastic frontier production function*

The results of the estimates of the parameters of the stochastic frontier and the inefficiency model are presented in Table 4. The coefficient of the gamma parameter (γ) of 0.99 was significant at a 1 percent level of significance. The sigma squared δ2 indicates the goodness of fit and correctness of the distributional form assumed for the composite error term, while the gamma γ indicates that the systematic influences are unexplained by the production. The mean profit efficiency was 18.73%. It implies that, on average, the respondents were able to obtain just 18.73% of the optimal profit from a given set of inputs. This indicates that most farmers are relatively too low in maximizing profit efficiency. In other words, about 81 % of the profit is lost to the inefficiency of management. This suggests that a sizeable portion of the earnings from moringa production in Osun State is wasted due to profit inefficiencies at the current input prices and technological levels. Hence, there is potential to increase profit from moringa production by 81% in the short run. The mean profit efficiency level obtained in this study was much lower than the levels reported by Okorie et al. (2021) for Nigerian cassava farmers (73%), Wongnaa et al. (2019) for Ghanaian maize farmers (48%), and Akite et al. (2022) for Ugandan smallholder rice farmers (65%).

The efficiency model revealed that the coefficient of hired labour (0.174) has a positive sign and is statistically significant at 1% profit efficiency. An increase in the cost of hired labour by N1 would increase the farm's profit efficiency by 17.4%. The coefficient of family labour (0.062) also has a positive sign and is statistically significant at 1% profit efficiency. An increase in the cost of family labour by N1 would increase the farm's profit efficiency by 6.2%. This conforms with the findings of Ojo et al., (2016). This could be because increasing labour rate would encourage more labour to work in moringa production and marketing activities thus reducing losses from post-harvest and weeds. Availability of family and hired labour, therefore, plays a censorious role in achieving profit efficiency. The price of Seeds and pesticides have a negative sign and are statistically significant at 1% and 5% respectively. The coefficient of seed cost was -0.159. This negative sign conforms with the expected negative sign and was significant at 1% level. This could be related to the upsurge in costs brought about by increased prices because seed costs account for a significant part of moringa production. However, transportation cost showed a positive effect on profit efficiency at a 1% level of significance. It was found that an increase in transportation cost by N1 would increase the farm's profit efficiency by 7.9%.

The inefficiency model revealed that the level of education and farm size are the inefficiency variables that have significant effects on the level of profit inefficiency. The level of education has a coefficient of -1.404, it has a negative sign and is statistically significant at 1%. This suggests that the level of education of the producers is a major constraint in moringa production. More education brings about a decrease in inefficiency and as such increases profit efficiency. This however conforms with Ezeh et al., (2012). The consequence is that having completed many years of education facilitates learning about new technology and developments that may increase the profitability of moringa farmers (Okon et al., 2010; Okorie et al., 2021). Thus, extension programmes should be used to fill the gaps in education among the farmers. Moringa farm size has a coefficient of -1.404 which is also negative but statistically significant at 10%. This implies that as the farm size increases, profit efficiency increases. Increased farm size may have encouraged the employment of contemporary technology, resulting in greater efficiency benefits. This conforms with Oyebanjo et al (2021).

**Table 4: Maximum Likelihood estimates of the stochastic frontier function and profit efficiency.**

| Variable | Parameters | Coefficient | Standard Error | T-ratio |
|---|---|---|---|---|
| Constant | Beta 0 | 5.812 | 0.465 | 12.492*** |
| Family labour | Beta 1 | 0.062 | 0.026 | 2.385** |
| Hired labour | Beta 2 | 0.174 | 0.030 | 5.882*** |
| Transport cost | Beta 3 | 0.079 | 0.025 | 3.189*** |
| Seed cost | Beta 4 | -0.159 | 0.052 | -3.052*** |
| Pesticide | Beta 5 | -0.094 | 0.038 | -2.466** |
| Constant | Delta 0 | 7.251 | 2.088 | 3.474*** |
| Gender | Delta 1 | 0.767 | 0.846 | 0.906 |
| Age | Delta 2 | -0.047 | 0.032 | -1.469 |
| Level of education | Delta 3 | -1.404 | 0.453 | -3.098*** |
| Household size | Delta 4 | 0.193 | 0.144 | 1.338 |
| Moringa farming experience | Delta 5 | -0.202 | 0.192 | -1.048 |
| Moringa farm size | Delta 6 | -1.814 | 1.015 | -1.788* |
| Record keeping | Delta 7 | -1.351 | 0.951 | -1.421 |
| Sigma-squared | | 5.649 | 1.553 | 3.638*** |
| **Gamma** | | **0.99999999** | **0.00000755** | **132458.900*** ** |
| **Mean technical efficiency** | **18.73** | | | |
| **Log likelihood function** | **-286.76843** | | | |
| **LR test** | **70.840005** | | | |

*Source: Field survey, 2017 ***, ** and * shows statistical significance at 1%, 5% and 10%*
*Notes: N = Naira (Nigerian currency)*

## *Conclusion and recommendations*

This study investigated the profit efficiency of Moringa oleifera production. A multistage sampling procedure was used for selecting 150 respondents for the study. The data were analyzed using descriptive statistics, budgetary analysis, and stochastic frontier production function. The descriptive statistics revealed that many of the respondents were male (53%), married (85%), and had formal education (87%). The results further revealed average values of 45 years for age, 7 people for household size, and 0.3 ha for farm size. Moringa production had a cost-benefit ratio of ₦5.857, profit margin of ₦0.182, expense structure ratio of ₦0.107, a net return on investment of ₦4.857, rate of return of ₦5.482, and profitability ratio of ₦0.981. Results obtained from the

stochastic frontier model showed that moringa farmers had an average profit efficiency of 19% in their production. The empirical results from the frontier model showed that the price of family labour, seed, pesticides, hired labour, and transport costs significantly influence the profit efficiency of moringa farmers. However, years of education, and farm size were the major sources of profit inefficiencies among moringa farmers. This study concluded that moringa producers in Osun State were profit inefficient, despite the high returns to moringa production. The findings further revealed that the level of education and farm size influenced the profit efficiency of moringa production. Based on the finding of the result, the study concluded by inferring from the results obtained that there is scope for increasing the profitability of moringa production in the study area by directing policy focus on the significant inefficiency factors. It was recommended that attempts at improving farm incomes need to look at enhancing the value of family and hired labour to achieve significant positive effects on moringa profits. Also, Channels of distribution need to be enhanced beyond local communities and extend to other States as well as other countries through exportation. This should be done in an attempt to improve transportation costs because of its positive and significant effect on moringa production. Finally, training should be provided to less educated farmers to enable them to adopt the best moringa farming practices and adopt innovative ideas in processing in order to add value to moringa. Moringa farmers in the study area should register in adult education centers to improve their efficiency. The same study should be encouraged in other zones of the country. A study should be conducted on the impact of profit efficiency on the welfare of moringa farmers in the area.

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# MARKET CONCENTRATION AND DEMAND FOR ALCOHOLIC BEVERAGES IN MAJOR MOTOR PARKS WITHIN IBADAN METROPOLIS, OYO STATE, NIGERIA

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**Abstract:** *The value addition to alcoholic beverages through packaging in small nylon and the increase in the introduction of new brands has led to its high demand and many Nigerians earning their means of livelihood through the sales. The study showed that the average consumption per day was 6.1 sachets per week. The study revealed that 28.6% of the consumers' monthly income was spent on alcoholic beverages per month. Seaman brand had the highest market share (73.4%); this was followed by Chelsea (66.2%). The study affirmed that 62.9% of the consumers based their choice on high alcoholic content while 3.1% claimed the choice was based on the medicinal (cures pile) value. Also, Captain Jack had the highest market concentration (0.35). The age of respondents, marital status, household size, and the quantity consumed per week were the factors that influenced consumers' monthly expenditure on alcoholic beverages. It is recommended that efforts should be made by the government to reduce the rate of consumption of alcoholic beverages at the motor parks by enforcing the existing (FRSC Act cap 141 Laws of the Federation of Nigeria) law banning/regulating the sales or increasing tax on the brands to make it out of reach for most consumers.*

***Keywords:*** *Alcoholic beverages, Burukutu, Market concentration, Probit regression*
(JEL Code: C01, D11, D40, R2)

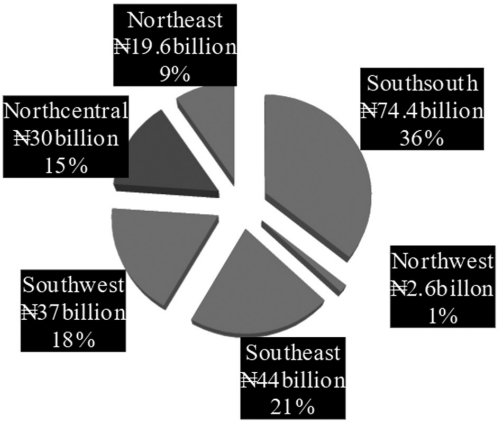
## INTRODUCTION

Alcohol has been consumed in many socio-cultural contexts for millennia, and its history dates back to the prehistoric era (Smart, 2007). In Africa and other areas of the world, alcohol use has long been accepted, particularly when it is used in moderation rather than to the point of total drunkenness. Nigeria has a lengthy history of alcoholic beverage manufacture and usage (Olorunfemi, 1984; Heap, 2005; Korieh, 2003). According to Ademola (2021) and National Alcohol Experiences (2007), Nigerian societies have been making and enjoying alcoholic beverages for a very long time, even before European traders arrived with foreign drinks. For almost 150 years, the nation has been consuming palm wine, which is made from oil and raffia palm trees. Drinks like pito, which is prepared from millet or guinea corn, and burukutu, which is produced from maize, are popular in northern Nigeria.

Alcoholic Beverage (AB) is a fermented liquor that contains ethyl alcohol, often known as ethanol (CH3CH2OH), as an intoxicating ingredient. Examples of ABs include wine, beer, and distilled spirits. Fruits, berries, grains, plant saps, tubers, honey, and milk are among the elements that ferment to produce them. The fermented liquid can then be concentrated to produce a stronger alcoholic beverage. In several societies, alcohol intake holds significant social implications. Beer, wines, and spirits are the three general categories into which alcoholic beverages can be divided according to their source and composition (Dimelu et al., 2011; Durodola, 2009). Durodola (2009) states that whereas wines and beers typically contain 10 to 22 percent alcohol, spirits (40–60%) tend to be "harder" or more prone to cause drunkenness than either wine or beer. Spirits, known by their street name Plebe, make up the majority of the banded sachet liquors.

The manufacture, distribution, and use of alcoholic drinks are governed by regulations in the majority of nations (Drug.com, 2021; International Wines and Spirits Record, 2018; International Alliance for Responsible Drinking, 2016). In Nigeria, the alcoholic beverage sector is a significant business in addition to creating jobs. National Bureau of Statistics (2016) estimates that Nigerians spent around ₦208 billion on alcohol (see Figure 1 for consumption by Geopolitical Zone (GPZ). The biggest and lowest percentages of Nigerians' alcohol expenditures were found in the geopolitical zones of the south-south and northwest. According to NBS (2016), the use of alcoholic drinks in rural areas costs ₦125 billion, whereas urban communities pay N82.5 billion. Although the intake of alcohol varies throughout Nigeria's ethnic groups, Dumbili (2013) posited that the cultural requirements of many communities and individuals allow alcohol to be an integral part of their culture through rituals, marriage ceremonies, and chieftaincy enthronement.

**Figure 1: Percentage distribution of amount spent on alcoholic beverages by GPZ**




*Source: NBS (2016)*

Alcohol is a depressant that, when taken in moderation, produces exhilaration, lowers anxiety, and boosts social interactions. Higher dosages can result in mortality, stupor, intoxication, or unconsciousness. Prolonged consumption may result in physical dependency, an increased risk of various cancers, and an alcohol use disorder. Approximately 33% of people worldwide today consume alcohol for recreational purposes, making it one of the most popular substances in the world (Griswold et al., 2018).

A valuable complement to agricultural products such as grains, tubers, fruits, berries, and palm wine is alcoholic beverages. According to Banars and Pawan (2019), farmers may see a decrease in price for a certain crop because of overproduction. A higher return is obtained by adding value through processing new items that are either partially or fully completed. Additionally, value addition creates new job prospects. alcohol-containing sachet, often marketed for between ₦50 and ₦100, and available in three different sizes: 30 ml, 35 ml, and 50 ml. There are several locations where you may buy sachet liquors, such as supermarkets, drug stores, motor parks, and beer parlors (Durodola, 2009). The sachets are comparatively inexpensive at ₦50, which leads to a high level of consumption. Numerous variables can contribute to the demand and sales of alcoholic drinks. Kehinde and Adegoke (2012) discovered that drivers drink alcohol because they think it can heal a remarkable variety of illnesses, but Adekoya et al. (2011) suggested that long-distance drivers who reported feeling stressed out use alcohol as a panacea or antidote to lessen their stress. Not only do drivers consume alcoholic drinks, but passengers do as well, along with vendors and craftspeople near the motor park. Petty traders are the ubiquitous sellers of alcoholic drinks. Petty trade, according to Mbisso (2012), is an economic activity that entails the small-scale sale and purchase of products and services, ranging from farm produce to locally made and imported consumer items.

Previous studies on alcoholic beverages within Nigeria (Arasi and Ajuwon, 2020; Taiwo et al., 2016; Abayomi et al., 2013) and outside Nigeria (Lim et al., 2013; Dimelu et al., 2011). Most of these studies carried out in Nigeria addressed the prevalence and health implications of alcoholic beverage consumption. However, this study is an attempt to bridge the gap in the literature on the demand for alcoholic beverages, identify the different brands, the reasons for the choice of brand, and the existing market concentration in alcoholic beverages most especially in the motor parks where most sellers are found. It is expected that the study will provide insight into how customers behave in large motor parks and how market concentration affects their preferences and decisions about alcoholic drinks. Analyzing market concentration in the beverage sector would reveal information about market dynamics and competitive intensity. Policymakers may find this information helpful in determining if regulations are necessary to encourage fair competition and stop monopolistic practices. To achieve the objective of the study, the following research questions are raised:

(i) What are the socio-economic characteristics of the buyers and sellers of alcoholic beverages?
(ii) What is the extent of inequality in sales revenue among sellers of alcoholic beverages?
(iii) What are the drivers of consumers' preference for brands of alcoholic beverages?
(iv) What are the factors influencing the amount spent on alcoholic beverages?

## THEORETICAL FRAMEWORK AND LITERATURE REVIEW

This study is supported by theories of consumer behaviour and brand loyalty. Utility, according to Reynolds (2005), is the ability of a good (or service) to fulfill a need. Psychological, economic, social, and cultural elements are among those that influence consumer behaviour. For example, price, consumer income, a brand of alcoholic beverage, and other factors would all influence consumer behaviour when it comes to the demand for alcoholic drinks. Jacoby (1971) posited that brand loyalty is the biased (non-random) behavioral reaction (buying) that a decision-making unit exhibits over time

about one or more alternative brands out of a collection of brands. It is a result of psychological processes and emotional responses. This idea implies that customers in the major motor garages may already have predilections for specific alcohol brands. Demand may rise if some brands have a dominating market share because consumers are more likely to choose well-known brands.

Demand analysis has made use of different analytical approaches. Almost Ideal Demand System is one of them (Motallebi and Pendell, 2013; Dawoud and Seham, 2013; Iwang, 2014.), Linear Expenditure System (Olubokun and Agbede, 2018), Double Hurdle Model (Akinbode and Dipeolu, 2012; Olasunkami, 2012). Notwithstanding the extensive application of these analytical instruments, their limitations have been widely noted in scholarly works. For example, the AIDS model did not perform well when income shifted in terms of price and income elasticity. The inconsistent estimates in the presence of heteroscedasticity and non-normality of the error components constitute the double hurdle model. Although the linear expenditure system is limiting, it nonetheless makes it possible to estimate the demand equations using the software that is now available and solve the issues of heteroscedasticity and zero consumption.

### *Analytical frameworks of Gini coefficient, Probit and multiple regressions*

The summary of the analytical framework of different tools used in the study is explained:

**Gini coefficient**

Following the Organization for Economic Co-operation and Development report (2023), the Gini coefficient is derived from the comparison of cumulative population proportions to cumulative income proportions. A perfect equality scenario yields a Gini coefficient of 0, whereas a perfect inequality scenario yields a value of 1. The Gini coefficient is represented as:

$$G=\frac{1}{2\upsilon}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}p(x)p(y)|x-y|dxdy \quad (1)$$

Where:

$\upsilon=\int_{-\infty}^{\infty}xp(x)dx$ is the mean obtained from the distribution.

**Probit regression**

Binary or dichotomous outcome variables are modelled using probit regression (Karlin, 2023: ). The probit link function is given as:

$$probit(EY)=\Phi^{-1}(p)=\Phi^{-1}(P[Y=1]) \quad (2)$$

Equation (2) is applied to alter this 0/1 dependent variable's expectation. Next, we have a linear predictor by modelling the probit of the mean as a linear mixture of the variables (regressors) X as:

$$probit(EY)=X\beta \quad (3)$$

Where X is the explanatory variable, and is the vector of the unknown regression coefficient

**Multiple regression**

Multiple regression analysis describes a group of methods used to examine the linear connections between two or more variables. Multiple regression estimates the β's in the equation:

$$y_j=x\beta+\varepsilon \quad (4)$$

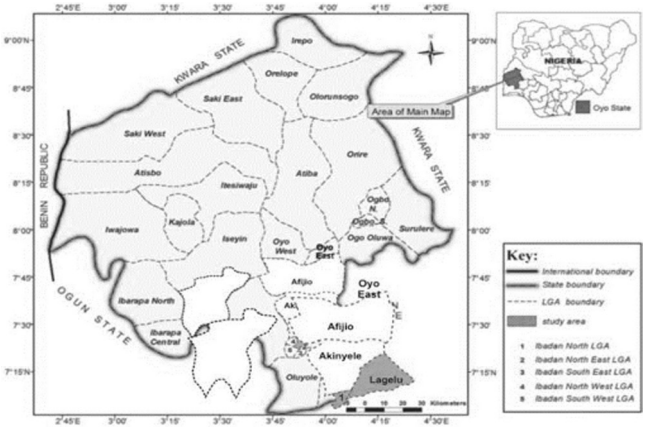
Where x is the regressor, y is the regressand, $\beta$ is the unknown coefficient, and $\varepsilon$ is the error term

## MATERIAL AND METHOD

### *Description of the study area*

The study was carried out in the Ibadan metropolis of Oyo State, Nigeria. The choice of the location was because there are many motor parks (intrastate, interstate as well as journey to West African countries) with high concentration of commercial activities which encourage demand for an alcoholic beverage in sachets. Oyo State is located in Southwestern Nigeria, and Ibadan is the capital. The capital of Oyo State is Ibadan. The city, which has a population of over 3 million, is situated on the edge of the savannah and is the third-largest metropolitan region in Nigeria in terms of population, behind Lagos and Kano (Makama, 2007). Latitude 7.23N and longitude 3.55E define the location of Ibadan. Ibadan metropolis is situated in Southwest Nigeria, 530 kilometers southwest of Abuja, the Federal Capital, and 128 km inland northeast of Lagos. The city spans 3080 km2 in total.

**Figure 1: Map of Oyo state**




### *Sampling Procedure*

A three-stage sampling procedure was used for the study. In the first stage, three major motor parks in the Ibadan metropolis were purposively selected. These were Iwo Road, Gate, and Sango. Sellers of alcoholic beverages were randomly selected from each of the motor parks proportionate to

size using the list of the sellers of alcoholic beverages in the motor park. The breakdown showed that eighteen (18), twelve (12), and eight (8) sellers were randomly selected from Iwo Road, Gate, and Sango, respectively. A random sample of 140 consumers of alcoholic beverages was selected from the three motor parks.

### *Type of Data and Research Instrument*

Primary data was used in this study. Data were obtained through the use of well-structured questionnaires (buyers and sellers). For the consumers of alcoholic beverages, one hundred (100) copies of the completed questionnaire were returned and thirty-eight copies of the completed questionnaire were returned to time and used for the analysis. The questionnaire contains two sections (consumers and sellers). The socioeconomic features were listed in Section A (for customers). Brand, and quantity of alcoholic beverages questions, among others, were in Section B (for consumers).

### *Methods of Data Analysis*

The socioeconomic profile of the sellers' households and consumers of alcoholic drinks in the motor parks sampled was created using descriptive statistics. Tables, charts, measures of central tendency, and measures of dispersion were the descriptive analysis carried out. The degree of inequalities in the revenue among the alcoholic drinks sellers was estimated/revealed using the Gini coefficient and Lorenz curve. It displayed the proportion of sellers who command the majority of alcoholic beverage sales. Based on the Lorenz curve, a mathematical definition of the Gini coefficient was developed. It displays the percentage of the total number of sellers that the total income/revenue earns over time. The equation for the Lorenz Curve:

$$L\left(\frac{k}{p}\right)=\frac{\sum_{i=1}^{k} Y_i}{Y} \quad (5)$$

Where:

$k=1.....n$ = is the position of each seller in the market share of total revenue

$i=1.....k$ = is the position of each seller in the market share of total revenue

$p$ = is the total number of sellers in the market

$Y_i$ = is the total revenue of the ith seller in the market

$\sum_{i=1}^{k} Y_i$ = is the cumulated revenue up to the kth-seller

It is apparent that $\sum_{i=1}^{k} Y_i$ ranges between 0, for k = 0, and Y, for k = n, therefore, equation (5) value ranges between zero and one.

Probit regression was used to determine the drivers of consumers' preference for the major brands of alcoholic drinks in the study area. The model takes the form:

$$\Pr(Y=1/X¿=\mathcal{O}(X^T\beta) \quad (6)$$

Where Y is the dependent variable (Y=1 for consumer preference for a particular brand, others=0), X1 is age (year) of consumer, X2 is marital status of consumer (Married=1, Others = 0), X3 is years of education of consumer, X4 is educational status of consumer (Educated=1, Not educated=0), X5 is household size of consumer, X6 is monthly income of consumer and X7 is quantity of alcoholic beverages drank by consumer

Factors influencing consumers' expenditure per month on alcoholic beverage was determined using multiple regression. Multiple regression estimates the β's in the equation:

$$y_j=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\varepsilon \quad (7)$$

Where y is consumers' expenditure per month on alcoholic beverages, X1 is the age (year) of the consumer, X2 is the marital status of the consumer (Married =1, Others = 0), X3 is years of education of the consumer, X4 is educational status of consumer (Educated=1, Not educated=0), X5 is household size of consumer, X6 is monthly income of consumer, X7 is the quantity of alcoholic beverages drank by consumer per month.

## RESULTS AND DISCUSSION

### *Socio-Economic Characteristics of Respondents (Consumers and Sellers)*

The study showed that 65.9% of consumers of Alcoholic Beverages (AB) were within the age bracket of 28 - 47 years while 76.3% of the sellers were within the same age bracket. The averages of consumers,' and sellers' ages were 44.7 and 41.1 years, respectively. The study also revealed that only males were consumers while only females were sellers of alcoholic beverages. This result is contrary to the claim of some female sellers (34.2%) that they consumed alcoholic beverages occasionally. About three percent (2.8%) of the sellers had tertiary education while none of the consumers had tertiary education. Also, 18.4% and 19.4% of the consumers and sellers had no formal education. More than seventy-one percent (71.1%) of the buyers and sellers of AB were married, respectively. Most consumers of AB (39.2%) were commercial drivers at the motor park while 18.6% were officials of NURTW (National Union of Road Transport Workers) and RTEAN (Road Transport Employer Association of Nigeria). This is in agreement with Adekoya et al. (2011) study that drivers consumed alcohol and cigarettes regularly.

**Table 1 Socioeconomic characteristics of consumers and sellers**

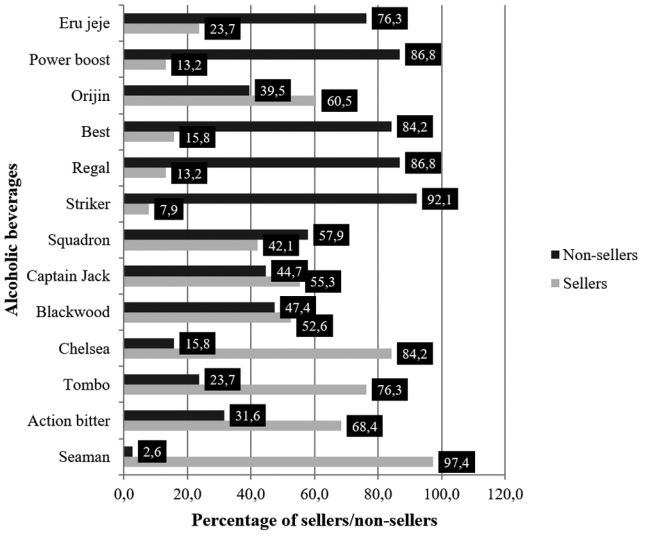
| Variables | Consumers | | Sellers | |
|---|---|---|---|---|
| Age of consumers (Years) | Frequency | Percentage | Frequency | Percentage |
| 18-27 | 2 | 2.1 | 2 | 5.3 |
| 28-37 | 24 | 24.7 | 9 | 23.7 |
| 38-47 | 40 | 41.2 | 20 | 52.6 |
| 48-57 | 13 | 13.4 | 7 | 18.4 |
| 58 and above | 18 | 18.6 | na | na |

| **Average** | **44.7 years** | | **41.1years** | |
|---|---|---|---|---|
| **Sex of respondents** | | | | |
| Male | 100 | 100 | 0 | 0 |
| Female | 0 | 0 | 100 | 100 |
| **Educational status** | | | | |
| No formal education | 19 | 18.4 | 7 | 19.4 |
| Primary education | 67 | 71.1 | 25 | 69.4 |
| Secondary education | 14 | 2.6 | 3 | 8.3 |
| Tertiary education | na | na | 1 | 2.8 |
| **Marital status** | | | | |
| Single | 16 | 16.5 | 8 | 21.1 |
| Married | 69 | 71.1 | 27 | 71.1 |
| Divorced | 5 | 5.2 | 2 | 7.9 |
| Widower | 7 | 7.2 | 1 | 2.6 |
| **Household size** | | | | |
| 1-4 | 54 | 55.7 | 20 | 52.6 |
| 5-8 | 41 | 42.2 | 18 | 47.4 |
| 9 and Above | 2 | 2.1 | na | na |
| **Average** | **4.36** | | **4.39** | |
| **Occupation/other occupation** | | | **Only 15 out of 38** | |
| Artisanal work | 19 | 19.6 | 2 | 5.3 |
| Trading | 15 | 15.5 | 4 | 10.5 |
| Civil/Public Service | 7 | 7.2 | na | na |
| Driving | 38 | 39.2 | na | na |
| NURTW and RTEAN official | 18 | 18.6 | na | na |
| Hairdresser | na | na | 3 | 7.9 |
| Laborer | na | na | 6 | 15.8 |
| **Monthly Income** | **₦17,111.13** | | | |
| 5000-25000 | 86 | 95.6 | na | na |
| 25001-50000 | 1 | 1.1 | na | na |
| 50001-75000 | 2 | 2.2 | na | na |
| 75000 and above | 1 | 1.1 | na | na |
| **Average** | **₦17,111.13** | | | |
| **How consumers get to know about their favorite drink** | | | | |
| Friends | 82 | 82.0 | na | na |
| Traditional drink | 10 | 10.0 | na | na |
| Party | 2 | 2.0 | na | na |
| Promotion sale | 2 | 2.0 | na | na |
| From childhood | 4 | 4.0 | na | na |
| **What influences the choice of drink of the consumer** | | | | |
| High alcoholic content | 61 | 62.9 | na | na |
| It is tasty | 21 | 21.6 | na | na |
| The volume is much | 7 | 7.2 | na | na |
| It is handy | 1 | 1.0 | na | na |
| It is cheap | 2 | 2.1 | na | na |
| Sexual booster | 2 | 2.1 | na | na |
| Medicinal (cures pile) | 3 | 3.1 | na | na |
| **How frequently consumers consume the drink** | | | | |
| Daily | 80 | 82.5 | na | na |
| Weekly | 16 | 16.5 | na | na |
| Occasionally | 1 | 1.0 | na | na |
| **Selling hours per day** | | | | |
| 5-8 | na | na | 7 | 19.4 |
| 9 and above | na | na | 29 | 80.6 |
| **Average** | | | **9.7 hours** | |
| **Sellers who you drink occasionally** | | | | |
| Yes | na | na | 13 | 34.2 |
| No | na | na | 25 | 65.8 |

However, the sales of AB at the motor park and its consumption by commercial motor drivers are contrary to the FRSC ban on the sales of alcoholic beverages in and around all motor parks in Nigeria as contained in FRSC Act cap 141 Laws of the Federation of Nigeria (LFN). The majority of the consumers (95.6%) had monthly income within the bracket of ₦5000 - ₦25000. The average monthly income of the consumers was ₦17,111.13. The study affirmed that respondents spent 28.6% of their income on AB per month with an average of 6.1 sachets consumed per week. The high percentage of monthly income spent on AB may be attributed to the fact that most consumers are youths that likely addicted to the daily consumption. This quantity is however smaller than 12.5 sachets per week (2.5 sachets per day) as revealed by Otim et al. (2019). Most drinkers (82.0%) of AB got to know about their favourite brands through friends. The choice of AB by consumers was Seaman (73.4%), Chelsea (66.2%), Squadron (52.7%), and Captain Jack (44.5%) (Table 2). The choice of AB by consumers (62.9%) was mainly influenced by high alcoholic content while 3.1% claimed the choice was based on the medicinal (cures pile) value. The study revealed that 82.5% and 16.5% of the respondents consume AB daily and weekly, respectively.

Moreover, the study showed that 39.4% of the sellers of AB engaged in other economic activities. Specifically, 7.9% were hairdressers and 15.8% as casual labourers. More than 50.0% of the respondents sold Seaman, Action Bitter, Tombo, Chelsea, Captain Jack, and Orijin while half of the sellers did not sell Erujeje, Power Boost, Best, Regal, Striker, and Squadron. Table 2 shows that Seaman sellers had the highest (see Figure 2). Almost all the sellers had Seaman to display for customers.

**Figure 2: Distribution of sellers and non-sellers of Alcohol Beverages by brand**



This is followed by Chelsea and Tombo, accordingly. This corroborates the highest demand for Seaman by the consumers. Most sellers (80.6%) displayed AB for at least 9 hours per day. The average selling hours was 9.7 hours.

## *The Extent of Inequalities in Daily Sales Revenue of Alcoholic Beverages*

The study revealed that 61% of Captain Jack sellers had around 82% of the total daily sales of Captain Jack, whereas 61% of Chelsea sellers held approximately 78% of the sales of Chelsea per day. Furthermore, 58% of the seaman sellers accounted for approximately 73% of the daily sales of a seaman (see Appendices for Figures 3a, 3b, 3c, 3d, 3e, and 3f). The findings indicate that there was a disparity in the alcoholic beverage market. The Gini coefficient displayed in Table 2 affirmed the disparities in the alcoholic beverage market. With a 0.36 Gini coefficient, Captain Jack had the highest (Table 1).

**Table 2: Average daily sales, percentage of brands' buyers, and Gini coefficient estimates of AB**

| Brand | Average daily sales(₦) | Number of sellers | Gini coefficient | Percentage of buyers |
|---|---|---|---|---|
| Seaman | 9861.11 | 36 | 0.239 | 73.4 |
| Action Bitter | 5245.45 | 22 | 0.243 | 34.8 |
| Tombo | 8125.93 | 27 | 0.252 | 36.9 |
| Chelsea | 9500.00 | 34 | 0.263 | 66.2 |
| Blackwood | 6000.00 | 5 | 0.173 | 23.4 |
| Captain Jack | 5663.16 | 19 | 0.357 | 44.5 |
| Squadron | 5333.33 | 6 | 0.302 | 52.7 |
| Best | 4200.00 | 2 | 0.167 | 18.6 |
| Orijin | 4100.00 | 16 | 0.232 | 17.4 |
| Eru Jeje | 6750.00 | 4 | 0.231 | 20.1 |

## *Determinants of Consumers' Preference for Alcoholic Beverage*

The regression result in Table 2 shows the factors influencing consumers' preference for each brand of alcoholic drink. The diagnostic result revealed that the log-likelihood and the Likelihood Ratio Ch2 were negative and significant, respectively. This means that the models have a good fit. Specifically, coefficients of age, educational status, and monthly income were the factors that influenced consumers' preference for the seaman. Monthly income and educational status negatively influenced consumer preference for seaman alcoholic drinks. Being educated will reduce the consumer's preference for seaman by 20%. Also, respondents' preference for Chelsea was influenced by age, educational status, quality of beverage, and monthly income. Every ₦1000 increase in the monthly income of respondents increases the preference for Chelsea by 11.8%. For Captain Jack, the age of respondents, household size and quality of the alcoholic beverage were the factors that influenced the preference of consumers. A unit increase in household size increases consumers' preference for Captain Jack marginally (0.049%).

**Table 2 Probit regression result**

| Year | Seaman | | | | | Chelsea | | | | | Captain jack | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variables | Coeff. | Std. | z | p | dy/dx | Coeff. | Std. | z | p | dy/dx | Coeff. | Std. | z | p | dy/dx |
| Ag | 0.035* | 0.0193 | 1.80 | 0.072 | 0.008 | -0.049** | 0.019 | -2.60 | 0.009 | -0.019 | -0.043** | 0.021 | -2.048 | -0.09 | -0.0014 |
| Marstat | 0.561 | 0.515 | 1.09 | 0.276 | 0.159 | -0.498 | 0.451 | -1.10 | 0.270 | -0.196 | 0 .269 | 0.714 | 0.377 | 0.707 | 0.0139 |
| Yoed | 0.068 | 0.075 | 0.90 | 0.369 | 0.017 | -0.161** | 0.076 | -2.12 | 0.036 | -0.064 | 0.108 | 0.112 | 0.964 | 0.333 | 0.00466 |
| Edstat | -0.687** | 0.327 | -2.10 | 0.046 | -0.200 | 1.124* | 0.645 | 1.74 | 0.081 | 0.410 | ¬-1.192 | 1.032 | 1.155 | 0.248 | -0.1166 |
| Hhs | 0.083 | 0.106 | 0.78 | 0.434 | 0.020 | 0.109 | 0.099 | 1.10 | 0.270 | 0.044 | 0.311** | 0.154 | 2.019 | 0.048 | 0.00049 |
| QuObev | 0.030 | 0.050 | 0.24 | 0.656 | -0.001 | .0208* | 0.012 | 1.73 | 0.076 | 0.008 | -0.474** | 0.206 | -2.301 | 0.022 | -0.0204 |
| Moninc | -0.005** | 0.012 | -2.23 | 0.035 | -0.007 | 0.297*** | 0.071 | 4.18 | 0.000 | 0.118 | -0.022 | .0215 | -1.023 | 0.022 | -0.00094 |
| Constant | -2.50 | 1.041 | -2.40 | 0.017 | | -.362 | 0.952 | -0.38 | 0.704 | | 2.756 | 1.859 | 1.483 | 0.138 | |
| | LR ch2 = 27.47<br>Probability = 0.0282<br>Log likelihood = -43.404<br>Pseudo R2= 0.0324 | | | | | LR ch2 = 35.94<br>Probability = 0.000<br>Log likelihood = -51.326<br>Pseudo R2= 0.215 | | | | | LR ch2 = 23.86<br>Probability = 0.0342<br>Log likelihood = -34.074<br>Pseudo R2= 0.327 | | | | |

*Note: *, **, *** Represents 10%, 5% and 1% level of significance respectively*
*Source: Field survey (2019)*

## *Factors Influencing Consumers' Monthly Expenditure (₦) on Alcoholic Beverages*

The regression results in Table 3 shows the determinants of the consumers' monthly expenditure on alcoholic beverage. The model has an F value of 6.51 showing that the model has a good fit ($p<0.01$). The significant variables accounted for approximately 24.6% variation of the variation in the monthly expenditure on AB. Age, marital status, household size, and quantity consumed were the factors that influenced the monthly expenditure on alcoholic beverages. Age, marital status, and household size negatively influenced the monthly expenditure on AB while quantity consumed (number of sachets consumed per day) had a positive relationship with the monthly expenditure on AB. Cheah et al. (2019) affirmed the negative relationship between monthly expenditure on AB and household size.

This may be attributed to the financial burden associated with larger households on the head of the household. The negative relationship between the age of the consumer and the monthly spending on alcoholic beverages agrees with the findings of the National Institute on Aging (2022) that as one ages, health issues or prescription medications may dictate that one cut back on alcohol consumption (spend less) or abstain from it entirely.

**Table 3: Multiple regression results**

| Variable | Coefficient | Std. dev | z-value | p-value |
|---|---|---|---|---|
| Age (year) | -79.472* | 43.467 | -1.828 | 0.071 |
| Marital status | -3895.813*** | 1071.918 | -3.634 | 0.002 |
| Year of Education | -116.688 | 186.366 | -0.626 | 0.533 |
| Education status | 1279.957 | 1522.694 | 0.841 | 0.403 |
| Household size | -562.508** | 238.861 | -2.355 | 0.021 |
| Quantity consumed per month | 285.029*** | 74.178 | 3.843 | 0.000 |
| Monthly income | -3.168 | 28.382 | -0.112 | 0.911 |
| Constant | 11453.07 | 2220.462 | 5.158 | 0.000 |

*Adjusted R square = 0.2461, F (7, 76) = 4.87, Prob p < 0.0001*
*Note: *, **, *** Represents 10%,*
*5% and 1% level of significance respectively*
*Source: Field survey (2019)*

## CONCLUSION AND RECOMMENDATIONS

The study showed that there was high demand for alcoholic beverages and a substantial percentage of respondents' income was spent on drinks. The larger proportion of consumers of alcoholic beverages among commercial motor poses a great danger to the safety of travellers. Other identified characteristics of the consumers of alcoholic beverages were youthfulness and poor education. The brand preference of most consumers of alcoholic beverages was based on high alcoholic content. Specifically, Seaman had the highest market share while Captain Jack had the highest market inequality based on sales revenue. Education had a negative influence on the consumers' preferences as well as the monthly spending on alcoholic beverages. The age (youth and non-youth), marital status and household size (areas where large and small household sizes are concentrated) are the key factors that producers of alcoholic beverages may consider for market segmentation to increase their market share and maximize their returns. Based on the evidence from the study, it is recommended that efforts should be made by the government to reduce the rate of consumption of alcoholic beverages at the motor parks by enforcing the existing (FRSC Act cap 141 Laws of the Federation of Nigeria) law banning/regulating the sales or increasing tax on the brands to make it out of reach for most consumers. Although individuals earn their means of livelihood from production and the sales of alcoholic beverages, the need for adult education and routine enlightenment campaigns on the danger inherent in the consumption of alcoholic beverages is imperative for the safety of travellers and drivers and the use of disposable income for other important needs.

### *Limitations of the Study and Areas of Possible Future Research*

The selection of commercial motor parks as study areas might have had an impact on the study's conclusions and introduced sampling bias. Increasing the sample size to include other locations other than the motor parks might yield a more accurate depiction of alcohol consumption in the city. Self-reporting, which is prone to social desirability bias, may be the basis for data on alcohol intake. Because of the stigma associated with alcohol use or legal concerns, participants might have under- or over-reported their intake. More objective measurements of alcohol intake may be investigated in future studies. The suggested possible future studies are:

- It is advised to start a longitudinal study to monitor how patterns of alcohol use evolve over-time. Study locations other than parking lots should be used to facilitate respondent monitoring.
- Health and human nutrition specialists can investigate the effects of alcohol use on the population under study.
- Another proposed future study is assessing the efficacy of various treatments and policies targeted at lowering alcohol use and its related harms in the examined region.

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## APPENDICES

**Figure 3a: Seaman's Lorenz curve**

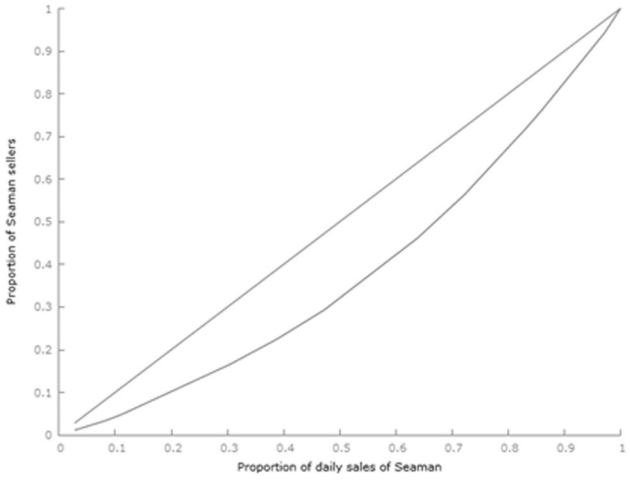



**Figure 3b: Action Bitter's Lorenz curve**

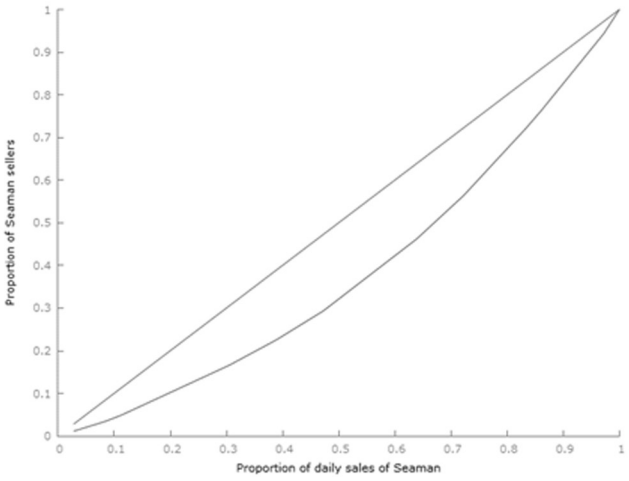



**Figure 3c: Tombo's Lorenz curve**

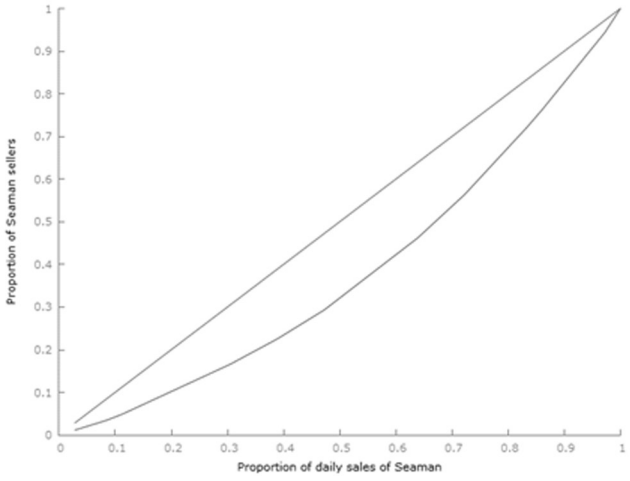



**Figure 3d: Chelsea's Lorenz curve**

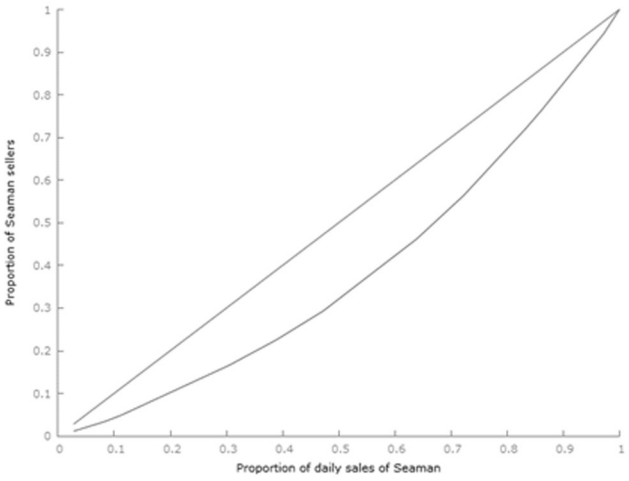



**Figure 3e: Blackwood's Lorenz curve**

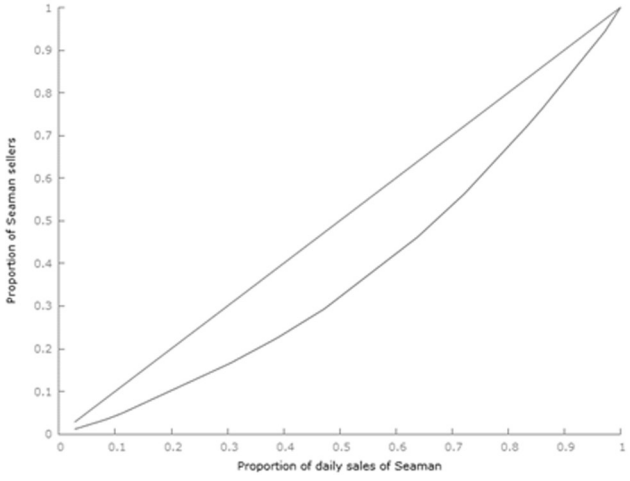



**Figure 3f: Captain Jack's Lorenz curve**

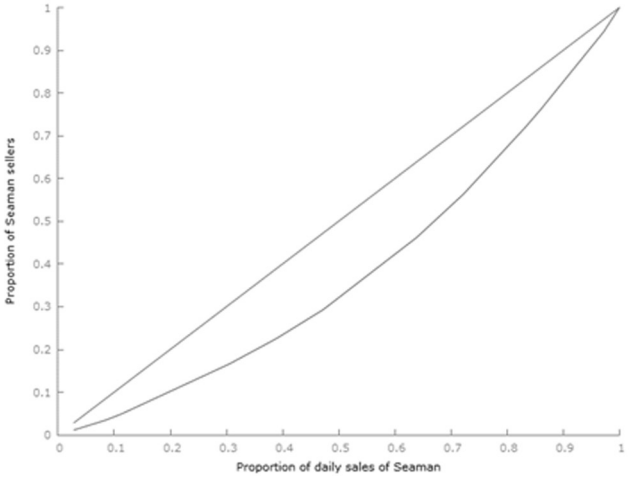


**Figure 3g: Squadron's Lorenz curve**

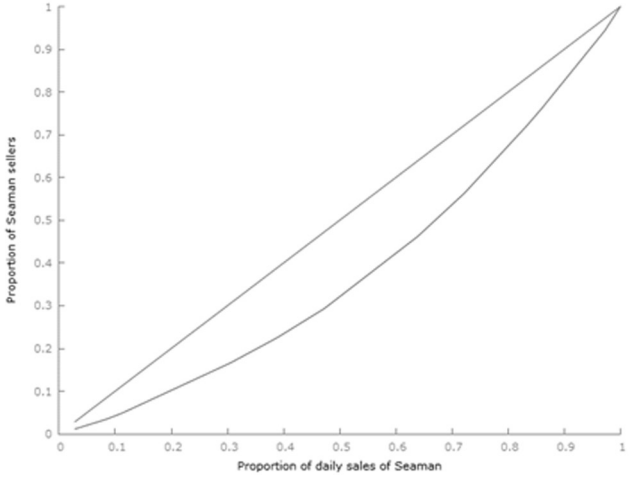



**Figure 3h: Blackwood's Lorenz curve**

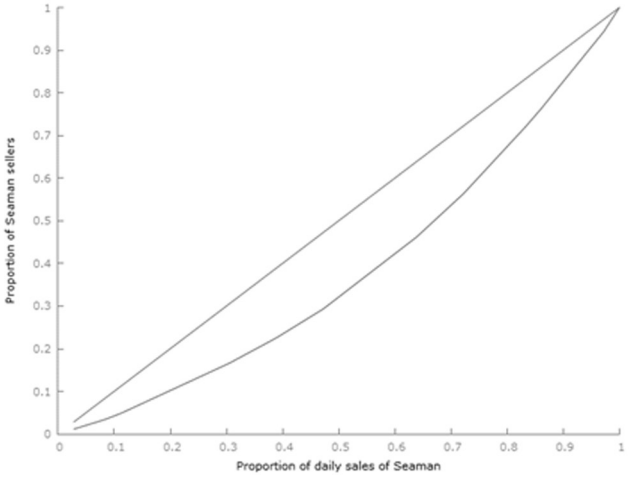



**Figure 3i: Origin's Lorenz curve**

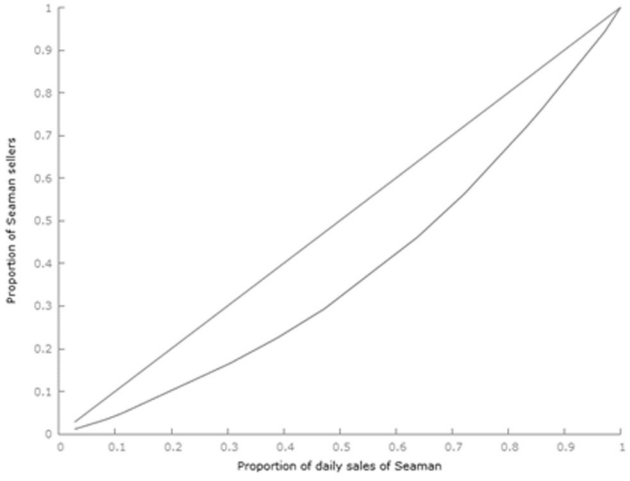
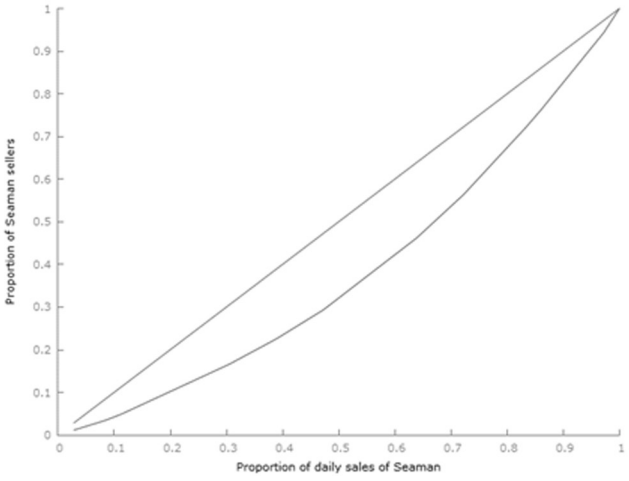



**Figure 3j: Blackwood's Lorenz curve**



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# HOUSEHOLDS FOOD CONSUMPTION BEHAVIOUR DURING COVID-19 PANDEMIC: EVIDENCE FROM RURAL HOUSEHOLDS IN SOUTH AFRICA

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**Abstract:** *The food consumption behaviour of households has been affected by the lockdown restrictions that were implemented to reduce the COVID-19 infection rate. This study was aimed at analysing the food consumption behaviour of rural households during the COVID-19 pandemic in South Africa. To achieve this, a simple random technique was used to collect data from 120 in Merry Pebble (MP) Stream Village. Thereafter, an Ordered Probit Model was used to examine the extent to which households have increased, decreased or maintained the same quantity of food consumed during COVID-19. The results indicated that 46.7% of the rural households had consumed less food during COVID-19 pandemic, 32.5% consumed about the same amount of food, and 20.8% consumed more food. The variables that contributed towards a decrease in food consumption are employment status, household size, loss of income, and social relief grants. On the contrary, bulk buying and food parcels had stabilised food consumption, while the number of employed people in a household and food bought from restaurants contributed towards an increase in food consumption during COVID-19 pandemic. With regard to consumption behaviour per food item, fresh produce, meat, snacks and fast food were consumed less during COVID-19, while there was a constant consumption in dairy products, and an increase in consumption of canned food, frozen food, prepared food, grains and water. The study recommends that the government should continue with the economic and social relief programmes that were created during COVID-19, as they play an important role in increasing and stabilising food consumption by rural households*

***Keywords:*** *COVID-19 pandemic; households; food consumption behaviour*
(JEL Code: D12)

## INTRODUCTION

During the early days of the COVID-19 pandemic in South Africa, lockdown was introduced as a strategy to reduce the infection rate (Kollamparambil and Oyenubi, 2021). Moreover, during Alert Levels 5 and 4 of the lockdown, trade between countries was restricted, borders were closed, and logistic restrictions were imposed, which resulted in a decrease in the supply of goods and services. This affected the purchasing behaviours of the consumers. For instance, consumers started panic buying (bulk buying), which led to purchasing limits being imposed and stock-outs occurring for many food items (Schneeweiss et al. 2020). As a result of bulk buying by those with high levels of affordability, shortages of products in retail stores resulted, and demand started to increase to more than what suppliers could supply. Therefore, to balance the demand and the supply of the commodities, some retail food stores increased prices of certain food items, such as meat, dairy, and eggs (Staff Writer, 2021).

Because of COVID-19 lockdown restrictions, some businesses had to shut down temporarily, resulting in job losses and loss of profit. Consequently, most households experienced a decrease in income, which affected their budget, resulting in a decrease in the level of affordability of food products (Rakhmanov et al. 2020). Moreover, gross domestic product (GDP) declined by 2.0% in the first quarter of 2020 (Stats SA, 2020), as the production of some goods and services was not taking place. This decrease in the amount of goods and servic-

es produced contributed to a shortage of some food products. In view of this, the government introduced the R500 Billion Stimulus Package to address the economic and social welfare losses caused by lockdown. Parts of the package were allocated for social safety net programmes for poor households through a temporary increase in social grants and the introduction of a new grant called the COVID-19 Social Relief of Distress Grant (SRD R350 grant), together with the distribution of food parcels.

The food consumption patterns for most rural households could have changed as a result of this intervention and the economic consequences of lockdown, such as income and job losses, and increases in food prices. Hence, there is a need for this study to analyse the food consumption behaviour of rural households. In particular, as to whether there has been a constant state, increase, or decrease in food consumption during COVID-19 pandemic in South Africa. This is achieved through two study objectives, of which the first is to examine rural households' food consumption behaviour during COVID-19 pandemic. By so doing, this study contributes to literature by providing an insight into the extent to which rural households' food consumption was affected by the COVID-19 lockdown restrictions. The second objective is to determine the influence of several factors on rural households' food consumption behaviour during the COVID-19 pandemic. An identification of those factors would assist policymakers in creating new food policies aimed at improving access to food by rural households in South Africa.

The remainder of this paper is organised as follows. Section 2 presents a review of previous studies on households' food consumption in the COVID-19 era. Section 3 describes the research methods, including study area, sampling procedure and data collection methods. The analytical techniques for data analysis and the variables under study are also described in that section. Section 4 discusses both the descriptive and empirical findings. Section 5 presents the conclusion, including implications and recommendations, of this study.

## LITERATURE REVIEW

The aim of the review is to underline the main findings deducted from previous empirical studies and, in the end, identify the gap in literature that the current study intends to fill. Special attention is given to the main findings regarding the factors reported to have influenced consumption behaviour during COVID-19.

Chenarides et al. (2021) investigated food shopping behaviours and consumption during the pandemic caused by COVID-19 in the United States of America (in two major metropolitan areas). An Ordered Probit Model was used to analyse data. The results obtained indicated that approximately 75% of the participants purchased the food they could get as a result of stock, and approximately 50% of participants purchased more food than under normal conditions. Moreover, consumers reported that they had purchased more groceries than under normality due to food service closures. The findings for food consumption behaviour showed that there was stable consumption of most food items. However, a larger percentage of the participants indicated that they had consumed more snacks since the inception of the pandemic, which is attributed to a sudden decline in consumption of fast food. Potential variables affecting consumption found by the study are socio-characteristics, food assistance and food shopping behaviours during COVID-19, and programmes for grocery pick-up and delivery, before and during COVID-19.

Hassen et al. (2020) have examined the effects of COVID-19 on consumers' awareness in Qatar, covering their attitudes and behaviours associated with food consumption in Qatar. Multiple Response Analysis was conducted to analyse the data. The results obtained indicated a surge in the consumption of local products due to food safety fears, a sharp increase in online grocery shopping, the nonexistence of stockpiling and panic buying of food, and an increase in cooking capabilities. Potential variables affecting food consumption in Qatar are the socio-characteristics of the participants and changes in behaviour during COVID-19 in Qatar with respect to changes in drinking or eating behaviour, changes in food-related behaviour, and behaviour regarding changes to food waste and stocking up of food.

Janssen et al. (2021) investigated changes in the consumers' food consumption behaviour of residents in Denmark, Germany and Slovenia. A Multinomial Regression Model was used to analyse the data. The results showed that food items that had experienced a higher rate of change were cake and biscuits, canned food and frozen food. Food items with a lower rate of change were dairy products, alcoholic drinks and bread. The potential variables, which affected food consumption, are food consumption frequencies, changes in shopping frequency, and socio-characteristics.

Laato et al. (2020) investigated the changes at individual consumer level and the influence of different factors related to the COVID-19 pandemic on changes in food consumption in Finland. The Stimulus-Organism-Response (S-O-R) framework was used for the empirical analysis. As with the study by Janssen et al. (2021), the results showed that food items that had experienced a higher rate of change were cake and biscuits, canned food and frozen food, while dairy products, alcoholic drinks and bread were food items with lower rates of change. In addition, many people experienced cyberchondria and an increase in information overload through the excessive exposure to online information sources. The results further indicated that cyberchondria significantly influenced unusual food purchasing behaviour and voluntary self-isolation. The potential variables that affected food consumption were cyberchondria, intention to self-isolate, online information, information overload, severity intention to make unusual purchases, source perceived, self-isolation, purchase self-efficacy and self-efficacy (Laato et al. 2020).

Fanelli (2021) investigated changes in food consumption and food-related behaviour of consumers in the Campobasso and Isernia provinces of Italy during the initial phase of lockdown. A Kapetanios and Shin Unit Root (KSUR) test was used to analyse the data. The results suggested that the effects of COVID-19 on consumer behaviour could be segregated into eating habits, changes in food shopping behaviour, and food-related behaviour. Potential variables that influenced changes

in food consumption were socio-characteristics, shopping for food, food as an antidote to anxiety, and changes in the shopping basket. Other variables were changes in diet, adherence to a Mediterranean diet, changes in eating habits and activities, food safety and difficulty encountered in finding certain food products.

The main findings from the previous studies can be summarised as follows. Previous studies indicated that there have been changes in behavioural consumption of food during COVID-19. Moreover, they discovered an overall decrease in the consumption of certain food items (i.e. fresh foods, bread, fast foods, dairy products and alcoholic drinks), but a shift towards consumption of food items with a longer shelf life (i.e. canned food, frozen food and snacks). In addition, consumers had stockpiled food in order to avoid trips to the food stores, as a mechanism to safeguard against COVID-19. Previous studies further indicated that the effects of COVID-19 on consumer behaviour could be segregated into eating habits, changes in food shopping behaviour, and food-related behaviour.

## RESEARCH METHODOLOGY

### *Study area*

This study focused on the food consumption behaviour of rural households in South Africa; hence, data were collected from MP Stream Village. MP Stream is one of the villages in the Bushbuckridge Local Municipality, which is located in the Bohlabela District in the Mpumalanga Province. According to Agincourt (2018), MP Stream Village has a population of 6771, with 1196 households. According to Bushbuckridge Local Municipality's IDP (2020), there was a high unemployment rate in MP Stream Village. Because of COVID-19, most consumers in the villages, like MP Stream Village, lost their jobs, which could have affected their level of food affordability due to a reduction in household incomes. Hence, MP Stream Village was used as the case study.

### *Sampling*

From the total MP Stream population of 6771, comprising 1196 households, a sample size of 120 households (10.03%) were drawn by using a simple random sampling technique. Simple random sampling was adopted as it allows or gives each household an equal probability of being chosen in the sample (Mohsin, 2016). In applying this technique, a list of MP Stream Village households was obtained from the traditional leaders, thereafter a simple random selection was used to select the sample of 120 households that were interviewed in the study.

### *Data collection*

Primary data was collected through using a face-to-face questionnaire in 2021, which constituted the key instrument used to collect data from the respondents. The questionnaire was composed of open-ended and close-ended questions. The questionnaire had two separate sections. The first section provided information about the socioeconomic characteristics of the respondents, such as age, household size, marital status, employment status, and loss of income. Other COVID-19 related factors were also embedded in the first section, such as food parcels received, social relief grants, information sources about COVID-19, consumption of food from restaurants during COVID-19, and bulk buying. The second section included questions on changes in households' food consumption behaviour during COVID-19 pandemic.

The questionnaires were pre-tested on a small sample of rural households before the full-scale survey was conducted, in line with the guidelines published by GAO (2019), to enhance the validity and reliability of the data. The pre-tested questionnaires were excluded from the sample data. In meeting the necessary ethical standards, the respondents' consent was sought and the purpose of the research was explained before interviews were conducted. Further to this, the respondents were given assurance that the information collected will be treated with confidentiality (with no mentions of names), and were informed that participation in the survey was voluntary.

### *Descriptive analysis*

Descriptive analyses were conducted to address the first objective of the study, which is to examine rural households' food consumption behaviour during COVID-19 pandemic. Food consumption behaviour is defined, in this study, as changes in food consumption patterns (frequencies) of a household, in terms of a constant state, decrease or an increase in food consumption. Changes in food consumption were measured, in line with Chenarides et al. (2021), by asking respondents, "How has your consumption been affected during COVID-19 pandemic, with regard to a decrease, increase, or constant consumption?" Consequently, several food categories were used to examine changes in the rural households' food consumption. These food categories are, in line with Chenarides et al. (2021), canned food, fresh produce, frozen food, dairy, prepared food, meat, grains, snacks, water and fast food. Ultimately, the descriptive analyses were conducted to examine whether there was a decreased, increased, or constant consumption of these food categories by rural households.

### *Empirical analysis*

Considering the discrete nature and ordinal ranking of the "food consumption behaviour" variable, an Ordered Probit Model was used in the empirical analysis. The unobserved preference obtained by households to maintain their consumption frequency during COVID-19 is as follows (Chenarides et al. 2021):

$$Y_{it} = \beta x_i + \varepsilon_i \quad (1)$$

x_i represents predictor variables, defined as variables that explain food consumption behaviour, including socio-characteristics. β represents x_i coefficients, and ε_i is an error term, which follows a standard normal distribution. Factor yi is the observed ordinal variable, representing the food consumption frequency of households, which is described as follows (Chenarides et al. 2021):

$$Y_{it} = \beta x_i + \varepsilon_i \quad (2)$$

where j = 0, …, M is the number of possible y outcomes where the highest category is M, and u_j's are unknown cut-off values. In this study, M is equal to three. By assuming the error term ε_i to follow a standard normal distribution, probabilities for y_(i )are (Chenarides et al. 2021):

$$\Pr(y_i = 0) = \int_{-\infty}^{-\beta x_i} \phi(\varepsilon_i)d\varepsilon_i = \Phi(-\beta x_i), \quad (3)$$

$$\Pr(y_i = 1) = \int_{-\beta x_i}^{u_1-\beta x_i} \phi(\varepsilon_i)d\varepsilon_i = \Phi(u_1 - \beta x_i) - \Phi(-\beta x_i),$$

$$\Pr(y_i = M-1) = \int_{u_{M-2}-\beta x_i}^{u_{M-1}-\beta x_i} \phi(\varepsilon_i)d\varepsilon_i = \Phi(u_{M-1} - \beta x_i) - \Phi(u_{M-2} - \beta x_i),$$

$$\Pr(y_i = M) = \int_{u_{M-1}-\beta x_i}^{u_M-\beta x_i} \phi(\varepsilon_i)d\varepsilon_i = \phi(u_M - \beta x_i) - \phi(u_{M-1} - \beta x_i) = 1 - \Phi(u_{M-1} - \beta x_i)$$

where ϕ represents the standard normal probability density, while Φ represents the cumulative distribution functions (Chenarides et al. 2021; Haobijam et al. 2021).

The base category or reference category is identified as a category of comparison for the other categories; therefore, the base category in the study was increase in food consumption, where it was used as a point of reference for other categories (i.e. decrease in food consumption and constant food consumption).

The Ordered Probit Model was further used to compute the marginal effects and predicted probabilities for each food consumption category. In line with Cranfield and Magnusson (2003), when computed at the averages of the data, the predicted probabilities show the probability that an average household's food consumption would fall within each of the food consumption categories. The parameter estimates (coefficients) are used to compute the marginal effects of predictor variables on the predicted probabilities. Marginal effects denote how a change in one of the predictor variables influences the predicted probability that a household's food consumption behaviour falls within each category of consumption frequencies. The change in probabilities for the consumption frequencies must be equal to zero, since the sum of probabilities for the consumption categories must equal one (Cranfield and Magnusson, 2003). The marginal effects for the discrete (categorical) variables and continuous variables are calculated differently (Williams, 2012). The equation for the marginal effects for the binary variables is as follows:

$$\frac{\partial Pr(INC=j-1)}{\partial xk} = [\phi(\gamma j - 1 - \boldsymbol{X\beta}) - \phi(\gamma - j - \boldsymbol{X\beta})]\beta k, \quad (4)$$

where ϕ(.) represents the normal probability distribution function. Marginal effects for the binary predictor variables are discretely estimated – they measure the difference in predicted probabilities, as the binary variable is set equal to zero and one (Cranfield and Magnusson, 2003). Marginal effects for continuous variables measure the rate of change in the predicted probabilities due to a 1-unit change in the predictor variable. The equation for the marginal effects for the continuous variables is as follows:

$$\frac{\triangle Pr(INC=j-1)}{\triangle xk} = \theta(INC = j-1 \,|\, xk = 1) - \theta((INC = j-1 \,|\, xk = 0) \quad (5)$$

Several predictor variables (factors), which are thought to influence household food consumption behaviour, can be augmented in the empirical model. Thus, the specific Ordered Probit Model used in this study to determine the relationship between food consumption behaviour and several factors is described as follows:

(6)

$$Y_i = \beta_0 + \beta_1 GEND + \beta_2 AGE + \beta_3 HS + \beta_4 EPH + \beta_5 MS + \beta_6 EDL + \beta_7 EPS + \beta_8 TE + \beta_9 TS + \beta_{10} GR + \beta_{11} FPA + \beta_{12} SRG + \beta_{13} MIHH + \beta_{14} ILP + \beta_{15} SCP + \beta_{16} CR + \beta_{17} PFRS + \beta_{18} HPS + \beta_{19} BB + U$$

where: Yi = food consumption behaviour; β0 = constant; β0 – β19 = parameters of estimates; and GEND–BB = abbreviations for several factors that might affect food consumption behaviour.

## RESULTS AND DISCUSSION

### *Descriptive results*

This section presents the descriptive results for the dependent variable and predictor variables. The dependent variable is explained in respect of changes in food consumption in terms of whether there was a decreased, increased, or constant consumption of food by rural households. The predictor variables are explained in terms of factors considered to influence the food consumption behaviour of households. The descriptive results for the dependent variable and predictor variables are presented in Table 1.

**Table 1: Descriptive statistics**

| CATEGORICAL VARIABLES | | | |
|---|---|---|---|
| **Variable** | **Category** | **Frequency** | **Percentage** |
| **Dependent variable** | | | |
| **Food consumption frequency** | Consumed less | 27 | 0.252 |
| | Consumed about the same | 34 | 0.263 |
| **Predictor variables** | | | |
| **Gender** | Male | 39 | 32.5% |
| | Female | 81 | 67.5% |
| **Age** | Less than 18 | 2 | 1.7% |
| | 18-35 | 33 | 27.5% |
| | 36-50 | 47 | 39.2% |
| | Above 50 | 38 | 31.7% |
| **Education** | No formal education | 12 | 10% |
| | Primary education | 13 | 10.8% |
| | Secondary education | 64 | 53.4% |
| | Tertiary education | 31 | 25.8% |
| **Marital status** | Single | 50 | 41.7% |
| | Married | 35 | 29.2% |
| | Divorced | 13 | 10.8% |
| | Widow | 22 | 18.3% |
| **Employment status** | Not employed | 73 | 60.8% |
| | Employed | 47 | 39.2% |
| **Type of employment** | Full time | 28 | 23.3% |
| | Part-time | 11 | 9.2% |
| | Contract | 8 | 6.7% |
| | Unemployed | 73 | 60.8% |

| | | | |
|---|---|---|---|
| **Type of sector** | Formal | 30 | 25% |
| | Informal | 17 | 14.2% |
| | Not employed | 73 | 60.8% |
| **Grants** | Old age | 15 | 12.5% |
| | Child support | 26 | 21.7% |
| | Care dependency | 2 | 1.7% |
| | Grant in aid | 0 | 0% |
| | War veteran | 5 | 4.2% |
| | Foster child | 1 | 0.8% |
| | Disability | 5 | 4.2% |
| | Not receiving grant | 66 | 55% |
| **Monthly income** | Less than R5 000 | 62 | 51.7% |
| | R5 000-R9 999 | 29 | 24.2% |
| | R10 000-R14 999 | 8 | 6.7% |
| | R15 000-R19 999 | 12 | 10% |
| | Above R20 000 | 9 | 7.5% |
| **Income loss due to pandemic** | Yes | 54 | 45% |
| | No | 66 | 55% |
| **Information sources about COVID-19** | Health institution | 14 | 11.7% |
| | Social media | 30 | 25% |
| | Family and friends | 21 | 17.5% |
| | Television | 37 | 30.8% |
| | Radio | 18 | 15% |
| **Social relief grant** | Yes | 52 | 43.3% |
| | No | 68 | 56.7% |
| **Food parcels** | Yes | 43 | 35.8% |
| | No | 77 | 64.2% |
| **Consumption of restaurant food** | Yes | 49 | 40.8% |
| | No | 71 | 59.2% |
| **Preferred food retail store** | Shoprite | 37 | 30.8% |
| | Boxer | 35 | 29.2% |
| | Pick n Pay | 33 | 27.5% |
| | Checkers | 5 | 4.2% |
| | Woolworths | 10 | 8.3% |
| | Other | 0 | 0% |
| **Grocery purchasing frequency** | Daily | 5 | 4.2% |
| | Weekly | 24 | 20% |
| | Monthly | 85 | 70.8% |
| | Whenever I need food | 6 | 5% |
| | Other | 0 | 0% |
| **Bulk buying** | Yes | 57 | 47.5% |
| | No | 63 | 52.5% |

| **CONTINUOUS VARIABLES** | | | | |
|---|---|---|---|---|
| **Variable** | **Minimum** | **Maximum** | **Mean** | **St. Deviation** |
| Household size | 1 | 11 | 5 | 2.480 |
| Number of employed people | 0 | 5 | 1 | 0.860 |

*Source: Research Data (2021)*

The results for food consumption behaviour (i.e. dependent variable) revealed that about 46.7% of the respondents from the sample size consumed less food during COVID-19, 32.5% consumed about the same amount, and 20.8% of the respondents consumed more food during the COVID-19 pandemic. These signify that majority of the households consumed less food during COVID-19, while fewer households consumed more food during COVID-19. The lower consumption of food is attributed to unemployment, as the descriptive results for employment status revealed that majority of the respondents were unemployed (60.8%).

The descriptive results for the predictor variables are as follows. With regard to gender, 32.5% of the respondents were males and 67.5% were females, indicating that there were more female-headed households than male-headed households. Regarding the age of the household heads, majority of the respondents were within the age category of 36 to 50 (39.2%), while fewer respondents were younger than 18 years (1.7%). Concerning the marital status, most respondents were single (41.7%), while the lowest numbers of respondents were divorced (18.3%). In terms of the level of education, most of the respondents had received secondary education (53.5%), while fewest of the respondents had no formal education (10%).

Regarding the employment status, 60.8% of the respondents were not employed, while 39.2% were employed. These statistic are in line with the high unemployment rate within the country. In terms of the nature of employment, fewer respondents were employed on a contract basis (9.2%), majority were unemployed (60.8%), while others were employed on a full time (23.3%) and part time basis (9.2%). In terms of the type of employment sector, 25% of the respondents were employed in the formal sector, 14.2% were employed in an informal sector, while 60.8% were not employed. For the type of employment sector, the results showed that while most respondents were not employed (60.8%), a majority of those who were employed, were employed in the manufacturing sector (6.7%), with fewer being employed in the finance sector (0.8%).

With regard to receiving a grant, most respondents did not receive social grants (55%), while fewer respondents received social grants (45%). In terms of the nature of the grant, majority of the respondents received child support grants (21.7%), while fewer respondents received the foster child grant (0.8%). Concerning monthly income, most household heads received a monthly income of less than R5 000 (51.7%), while fewer received monthly incomes between R10 000 and R14 999 (10%). With regard to loss of income, the majority of the respondents did not lose income during COVID-19 (55%), while fewer lost income during COVID-19 pandemic (45%). These results are attributed to the fact that the majority of the respondents (60.8%) were unemployed; hence, most respondents did not lose income during the COVID-19 pandemic.

In terms of information sources, most respondents obtained information about COVID-19 from television (30.8%), while fewer respondents received information from health institutions (11.7%). Regarding the social relief grant, 43.3% of the respondents received the Social Relief of Distress Grant (SRD, R350), while the other 56.7% did not. These results signify that most of the respondents did not receive the Social Relief of Distress Grant, as some (those who had lost employment during COVID-19) were receiving income relief through the Unemployment Insurance Fund (UIF).

Concerning the food parcels, 35.8% of the respondents received the food parcels, while 64.2% did not receive food parcels. This indicates that the majority of the respondents did not receive food parcels, which is attributed to the alleged incidents of nepotism in the allocation of food parcels and looting of food parcels (Mahlangu, 2020; Staff Writer, 2020; Tau et al. 2020). With regard to the consumption of restaurant food,

40.8% of the respondents consumed food from restaurants, while 59.2% did not consume food from restaurants during the COVID-19 pandemic. This finding is attributed to the closure of restaurants during Alert Levels 5 and 4, and restrictions of trading hours during the COVID-19 due to the curfew.

Concerning their preferred retail stores, the majority of the respondents preferred purchasing from Shoprite (30.8%), while fewer respondents preferred purchasing from Checkers (4.2%). This finding is attributable to the fact that Shoprite is more accessible to rural households, as it has more stores around the country.

For grocery purchasing frequency, most respondents purchased their groceries monthly (70.8%), while fewer respondents purchased groceries daily (4.2%). This is because most people receive their income monthly; hence, most households purchased grocery monthly. With regard to bulk buying, most respondents did not participate in bulk buying (52.5%), which is attributed to lacking or limited income, as most respondents were unemployed.

The descriptive statistics results for the continuous variables are included in Table 1, alongside the statistics for the dependent variable and predictor variables (i.e. categorical variables). The statistics show that the average household size was 5, with a minimum of 1 person in a household, and a maximum of 11 people. The number of employed people in a household ranged from a minimum of 0, with an average of 1, to a maximum of 5.

## *Households' food consumption behaviour per food item*

Several food categories were used to examine changes in the food consumption of rural households. These food categories were fresh produce, dairy, frozen food, canned food, prepared food, meat, grains, snacks, water and fast food. The descriptive analyses were conducted to examine whether there was a decreased, increased, or constant consumption of these food categories by rural households. The results for food consumption per food item are presented in Table 2 below.

**Table 2: Food consumption per food item**

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| **Fresh produce** | Consumed less | 50 | 41.7% |
| | Consumed about the same | 47 | 39.2% |
| | Consumed more | 23 | 19.1% |
| **Dairy** | Consumed less | 42 | 35% |
| | Consumed about the same | 46 | 38.3% |
| | Consumed more | 32 | 26.7% |
| **Frozen food** | Consumed less | 33 | 27.5% |
| | Consumed about the same | 38 | 31.7% |
| | Consumed more | 49 | 40.8% |
| **Canned food** | Consumed less | 35 | 29.2% |
| | Consumed about the same | 41 | 34.1% |
| | Consumed more | 44 | 36.7% |
| **Prepared food** | Consumed less | 28 | 23.3% |
| | Consumed about the same | 36 | 30% |
| | Consumed more | 56 | 46.7% |
| **Meat** | Consumed less | 44 | 36.7% |
| | Consumed about the same | 42 | 35% |
| | Consumed more | 34 | 28.3% |
| **Grains** | Consumed less | 41 | 34.3% |
| | Consumed about the same | 35 | 29% |
| | Consumed more | 44 | 36.7% |
| **Snacks** | Consumed less | 53 | 44.2% |
| | Consumed about the same | 43 | 35.8% |
| | Consumed more | 24 | 20% |
| **Water** | Consumed less | 36 | 30% |
| | Consumed about the same | 41 | 34.2% |
| | Consumed more | 43 | 35.8% |
| **Fast food** | Consumed less | 43 | 35.8% |
| | Consumed about the same | 41 | 34.2% |
| | Consumed more | 36 | 30% |

*Source: Research Data (2021)*

The results for consumption of fresh produce are that 41.7% of the respondents indicated that they had consumed less fresh produce, with 39.2% indicating that they had consumed about the same, and 9.1% indicated that they had consumed more fresh produce during the COVID-19 pandemic. The lower consumption of fresh produce by most households is attributed to the fact that the informal fresh produce traders (street vendors) were not allowed to operate during Alert Level 5, while only those with trading licences or permits were allowed to operate during Alert Level 4. These results are in line with those of previous studies, which found an overall reduction in consumption of fresh produce in Italy (Fanelli, 2021), Denmark, Germany and Slovenia (Janssen et al. 2021). However, these results are in contradiction to those of Hassen et al. (2020) and Chenarides et al. (2021), who ascertained an increase in the consumption of fresh produce products in Qatar and the United States, respectively, during the COVID-19 pandemic.

With regard to dairy products consumption, 35% of the respondents indicated that they had consumed less dairy products, with 38.8% indicating that they had consumed about the same and 26.7% indicating that they had consumed more dairy products during the COVID-19 pandemic. The lower consumption of dairy products is attributed to the surge in dairy prices during the COVID-19 pandemic in South Africa (Stats SA, 2021). However, these results are in contradiction to those of previous studies that found that there was an increase in the consumption of dairy products in Italy (Fanelli, 2021), Qatar (Hassen et al. 2020), and the United States (Chenarides et al. 2021) during the COVID-19 pandemic.

In terms of frozen food, 40.8% indicated that they had consumed more frozen food, 31.7% indicated that they consumed about the same amounts, while 27.5% of the respondents indicated that they had consumed less frozen food during the COVID-19 pandemic. The higher consumption of frozen foods is alluded to households' preference for food items that had a long shelf life to minimise travelling to buy food in order to protect themselves from contracting COVID-19. These results are in line with those of previous studies, which found that there was an increase in the consumption of frozen foods in Italy (Fanelli, 2021), the United States (Chenarides et al.

2021), and Denmark, Germany and Slovenia (Janssen et al. 2021) during the COVID-19 pandemic. However, the results are in contradiction to those of Hassen et al. (2020), as they discovered a constant consumption in frozen food in Qatar during the COVID-19 pandemic.

Concerning canned foods, 29.2% of the respondents indicated that they had consumed less canned food, 34.1% indicated that they had consumed about the same amounts, and 36.7% indicated that they had consumed more canned food during COVID-19. This suggests that there was a shift away from food with a shorter shelf life, as most households consumed less fresh produce, to foods with a longer shelf life. These results are in line with those of previous studies, which found an overall reduction in the consumption of fresh produce in Italy (Fanelli, 2021), and Denmark, Germany and Slovenia (Janssen et al. 2021). However, these results are in contradiction to those of Hassen et al. (2020) and Chenarides et al. (2021), who found an increase in the consumption of fresh produce products in Qatar and the United States, respectively, during the COVID-19 pandemic.

In the case of prepared food, 46.7% of the respondents indicated that they had consumed more amounts of prepared food, 30% indicated that they consumed about the same amounts, while 23.3% of the respondents indicated that they had consumed lower amounts of prepared food during COVID-19. This means that most households consumed more prepared food, while fewer households consumed less prepared food during COVID-19. This shows that there was a shift away from restaurant food to home-prepared food due to lockdown restrictions, which required closure of restaurants (Alert Levels 5 and 4) and restricted the movement of consumers and the trading hours of restaurants. The results are in line with the results of previous studies, which found that there was an overall increase in the consumption of home-prepared food during the COVID-19 pandemic in Italy (Fanelli 2021), Qatar (Hassen et al. 2020), and Denmark, Germany and Slovenia (Janssen et al. 2021). However, the results are in contradiction to those of Chenarides et al. (2021), as they found that there was a lower consumption of prepared food in the United States during COVID-19.

With regard to meat consumption, 36.7% of the respondents indicated that they had consumed less meat, 35% indicated that they had consumed about the same amounts, and 28.3% indicated that they had consumed more meat during COVID-19. This means that the majority of the households consumed less meat, while fewer households consumed more meat during COVID-19. This is a result of the increase in meat prices during COVID-19 in South Africa (Fin24 2021). The results are in line with those of a study by Janssen et al. (2021), which found that there was a decrease in the consumption of meat in Denmark, Germany and Slovenia during COVID-19. However, the results are contrary to those of Chenarides et al. (2021), as they discovered that there was an increase in the consumption of meat in the United States during COVID-19.

Concerning grains, 34.3% of the respondents indicated that they had consumed lower amounts of grains, 29% indicated that they had consumed about the same amounts, and 36.7% indicated that they had consumed more amounts of grains during the COVID-19 pandemic. The results signify that the majority of the households consumed more amounts of grains during COVID-19, whereas fewer households consumed lower amounts of grains during COVID-19. This shows that there was a shift away from dietary foods (fresh produce), since most respondents consumed less fresh produce (39.2%), towards the consumption of staple foods. This shift is attributed to the fact that grains are more affordable and have a longer shelf life. The results are in line with those of previous studies (Chenarides et al. 2021; Janssen et al. 2021), which found that there was a greater consumption of grains in the United States, and in Denmark, Germany and Slovenia during COVID-19. However, the results are in contradiction to those of Hassen et al. (2020), who found that there was a lower consumption of grains in Qatar during COVID-19.

In the case of snacks, 44.2% of the respondents indicated that they had consumed fewer snacks, followed by respondents who had consumed about the same amount of snacks, at 35.8%, while 20% indicated that they had consumed more snacks during the COVID-19 pandemic. This means that most households consumed fewer amounts of snacks, while fewer households consumed more snacks during COVID-19. This was attributable to the restrictions that were imposed, since retail stores were not allowed to sell snacks during Alert Level 5 of the lockdown. The results are in contradiction to those of previous studies, which found that there was a general increase in snack consumption in the United States (Chenarides et al. 2021), Italy (Fanelli, 2021), Qatar (Hassen et al. 2020), and Denmark, Germany and Slovenia (Janssen et al. 2021) during COVID-19.

With regard to water, 30% of the respondents indicated that they had consumed lower amounts of water, 34.2% indicated that they has consumed about the same amounts, and 35.8% indicated that they had consumed more water during the COVID-19 pandemic. This shows that most households consumed more water, while fewer households consumed lower amounts of water. These results are contrary to those of previous studies by Hassen et al. (2020), who discovered that there was constant consumption of water in Qatar, and those of Chenarides et al. (2021), who found that there was less consumption of water in the United States during COVID-19.

Concerning fast food, 35.8% of the respondents indicated that they had consumed less fast food from restaurants, 34.2% indicated that they had consumed about the same amounts, and 30% indicated that they had consumed more fast food during the COVID-19 pandemic. The lower consumption of fast food is attributed to the closure of restaurants during Alert Levels 5 and 4, and to the restrictions of trading hours during COVID-19 because of the curfew. This shows that there was a shift away from the consumption of fast food towards the consumption of food prepared at home, foods with a long shelf life and grains. This is because the study found that most households had consumed more amounts of prepared food (46.7%) and foods with a long shelf life (canned food [36.7%]) and grains [36.7%]) during COVID-19. The results are in line with those of Chenarides et al. (2021) who discovered a decrease in the consumption of fast food in the United

States. However, the results are contrary to the results of other studies that discovered an increase in the consumption of fast food in Qatar (Hassen et al. 2020), and in Denmark, Germany and Slovenia (Janssen et al. 2021) during COVID-19.

## *Ordered Probit Model results*

An Ordered Probit Model was used to determine the influence of several factors on the food consumption behaviour of rural households during the COVID-19 pandemic. The findings indicating the estimated coefficients, t-statistics, standard errors and levels of significance are shown in Table 3 below.

**Table 3: Ordered Probit Model results**

| Variables | B coefficients | Standard error | T-statistics | Significance |
|---|---|---|---|---|
| **Gender (GEND)** | 0.466 | 0.028 | 2.034 | 0.154 |
| **Age (AGE)** | 0.314 | 0.072 | 4.361 | 0.000*** |
| **Household size (HS)** | -0.522 | 0.295 | 1.769 | 0.076* |
| **Number of employed people in the household (EPH)** | 0.647 | 0.205 | 3.156 | 0.006*** |
| **Marital status (MS)** | 0.520 | 0.261 | 1.992 | 0.078* |
| **Education (EDL)** | 0.721 | 0.494 | 0.525 | 0.469 |
| **Employment status of the household head (EPS)** | 0.534 | 0.286 | 1.867 | 0.083* |
| **Type of employment (TE)** | -1.905 | 0.418 | 2.193 | 0.139 |
| **Type of sector (TS)** | 0.063 | 0.205 | 0.875 | 0.350 |
| **Type of grant (GR)** | -5.835 | 0.589 | 1.725 | 0.110 |
| **Food parcels or assistance (FPA)** | 0.419 | 0.108 | 3.879 | 0.003*** |
| **Social relief grant (SRG)** | -0.414 | 0.237 | 1.746 | 0.081* |
| **Income of the household head (MIHH)** | -0.394 | 0.340 | 0.038 | 0.846 |
| **Loss of income (ILP)** | -1.426 | 0.656 | 2.173 | 0.005*** |
| **Information sources about the COVID-19 (SCP)** | 0.269 | 0.114 | 2.359 | 0.004*** |
| **Food from restaurants (CR)** | 0.411 | 0.095 | 4.2810 | 0.000** |
| **Preferred retail store (PFRS)** | -0.547 | 0.638 | 0.735 | 0.391 |
| **Purchasing frequency (HPS)** | -0.595 | 0.783 | 0.578 | 0.447 |
| **Bulk buying (BB)** | 0.275 | 0.073 | 3.666 | 0.000*** |
| **Model summary** | | | | |
| (-2) Log-likelihood | 202.740 | | | |
| **Pseudo R-Square** | | | | |
| Cox and Snell R-Square | 0.606 | | | |
| Nagelkerke R-Square | 0.640 | | | |

*Source: Research Data (2021);*
*Note: *p < 0.1 **p < 0.05. ***p < 0.01*

The analysis was undertaken by using the Statistical Package for the Social Sciences (SPSS). The (-2) Log-likelihood of the estimated model is 202.740, which implies that the model can be relied upon to predict the food consumption behaviour of households. A Nagelkerke pseudo-R2 of 0.640 was obtained, which signifies that the predictor variables account for approximately 64% of the variation in food consumption behaviour.

The Ordered Probit model was also used to derive the predicted probabilities and marginal effects for the three food consumption frequency categories, evaluated at the average of the data. The analyses were undertaken using STATA. The results for the predicted probabilities, as well as the marginal effects, are presented in Table 4.

**Table 4: Ordered Probit Model (predicted probabilities and marginal effects)**

| Food consumption categories | FCF=0 | FCF=1 | FCF=2 |
|---|---|---|---|
| Predicted probabilities | 0.444 | 0.316 | 0.240 |
| **Variables** | **Marginal effects** | | |
| **GEND** | -0.011 | -0.016 | 0.027 |
| **AGE** | -0.041 | 0.020 | 0.021 |
| **HS** | 0.006 | 0.007 | -0.013 |
| **EPH** | -0.027 | 0.016 | 0.011 |
| **MS** | -0.088 | 0.046 | 0.042 |
| **EDL** | -0.043 | 0.006 | 0.037 |
| **EPS** | -0.0013 | 0.009 | 0.004 |
| **TE** | 0.082 | -0.044 | -0.038 |
| **TS** | -0.001 | -0.002 | 0.003 |
| **GR** | 0.029 | 0.043 | -0.072 |
| **FPA** | -0.076 | 0.042 | 0.030 |
| **SRG** | 0.047 | 0.025 | -0.072 |
| **MIHH** | 0.064 | -0.009 | -0.055 |
| **ILP** | 0.007 | -0.0034 | -0.0036 |
| **SCP** | -0.091 | 0.047 | 0.044 |
| **CR** | -0.054 | 0.032 | 0.022 |
| **PFRS** | -0.018 | 0.008 | 0.010 |
| **HPS** | -0.103 | -0.137 | 0.240 |
| **BB** | -0.087 | 0.046 | 0.041 |

*Source: Research data (2021)*

As per default, the values for the marginal effects for the three consumption frequency categories are equal to zero, while the values for the predicted probabilities for equal to one. The results for the estimated coefficients (Table 3) and marginal effects (Table 4) are discussed concurrently though the interpretation of the estimated effects and marginal effects differs. From the nineteen predictor variables that were included in the empirical analysis, eleven variables were significant, as presented in Table 3. Consequently, the discussion of the results for the coefficients and marginal effects are limited to the significant variables.

### Age (AGE)

Age (AGE) Variable is significant at 1%, and has a positive influence on the food consumption behaviour of rural households. The marginal effects for the AGE Variable are negative for the first category of food consumption frequency ("less consumption"), but positive for the rest of the consumption categories ("constant consumption" and "more consumption"). This signifies that the older the head of a household is, the lower the probability of that household consuming less amount of food is, and the higher the probability of consuming stable or more

amounts of food. The implication is that households headed by older consumers are more likely to consume stable amounts or more food, while those headed by younger people are more likely to consume lower amounts of food.

**Household Size (HS)**

Household Size (HS) Variable is significant at 10%, and has a negative influence on food consumption behaviour of rural households. The marginal effects for HS are positive marginal effects for the first two categories of consumption, but a negative effect for the third category. This suggests that the larger the household is, the higher the probability is of consuming lower or stable amounts of food, compared with smaller households. In particular, larger households are more likely to consume lower or stable amounts of food, while smaller households are more likely to consume more food. This is attributable to the increase in food prices and the high unemployment rate experienced during the COVID-19 pandemic, since most respondents with larger household sizes were more likely to have been unemployed.

**Number of employed people in the household (EPH)**

The number of employed people in the household (EPH) Variable is significant at 1%, and has a positive influence on food consumption behaviour. The marginal effects for the EPH Variable are negative for the first category of food consumption frequency and positive for the second and third categories. This indicates that the higher the number of employed people there are in a household, the higher the probability is of them consuming stable or greater amounts of food. On the contrary, the lower the number of employed people there are in a household, the higher the probability is of them consuming lower amounts of food. In other words, households with more numbers of employed people are more likely to consume stable or greater amounts of food, relative to those with lower numbers of employed people.

**Marital status (MS)**

The Marital Status (MS) Variable is significant at 10%, and has a positive influence on food consumption behaviour of households. The marginal effects for MS are negative for the first category of food consumption category and positive effects for the remaining categories. This means that being in a household headed by married consumers decreases the probability of consuming less food, and increases the probability of consuming stable or more amounts of food. In other words, households with married household heads were more likely to consume stable or greater amounts of food during the COVID-19 pandemic, while those with another marital status (i.e. single, divorced or widowed) were more likely to consume lower amounts of food.

**Employment Status (EPS)**

The Employment Status of the Household Head (EPS) Variable is found to be significant at 10%, and it was found to have a negative influence on food consumption behaviour. The EPS has negative marginal effects for the first category of food consumption frequency, but positive for the other two categories. This signifies that being employed reduces the probability of consuming lower amounts of food, and increases the probability of consuming stable or greater amounts of food. In other words, households with employed heads of the household are more likely to consume stable or greater amounts of food, while those with unemployed heads of the household are more likely to consume lower amounts of food. However, these results are not as was expected, as employment is known to influence food consumption positively. This result is attributable to the fact that some of the employed consumers had experienced losses of income (45%) during the COVID-19 pandemic due to the temporary shutdown of operations in the nonessential sectors.

**Food Parcels (FPA)**

The Food Parcels (FPA) Variable has a positive influence on food consumption behaviour, as it is significant at 1%. The FPA Variable has negative marginal effects for the first category of food consumption frequency and positive effects for the second and third categories. This signifies that receiving food parcels reduces the probability of consuming lower amounts of food, and increases the probability of consuming stable or greater amounts of food. The implication is that households that receive food parcels are more likely to consume stable or greater amounts of food. On the contrary, those who do not receive food parcels are more likely to consume lower amounts of food.

**Social Relief of Distress Grant (SRG)**

Social Relief of Distress Grant (SRG) Variable is significant at 10%, and has a negative influence on food consumption behaviour. The marginal effects for the SRG Variable are positive for the first and second categories of food consumption frequencies and negative for the third category. This signifies that receiving the social relief of distress grant increases the probability of consuming lower or stable amounts of food, and reduces the probability of consuming greater amounts of food. In other words, households that received the social relief of distress grant were more likely to consume lower or stable amounts of food. On the contrary, those who did not receive the social relief of distress grant were more likely to consume greater amounts of food. The fact that the SRG increases the probability of stable amounts of food being consumed by the grant recipients implies that the social relief of distress grant plays an important role in stabilising food consumption by rural households.

**Loss of Income (ILP)**

The Loss of Income (ILP) Variable is significant at 1%, and has a negative influence on food consumption behaviour. The marginal effects for the ILP Variable are positive for the first category of food consumption frequencies, but negative for the remaining two categories. This indicates that losing income increases the probability of consuming lower amounts

of food, and reduces the probability of consuming stable or greater amounts of food. In other words, households whose heads lost income were more likely to consume less food, while those whose heads did not lose income were more likely to consume stable or greater amounts of food.

**Information Sources about COVID-19 (SCP)**

The information sources about COVID-19 (SCP) are significant, at 1%, and have a positive influence on food consumption behaviour. The variable SCP has negative marginal effects for the first category of food consumption frequency, but positive effects for the second and third categories. This signifies that receiving information about COVID-19 through television increases the probability of consuming stable or greater amount of food and decreases the probability of consuming lower amounts of food. In other words, households that received information about COVID-19 through television were more likely to consume stable or greater amounts of food. On the contrary, households that received information about COVID-19 through other sources (health institutions, social media, family and friends and radio) were more likely to have consumed lower amounts of food.

**Food from Restaurants (CR)**

The Food from Restaurants (CR) Variable is significant at 1%, and has a positive influence on food consumption behaviour. The marginal effects of the CR Variable are negative for the first category of food consumption frequency, but positive for the remaining categories. This shows that purchasing food from restaurants reduces the probability of consuming lower amounts of food, and increases the probability of consuming stable or greater amounts of food. Thus, households that purchased food from restaurants were more likely to have consumed stable or greater amounts of food, relative to those that did not purchase food from restaurants.

**Bulk Buying (BB)**

The Bulk Buying Variable is significant at 1%, and has a positive influence on food consumption behaviour. The marginal effects for the BB Variable are negative for the first category of food consumption frequency and positive effects for the second and third categories. This denotes that purchasing food in bulk reduces the probability of consuming lower amounts of food and increases the probability of consuming stable or greater amounts of food. Thus, households that engaged in bulk buying were more likely to have consumed stable or greater amounts of food, compared with those that did not engage in bulk buying.

## CONCLUSION

### *Summary, implications and recommendations*

The lockdown measures that were imposed to reduce the rate of COVID-19 infections in South Africa resulted in decreases in the supply of goods and services and income, as well as job losses and increases in food prices, all of which affected consumers' purchasing behaviours. Against this backdrop, this study aimed at analysing the food consumption behaviour of rural households. This was achieved through pursuing two objectives, the first of which was to examine the food consumption behaviour of rural households during the COVID-19 pandemic. To achieve this objective, descriptive analyses were conducted to examine whether there was a decreased, increased, or constant consumption of various food categories by rural households. The second objective was to determine the influence of several factors on the food consumption behaviour of rural households during the COVID-19 pandemic. An Ordered Probit Model was used to achieve this objective.

Overall, regardless of food items, there was a shift away from the consumption of certain food items towards the consumption of other food items in three ways. First, there was a shift away from the consumption of foods with a shorter shelf life towards foods with a longer shelf life (canned food, frozen food and grains). Second, there was a shift away from the consumption of fast food towards the consumption of food prepared at home. Lastly, there was a shift away from dietary foods (fresh produce) towards consumption of staple foods (grains).

The empirical results showed that larger households were more likely to have consumed less food during the COVID-19 pandemic than smaller households were. This is attributable to an increase in food prices and the high unemployment rate, since most respondents with a larger household size were more likely to have been unemployed. Therefore, regulations for food prices and employment creation should be put into place to increase rural households' level of food affordability. The further results of this study show that rural households with a higher number of employed people were more likely to have consumed greater amounts of food during the COVID-19 pandemic. Therefore, the South African government should design strategies or policies that would focus on increasing the number of employed people in a household, particularly in rural households. For example, a policy could aim at having at least an average of 3 people being employed in a household, since the greater the number of employed people in a household, the higher the food consumption frequency within that household would be.

Rural households that were headed by unemployed consumers were more likely to have consumed greater amounts of food in the circumstances of this study, relative to those that were headed by unemployed consumers. Therefore, this study recommends a continuation of these social safety net programmes so as to enhance the prospects of appropriate food consumption by rural households.

Households that received social relief grants are more likely to have consumed less food during the COVID-19 pandemic, as compared with those that did not receive social relief grants. This is attributed to the finding that most of the households under study did not receive the Social Relief of Distress Grant. Therefore, the government should expand the Social Relief of Distress Grant to qualifying households in order to enhance their capacities for food consumption.

The results further proved that rural households that had received food parcels were more likely to have consumed more food during the COVID-19 pandemic than those who had not received food parcels. Therefore, the government should continue distributing food parcels to the poor rural households, as food parcels contributed towards increasing food consumption frequencies during COVID-19.

Rural households that indicated that they had purchased food from restaurants are more likely to have consumed more food during the COVID-19 pandemic than those who did not purchase food from restaurants. Therefore, restaurants should be allowed to remain open, following all the COVID-19 protocols, during the pandemic as the closure of restaurants decreases the food consumption frequencies in rural households. Households that had participated in bulk buying were more likely to have consumed more food during COVID-19, compared with those that did not participate in bulk buying. Therefore, bulk buying should be encouraged, as people can purchase food products at lower prices, as compared with when purchasing in small quantities. This would increase the amount of food that households can purchase, as compared with buying a single product, and would ultimately increase the consumption of food by rural households. However, it is acknowledged that bulk buying could lead to supply shortages. Therefore, retailers could overcome this by limiting the number of food items that each customer is permitted to purchase.

### *Delimitations and areas for further analysis*

While the study objectives have been achieved and the implications have been highlighted, the study could be extended in three areas. The first area involves extending the research to the national level in order to enable a generalisation of the findings. This could be achieved by investigating food consumption behaviours across the nine provinces of South Africa, including the rural, peri-urban and urban areas. However, it should be noted that, while the data were collected from one village in South Africa, the key findings are similar to those observed in other countries, in the following respects. A shift was observed away from the consumption of food with a shorter shelf life towards foods with a longer shelf life (Italy and Germany), a shift was observed away from the consumption of fast food towards the consumption of food prepared at home (the US), and a shift was observed away from dietary foods towards consumption of staple food (Slovenia and the US).

The second area for an extension of this study requires the inclusion of other factors that might affect food consumption behaviour, but which were unaccounted for in this study. This includes factors associated with grocery delivery services, food safety, eating/drinking habits and dietary requirements. The third area involves analysing the food consumption behaviours according to the individual lockdown levels (i.e. Alert Level 5 through to Alert Level 1), as food consumption behaviour could have changed as the lockdown restrictions were relaxed, as we moved down through to the lower levels.

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# EXAMINATION OF NARCISSISTIC AND MACHIAVELLIAN CHARACTER TRAITS IN LEADERS

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**Abstract:** *The leader is a person of essential importance in the life of an organization. Someone who can keep things in order. All of this is a very diverse task that requires countless skills, which affects the organizational culture, the success of the company, the satisfaction and efficiency of the employees. The objective of my research is to examine whether narcissistic and Machiavellian traits appear in individuals with leadership experience, and how they feel about the issue of empowerment and certain assertive situations. The sample of my research was 102 leaders. I made sure that there is a correlation between the mentioned variables.*

***Keywords:*** *leader, narcissism, machiavellianism, empowerment, assertiveness*
(JEL Classification: D90)

## INTRODUCTION

Most of our lives are filled with work, as we are obliged to earn money, and the satisfaction of our basic needs is a function of existence. Although many of us identify work with this, work is much more than that. Work is actually a manifestation of personality, which is also a personality shaper. To put it simply, two types of employees can be distinguished, there are those who struggle to get up, those who don't even get to work and already know that only negativity is waiting for them inside, and there are those who approach their work with great desire. This is an extremely simplified form of categorization, and it is of course influenced by many different factors, for example the leader's personality and the relationship between the leader and subordinate.

This can also be considered the subject of work psychology, in addition to its many other functions. One of its most important tasks is to get to know the suitability and competence of the person capable of working, and to facilitate in the most favorable way so that as many people as possible can do "good work". As a task, we can also list the psychological root of the problems that occur during work. The goal is to maximize profit, in such a way that the employee also feels good in the process. This is where creating the right work environment, cooperating colleagues and the person of the manager come into play.

One of the most popular research areas in modern psychology today is the Dark Triad, i.e. psychopathy, narcissism and Machiavellianism. The term was coined by Paulhus and Williams in 2002. Many aspects of our lives can be affected by those people who can be characterized by this triad, and it cannot be a coincidence that these personality traits are very common in leadership positions. Undeniably, we all have these traits, that is, we are persuasive, we represent our interests, we are able to gather people around us, we can handle criticism, and we handle spontaneous situations appropriately. The target group of Barizsné and Ujhelyi's (2018) research was the students of the University of Debrecen, and their goal was to explore the relationships between the Dark Triad's personality traits and its ethical attitude, 16% of the sample of their research can be described as Dark Triad membership marks, and men's higher rates of Machiavellianism and psychopathy are typical.

The manager's task is to create an atmosphere that is stimulating and encourages appropriate efficiency. However, there are also conditions for this, a leader's job is not easy, but the fundamental thing is that he can only lead if he knows himself and evaluates himself properly. You must be aware of your strengths, weaknesses, limitations, and you must be constantly open to the new, i.e. to development. I also based my research on this appropriate self-evaluation, as I was curious to what extent the given individual could identify with specific

narcissistic and Machiavellian personality traits. The concept of narcissism is such a hot topic these days that Narcissus himself would blush with pride (Malkin, 2015). A narcissistic personality can often seem like an excellent choice for a leadership role, as they crave a challenge, enjoy competition and, by the way, are there to win. He has abilities and skills that direct him to this field. However, this is not necessarily true, as interpersonal skills that may be essential are lacking, for example, he is not a good team player (Bánki, 2016). Machiavellians can be like that, tricksters, cheats, swindlers, but still leaders, they achieve their goals by using others. They are smart and rational, able to think with a cool head and without emotion (Bereczkei, 2016).

Narcissistic and Machiavellian traits often go hand in hand, as self-adoration and the ability to effectively influence others are key elements in the exercise of power. All of these are character strengths that can balance out their undesirable behavior, but if they all go hand in hand, the positive qualities of one cannot offset the negative of the other. The main question in the case of leaders is not whether they are narcissistic or Machiavellian, but what characteristics are associated with all of this and in what proportion these are manifested in their behavior. People with narcissistic personality traits can be found most easily by looking for positions involving power: a large number of them are company managers, politicians, and law enforcement officers. As a result, it is an interesting question whether they got into these positions because of the desire for power, or because they are treated well?! There are many ways in which someone can abuse their power, using abuse as a means of power control, and they are able to control subordinates, students, or other subordinates with mastery.

The essence of narcissistic personality disorder is that the person suffering from it develops maladaptive (that is, ill-adjusted) strategies in their thinking about the world and themselves, and because of this they get involved in repeated conflicts in which only the actors change, everything else is eerily similar to the previous occasions (Farkas, 2018). Decision-making is one of the most important expectations from the leader, and the resulting responsibility. Of course, all this does not mean that the narcissistic leader only makes good decisions, rather that whatever the consequences of his decision, he will consistently stand up for what is right. Of course, managing others is also an equally important task, and this is particularly typical for this personality type, as they like to be the center of attention and are not embarrassed at all when attention is drawn to them, and they also like it when others are aware of their knowledge, which is why they find them impressive. With their appearance and charisma, they are able to draw attention to themselves.

It goes without saying that these personality traits also have a positive side, we often think that narcissistic traits are inherent in successful people (Danka, 2019). They are actually characterized by a kind of charisma, they affect subordinates with their personal radiance and charm. With his easy irony and cynicism, he goes against company processes and even organizational culture. For example, he easily gives negative feedback such as: “let’s be honest, you don’t have the talent for this” or “it’s hard for me to understand that if you don’t even know what you’re doing here” (Lisznyai, 2018), he can say these with sufficient relaxation and seriousness, thereby destroying the person who receives it. His belief in his talent is unshakable, in fact it’s healthy, since we all need to think of ourselves as special, and the aggressive narcissist shrinks away from the very thought of someone making him indispensable.

“Machiavellianism” is a mindset that is associated with a behavioral strategy (Paál, 2011), a so-called cold rationalism, which can often be recognized in leaders, sometimes ignoring moral rules. Nowadays, it is no coincidence that there are many negative signs at the leadership level, but this person still has the skills that enable him to become a leader, that is, in addition to power, ability is also important, it is not enough to want it, you have to acquire and keep it. Dark Triad personality traits (Machiavellianism, psychopathy, narcissism) often appear among leaders who tend to use their subordinates as tools to achieve their own goals. On average, the listed personality traits can be demonstrated to a greater extent in men (Ujhelyi, 2017). We call Machiavellian leaders those who are able to influence others in such a masterful way that they do not even notice it, or are even particularly happy about it, we identify Machiavellian leaders with authoritarianism. Machiavellian traits are not necessarily bad and destructive, since if their interests are the same as the goals of a group, they can bring significant benefits in the long term (Jones and Paulhus, 2009). As a result, we assume the existence of leadership qualities in these people, since they are assertive, able to control others and events, and also influence others in an amazing way, for their own purposes. They regulate their emotions excellently (Gardner and Avolio, 1995,1998; cited by Deluga, 2001), they are confident even in doubtful situations, although they are uncertain if they do not have sufficient or adequate information (House, 1977, Jameson, 1975; cited by Deluga, 2001). They perform excellently in stressful, personal disputes and competitive situations, as they are driven by the ability to keep emotions in the background, and at the same time, they quickly see through situations and analyze them excellently, thus smoothly finding a suitable strategy (Christie and Geis, 1970; quoted by Deluga, 2001). In the vocabulary of today’s modern psychology, a Machiavellian personality is one who sees other people as a means to achieve his own goals. A behavioral strategy in which manipulation of others is the path to self-interest (Wilson, Near and Miller, 1996).

The downside of the Machiavellian personality is that they are excellent liars, sneaky and hypocritical (Christie and Geis, 1970; cited in Deluga, 2001). Manipulation can be the result of emotionlessness and “cold-bloodedness”, i.e. their empathic skills and willingness to cooperate are low, as a result they are able to act calmly, as they do not allow others to affect their own emotions (Wilson et al., 1996). Machiavellians convincingly lead others astray, if there is a way, they even resort to family. Leary and Hoyle (2009) hypothesized that high Mach people - referring to the above - have higher intelligence, since they understand their communication partners through persuasive communication. However, they found out that all of this is not connected, in fact, the emotional intelligence of people with a high Mach is significantly lower.

## MATERIALS AND METHODS

With my research, I would like to get an answer to the extent to which Machiavellian and narcissistic personality traits appear among managers, how they evaluate themselves, how they handle specific assertiveness situations, and how they think about the issue of empowerment in their work.

I was interested in whether there are common characteristics between people with narcissistic or Machiavellian traits, and whether they differ in self-esteem, empowerment and the way of solving different situations. My aim is to assess the relationship between self-esteem, narcissistic and Machiavellian personality traits, as well as empowerment and assertiveness.

To examine my research questions, I chose the questionnaire method, which took place from October to November 2019 within the framework of my master's thesis in psychology. In advance, the Research Ethics Committee of the University of Debrecen's Institute of Psychology reviewed my research, deeming it to be free of ethical problems, so I was able to start carrying out my research. My research ethics permit number: UD-IP-2019/121. In the questionnaire, I used the Rosenberg Self-Esteem Scale, RSES, Rosenberg (1965), which was adapted for a Hungarian sample by Sallay et al. in 2014. Due to the inadequate fit of the two-factor model (CFA results for two factors: cmin/df=3.53; RMSEA: 0.111; SRMR: 0.076; CFI: 0.909; TLI: 0.88), I used the one-dimensional model. The reliability of the scales is good (Cronbach's alpha: 0.866), the first principal component explains 47%.

Dahling, Whitaker, and Levy (2009) created the Machiavellianism Personality Scale (MPS) in order to eliminate the criteria of the earlier Mach-IV. The four factors of this model (amorality, sense of control, desire for control and distrust of others) contain a total of 15 items. All this was validated by György Talmácsi (University of Szeged), Gábor Orosz (University of Szeged), Béla Birkás (University of Pécs) and Tamás Bereczkei (University of Pécs) on a university sample of 404 students. This enables the usability of the questionnaire, as both its validity and reliability are adequate, the original model fitted well (cmin/df=1.39; RMSEA: 0.044; SRMR: 0.074; CFI: 0.949; TLI: 0.936), thus psychological can be used in research.

Based on the literature summaries, the NPI (Narcissistic Personality Inventory) and HSNS (Hypersensitive Narcissism Scale) tests play a prominent role in the empirical investigation of the phenomenon of narcissism. The HSNS is a 10-item self-report test created by Holly M. Hendin and Jonathan M. Cheek in 1997 to measure covert narcissism, and then in 2013 a new, expanded version of the HSNS was created, which became a 23-item test, so the The MCNS (Maladaptive Covert Narcissism Scale) test is considered an improved version of the HSNS. The Institute of Psychology of the University of Pécs adapted the HSNS and then the MCNS tests, the Hungarian version was prepared by Ivett Horváth and Szabolcs Bandi (University of Pécs). In my current research, I used this improved version to map narcissistic personality traits.

The test, which contains 12 statements, explores the question of empowerment along different dimensions, which are as follows: Meaning, competence, self-determination and impact. The model itself fits well (cmin/df=1.52; CFI: 0.920; TLI: 0.891; RMSEA: 0.053; SRMR: 0.052). I used the statements based on my own translation, and my respondents had to rate how much they agreed on a five-point Likert scale. The test was validated by Gretchen M. Spreitzer in 1995.

I used the assertive situations based on the unpublished questionnaire of Szilvia Fodor and Tímea Olajos (n.n.; forthcoming). Seven situations were formulated, to which four reactions were associated, in each case they were formulated based on the following: Aggressive Assertive (AgrAssz), Adaptive Assertive (AdAssz), Submissive (Szub), Aggressive (Agr). With the diversity of the tests used, my aim was not to look at the examined question along an existing dimension.

The questionnaire was filled out by 207 people, of which 102 people have management experience (1-30 years), so in my current assessment I deal with this sub-sample.

The sample included 40 men and 62 women, whose average age was 41 years. Fillings were received from many work areas, the data is too scattered among the different areas, significantly represented areas were the following: finance and accounting, tourism and hospitality, HR, trade.

## RESULTS AND DISCUSSION

I considered Spearman's correlation suitable for investigating the correlation, which is a kind of rank correlation and shows to what extent the magnitude of one variable determines the magnitude of the other variable, as well as the direction and strength of the correlation. In this way, we can say whether the two examined variables are related.

The result achieved in the Rosenberg self-assessment test correlates with managerial experience (Correlation Coefficient = 0.274** The correlation is significant at the 0.01 level). From this, I conclude that success at work, or the number of years spent at work, has a great impact on our self-evaluation. Being a leader encourages self-acceptance and affects all areas of life. For managerial self-evaluation through individual experiences; it can be realized through the individual's goals of success and failure, methods of reward and punishment, and the degree of group acceptance. Thus, I retain my hypothesis that managers have high self-esteem, as it has been confirmed that the experience gained in leadership is positively correlated with self-esteem.

During the period of processing literature, I read many articles about the fact that the vast majority of leaders have narcissistic or Machiavellian traits, based on which I considered it essential to examine whether this proposition is confirmed in my research. Leadership experience and narcissism are negatively correlated with each other (Correlation Coefficient= -0.232* The correlation is significant at the 0.05 level), i.e. the more leadership experience a given person has, the less narcissistic traits are perceptible. This can be explained in several ways, but it contradicts the research that focuses on toxic leaders. Probably for the sake of group acceptance, the leaders in my sample do not use behaviors that could be identified with narcissism. I also examined all of this with the variables of Machiavellianism (desire for control, sense of control, mistrust of others, amorality), and it showed no significant difference. Based on these, I reject my hypothesis

that narcissistic and Machiavellian traits appear among leaders, as it correlates negatively with narcissistic traits and not with Machiavellian traits.

Furthermore, I wanted to examine how the leaders in my sample feel about the issue of empowerment, and I hypothesized that: Narcissistic leaders have a high need for empowerment. I got the following results:

**Table 1. Correlation between Narcissism traits and Empowerment**

| | Competence | Intellect | Self-determination | Influence |
|---|---|---|---|---|
| Narcissism | -,330** | -,172 | -,172 | -,074 |

*Source: Own editing based on own research, 2020*
*Note: The values in the table are Spearman rank correlations*
*** Correlation is significant at the 0.01 level*

The table clearly shows that the statement formulated in my hypothesis is to be rejected, since in all cases a negative correlation can be read for my management group, moreover, what is significant is only the variable of competence.

Regarding Machiavellian leaders, I believed that Machiavellian leaders have high influence.

**Table 2. Correlation between Machiavellian traits and Empowerment**

| | Competence | Intellect | Self-determination | Influence |
|---|---|---|---|---|
| Desire for control | ,357* | ,149 | ,158 | ,200* |
| A sense of control | -,225* | -,220* | -,020 | -,180 |
| Distrust of others | ,171 | ,131 | ,199* | ,203* |
| Amorality | -,021 | -,066 | ,134 | ,204* |

*Source: Own editing based on own research, 2020*
*Note: The values in the table are Spearman rank correlations*

My hypothesis was confirmed, as influence showed a correlation with the desire for control, distrust of others, and amorality. An interesting additional result is that there was a negative relationship with the sense of control in all cases. And independence correlates with mistrust of others.

In addition, I wanted to compare how narcissistic leaders behave in different assertive situations. I believed that: Narcissistic leaders are characterized by assertive problem solving.

**Table 3. Correlation between Narcissism traits and Assertiveness**

| | Aggressive assertive | Adaptive assertive | Submissive | Aggressive |
|---|---|---|---|---|
| Narcissism | -,097 | -,196* | -,178 | -,047 |

*Source: Own editing based on own research, 2020*
*Note: The values in the table are Spearman rank correlations*
** Correlation is significant at the 0.05 level*

I reject my hypothesis, since the results clearly show that there is a negative correlation with adaptive assertive problem solving.

After that, the examination with assertive situations followed, in this case I am examining Machiavellian traits with different assertive situations. My hypothesis is the following: Machiavellian leaders are characterized by aggressive problem solving.

**Table 4. Correlation between Machiavellian traits and Assertiveness**

| | Aggressive assertive | Adaptive assertive | Submissive | Aggressive |
|---|---|---|---|---|
| Desire for control | -,031 | -,193 | ,000 | ,136 |
| A sense of control | -,070 | -,215* | ,173 | -,017 |
| Distrust of others | -,023 | -,116 | ,003 | ,130 |
| Amorality | ,046 | -,188 | -,100 | ,220* |

*Source: Own editing based on own research, 2020*
*Note: The values in the table are Spearman rank correlations*
** Correlation is significant at the 0.05 level*

All this was verified with the amorality variable, a correlation was shown. Another result is that the sense of control is negatively correlated with adaptive assertive problem solving.

Based on the results, it can be concluded that there is a relationship between the examined dimensions. When comparing self-esteem with narcissism, a negative relationship was revealed, which was surprising to me - although in pathological cases it can all be a real negative relationship (Bánki, 2016). At the same time, a positive relationship with Machiavellianism's desire for control and mistrust of others was confirmed. Managerial experience also showed a connection with self-evaluation, I interpret all this in terms of the time spent at the workplace, since success and performance at the workplace increase our evaluation of ourselves.

In terms of empowerment, narcissism brought negative relationships, which raised new questions for me, since in all cases I assumed a positive and strong relationship (Bánki, 2016). This may be worth investigating with further research. With regard to Machiavellianism, the issue needs to be renegotiated, as the influence was not as strong as what was supported in the literature (Bereczkei, 2016). In the case of persons with leadership experience, narcissism showed a negative relationship with the variable of competence, while Machiavellian leadership showed a negative relationship with influence. Although the latter has typically developed for non-leaders as well.

I consider situations based on problem solving to be an extremely useful element of my research, and I am glad that I was one of the first to use this research tool. Assertiveness is closely related to my areas of interest anyway, so I was happy to use it. The four behavioral differences can properly separate the personality traits. Regarding narcissism, the results did not develop as expected, but the relationship with

Machiavellianism was fulfilled, since the aggressive behavior appeared to a high degree. The presence or absence of managerial experience did not show any significant difference in the examined situations.

## CONCLUSION

I believe that my research, together with the significant and non-significant results, despite the limitations, adequately addressed the desired questions, i.e. the examination of narcissistic and Machiavellian traits among leaders with leadership experience in terms of self-esteem, empowerment, and assertive situations.

Based on the results of my research, it can be concluded that the people participating in the research did not achieve exceptionally high results on the narcissism or Machiavellianism test, possibly with the inclusion of a larger sample, more people with more serious management experience, there could have been a greater difference. In terms of future research, it is by all means necessary to further develop all of this, possibly to use a different narcissism test, which can more precisely define the investigated characteristics. I would call the mapping of Machiavellian traits the main result of my research, since both influence and aggressive behavior were confirmed. Another result of my research is that high Machiavellians communicate assertively and aggressively in many cases.

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# WHAT KINDS OF COMPETENCES DO WE REQUIRE AT THE EMPLOYMENT MARKET - JOB ADVERTISEMENTS REVIEW BASED ON COLLECTED DATA FROM WORKLINE.HU JOB-SEEKING SITE

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**Abstract:** *The epidemic of coronavirus induced radical changes on the employment market as well, hence we may reasonably ask what (new) competences do we have to own to become successful in seeking jobs. The goal of this research is to shed light on the employment market's new competence demands by analysing job offers found on the website workline.hu. Execution of the investigation took place during the Spring of 2022, during which 410 job vacancies were examined. By utilizing the method of content-analysis, the most important competences were defined first, they were compared to other research findings, and then, using KSH's employment rate statistics, crosstab analysis have revelaed the developments of the most paramount key competences, specializations, competence expectations and connections between the regions. Ultimately, I have determined the foreign language knowledge demanded by employers, and other requirements displayed in the advertisements. Based on the results, the most important key competences include precision, independent working skills and excellent communication skills, which fulfilled a major role in sortments both by regions or national economy sectors. Furthermore, the higher skill demands of inviting applications originated from Transdanubial regions were also corroborated. Beyond said competences, however, numerous other factors (consisting but not limited to: computer science knowledge, B-category driver's license) may also play a significant role during selection of employees. That being said, the examination did not confirm bigger successfulness rate amongst people with foreign language knowledge. Further investigation of the study includes compare and contrast or results with the competence demands found on other job advertisement portals.*

***Keywords:*** *employment market changes, job vacancy examination, competences*
(JEL Code: F66, J24)

## INTRODUCTION

The appearance and spread of the virus COVID-19 induced crises and dramatic changes in all aspects of our lives. The confining provisions conceived by the authorities to prevent or mitigate the spread (such as curfews, complete border lock-downs, store closures) have forced employment market participants as well to react accordingly (for instance: application of home-office, relocations and mass discharges). And even though during the examination period it seemed that we have successfully pulled through these hard times, the long-term effects of the crisis shall be noticeable in the entire world. It can be observed effectively that upon the exhaustion of the pandemic, employers once again are offering several opportunities for career entrants and people looking for new possibilites. Most of them prefer online platforms in accordance with their needs of promptitude and efficiency, whilst the once-popular paper-based job advertisements are getting effaced and played down. Internet job-seeking homepages can be classified as exterior recruiting tools, namely, the company can not fill the emptied position from within its own stocks of personnel, hence, in this case, an advertisement for a new position is conceived. Besides the popularity of online job-seeking sites (MOURYA, 2022), the number of job advertisements displayed on community websites are also outstanding, as the information can find its way to great masses of users within a short time, and can even positively influence the corporational brand in some cases (MCCABE, 2017).

The goal of this study is to highlight those competences of key importance, which may prove cruical for employees during the selection process. The examination took place at the Spring of 2022, during which 410 job vacancies of the webside workline.hu have been subjected to research. First, I have performed source reviews on the related literature, which summarily describes the various approaches on the concept of competence. The „results" chapter showcases the competences assorted by regions, as well as national economy sectors, also demonstrating said key competences on a Pareto-diagram and it also aims to compare with previous research results. Furthermore, we can take a good look on other kinds of requirements in job vacancies, too (for instance: foreign language knowledge, computer science knowledge, professional experience). And even though the results obtained during this investigation are ought to be tested and collated with much more extensive samples, I still firmly believe that the employers' expectations uncovered during the reviews of job vacancies in this sample will mean great assistance to obtain better knowledge on the current trends of the employment market. Furthermore, gaining insight into employer competencies and other requirements uncovered during job advertisement analysis can prove to be beneficial during career decision-making processes. These insights can indeed illuminate new expectations that have emerged in the aftermath of the COVID-19 pandemic situation for professionals. Consequently, they can more effectively assist individuals in making informed choices regarding their career and profession.

## LITERATURE REVIEW

Competence demands have been examined prior by several studies (HINCHLIFFE G.W. and JOLLY, 2011; PEGG et al. 2012). In respects of employment, the results of researches performed on this subject may prove to be extremely useful, as employees can be integrated into the system more easily, provided they have the right competences, not to mention they might be able to perform better (BALÁZS and SZABÓ, 2020). Due to the constant changes in economy and society around the world, the employers manage their competence expectations in accordance with the current situations which emerge in the employment and goods market (CAPPELLI, 1995). Before presenting the most important competencies unveiled during the research performed on of workline.hu, however, it must be ascertained exactly what do we classify under the word „competence". Establishing an unified, collective definition is highly improbable, due to differences in theoretic basics, usage of competence goals, cultural discrepancies, and contradictions in terms (HOFFMANN, 1999; ROBOTHAM and JUBB, 1996). The first pedagogic approach on an attempt of defining „competence" can be linked to Noam Chomsky. Within the confines of the generative linguistics subject, he can be credited establishing the theory on the antagonism between competence and performance. The author distinguishes the abilities of recognizing grammatically correct statements (competence), and the fore-claimed statements (performance). In other words, linguistic competence, in this aspect „forms the base of behavior, but [...] will not appear or display itself in a direct and simplified way" (CHOMSKY, 2003:141). Based on the claims of BAARTMANN and DE BRUIJN (2011:126), „competence can be described as a combination of integrated knowledge, skill and attitude, which is ultimately necessary to perform adequately at the workplace". The fundamental concept of competence according to HAMEL an PRAHALAD (1990) includes all those abilities and skills, which are essential in respect of the company's performance and strategies, thus, they form sort of a foundation for the company to build upon them in regards of the many different segments of the market, and establish itself in the competition. Furthermore we may also make a claim that competence is the cluster of relevant knowledge, attitude, and skills, which in fact, has a great influence above employment, correlating with performance, can be measured and even improved (PARRY, 1996). Summarizing all the concepts of competence in literature, it is safe to determine that competence is a combination of inherited or obtained knowledge/ability, which makes every job seeker unique on a labour market which constantly shifts and changes. For this reason, it might be extremely important to acquire the adequate competences prior to the entering to the employment market. This is heavily emphasized in the studies prepared by CHAN (2016) and SMALL et al. (2018), to, according to whom, delivering these key competences are ought to be a primary objective for educational institutions and social background – taking the employer's requirements of employing into account.

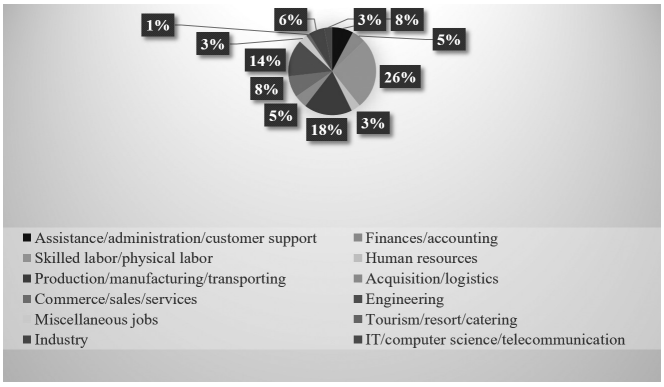
## MATERIALS AND METHODS

In my analysis, prepared by the data collected upon the examination of job-seeking website workline.hu, I made great efforts to unveil the employer's expectations in regards of their employees. This research was conducted to process the contents and information of the advertised jobs. During the first stage of the two-staged data acquisition method, those job-seeking sites have been chosen, which can be easily accessed by anyone, the amounts of their on-site data can be reasonably analyzed, and there is possibility to designate the required competences for the job advertisements. The job-seeking sites workline.hu and karrierem.hu fulfilled all these conditions flawlessly. During the second stage, the job offers (N=410) that form the basis of this study have been gathered during the Spring of 2022. It should be emphasized that only those job advertisements have been included in taking the sample, which satisfied at least one competence requirement towards the job seekers. As such, without a proper designation of the needed competence, an advertisement could not be included in this examination. Gathering the job advertisements may result in such a measurable and comparable research database, which can reveal any changes in scopes of activities (HARPER, 2012). Reviewing job advertisements can be best compared to methods of content analysis, which have emerged into the focus of attention since the 1950s, by the effect of the press. The first scientific approach of the procedure can be linked to HOLSTI (1969). The basic definition for the method of the content analysis is: „a research method, whose goal is to describe the communication's manifested contents with quantitative means objectively and systematically (BER-

ELSON, 1952:18)". It can be classified as a non-intervening method, as the document had already been created prior to the data collection. The objective of the content analysis is to have the documents reviewed and evaluated during a systematic procedure to ascertain their meanings, understand them, and improve empirical knowledge (CORBIN and STRAUSS, 2008).

Most of the job vacancy samples taken were full-time jobs (402 pcs). As for reviewing the distribution of scholastic qualification requirements, we could have see that the website offers 89 elementary (8 elementary school classes), 189 intermediate (technical college, high school) and 132 superlative (BSc, Master's degree) type of jobs for the job-seekers. The most advertisements have been submitted from counties Zala (51), Győr-Moson-Sopron (33), Hajdú-Bihar (33), Bács-Kiskun (32), Somogy (31), and Baranya (30). Their allocation in regards of specialization can be viewed on figure 1.

**Figure 1: The rate of invited applications aránya by national economy sectors**




*Source: own construction based on the results of the research*

According to the results of the analysis, the most widespread choices are allocated for those job-seekers, who desire to take up positions within skilled/physical labor (26%), production/manufacturing and transporting (18%) and engineering (14%). In contrast, advertisements from the sectors of tourism/resort/catering and building/real estate categories were the lowest in numbers within the time period subjected to this research. The most probable reason for that might be that job advertisements of this sector did not assign any competences. Despite the quantitative and qualitative profile of this research, it can be noticed that there are certain confines. These are included but not limited to the sample with relatively few subjects, and taking one sole job-seeker website under the scope of research. In the foreseeable future, it might be a reasonable idea to collate the results with a research which includes more samples, as well as compare & contrast between several different job-seeking websites' advertisements.

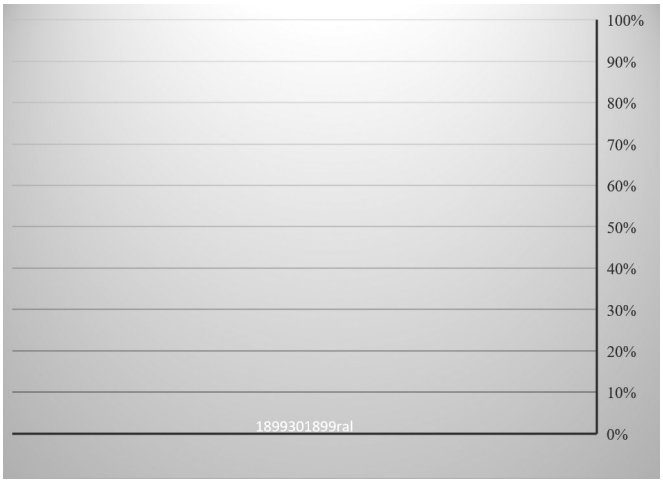
## RESULTS AND DISCUSSION

The following chapter shall summarize the topmost results of the research: all those key competences have been disclosed, which are at high demand at employers, as well as the correlations between competences and the various sectors of national economy / regions. Moreover, the examination unveiled all the other expectations (such as foreign language knowledge, computer science knowledge, professional experience) as well.

### *Competences*

Foremost, all those competences have been described, which have proved the most paramount according to the jobs advertised during the reviewed time period. The results were displayed in a Pareto-diagram, which represents the distribution of data in a descending order, marking the percentage rate compared to the grand total with a cumulative line on the secondary axis (figure 2).

**Figure 2: The most frequently demanded competences**




*Source: own construction based on the results of the research*

Based on the examination, according to the job advertisements, the competences most wanted for work activities can be classified among standard (precise, self-sufficient, diligent, reliable) and professional (good communication and problem-solving skills) groupings. The research results of FÜLÖP (2008) also well emphasize how paramount precision and self-reliance are at the employment market. The appearance of Covid-19 virus have caused the competences required by the employment market to be rearranged, which was also corroborated by the nationwide research SZŰCS et al. (2021) performed during the pandemic. According to their results, the most desired competences include but are not limited to flexibility, communication skills, empathy and self-reliance, whilst importance of competences based on personal presence (for instance: teamwork and collaboration) have dwindled. HORVÁTH-CSIKÓS and JUHÁSZ (2021) have also rated flexibility and good communication skills among the most wanted competences by the employers. The obtained results for teamwork skills' importance on the employment market, however, show a discrepancy; while Szűcs and his accomplices judged it to be less important, the latter authors claimed them to be most essential. Surprisingly, the research results could not corroborate either author's claims; hence in this research, working as part of a team can be classified as a

moderately frequent demand. Confidence, creativity, critical and analitical thinking were deemed to be the least demanded by the job advertisements reviewed in this sample.

During my own research, I compared the 10 most important competencies I obtained with the competency rankings of the World Economic Forum (2018, 2020) and Szűcs et al. (2021) (chart 1). In each case, only the top 10 competencies were examined.

**Chart 1: Comparison of the most important competencies**

| World Economic Forum 2018 | World Economic Forum forecast 2022 | Poór et al. 2021 | Own research 2022 | World Economic Forum forecast 2025 |
|---|---|---|---|---|
| Analytical thinking and innovation | Analytical thinking and innovation | Flexibility | Precision | Analytical thinking |
| Complex problem-solving | Active learning and learning strategies | Communication | Independent working | Active learning and learning strategies |
| Critical thinking and analysis | Creativity, originality and initiative | Digital competence | Communication | Complex problem-solving |
| Active learning and learning strategies | Technology design and programming | Empathy | Diligence | Critical thinking and analysis |
| Creativity, originality and initiative | Critical thinking and analysis | Independent working | Reliability | Creativity, originality and initiative |
| Attention to detail, trustworthiness | Complex problem-solving | Cooperation, teamwork | Problem solving | Leadership and social influence |
| Emotional intelligence | Leadership and social influence | Stress tolerance, loadibility | Teamwork | Technology use, monitoring and control |
| Reasoning, problem-solving and ideation | Emotional intelligence | Problem-solving | Loadability | Technology design and programming |
| Leadership and social influence | Reasoning, problem-solving and ideation | Health awareness | Flexibility | Resilience, stress tolerance and flexibility |
| Coordination and time management | System analysis and evaluation | Expertise | Client orientation | Reasoning, problem-solving and ideation |

*Source: Based on the World Economic Forum (2018, 2020), Szűcs et al. (2021), and my own research findings, with my own editing*

The table excellently illustrates that the World Economic Forum's 2018 research concluded that in 2020, workers would still need similar competencies as in previous years. The change observed was mainly in the ranking of these competencies. Additionally, two new competencies were added to the 2022 forecast, presumably due to rapid digitalization. These were technological design and programming, as well as system analysis and evaluation. It is essential to note that when creating the 2022 forecast, researchers could not anticipate the emergence of the coronavirus pandemic. In their study, Szűcs et al. (2021) shed light on the most critical competencies during the pandemic. Six of these competencies appeared in my own research but in a different order. Independent work and problem-solving skills received more emphasis in my job advertisement analyses compared to the results of Szűcs et al. (2021). Conversely, communication skills, teamwork, endurance, and flexibility competencies were different. According to the World Economic Forum's forecast, the competencies deemed most useful in 2022 will remain the most important in the labor market in 2025. However, flexibility and stress tolerance have been added as new competency elements to the future competency ranking list. This suggests that lifelong learning and digital competencies will continue to be crucial in the coming years.

Hereinafter, the connections between single specialties and required competences shall be defined (chart 2). In all cases, the competences most relevant (6) will be rendered to a certain particular branch in frequency order.

**Chart 2: The hierarchy of the most important competencies by industry branches**

| Specialty | Key competences | | | | | |
|---|---|---|---|---|---|---|
| **Assistance/ administration/ customer support** | **communication skills** | **self-reliant working** | **precision** | **diligence** | **reliability** | **problem solving skills** |
| Acquisition/ logistics | self-reliant working | diligence | reliability | precision | loadability | problem solving skills |
| Miscellaneous jobs | precision | diligence | communication skills | self-reliant working | problem solving skills | reliability |
| Building/ real estate | reliability | communication skills | self-reliant working | creativity | Flexibility | |
| Human resources | communication skills | proactivity | diligence | self-reliant working | precision | problem solving skills |
| Tourism/ resort/ catering | precision | teamwork | diligence | flexibility | loadability | client orientation |
| IT/ computer science/ Telecommunication | problem solving skills | self-reliant working | precision | communication skills | teamwork | client orientation |
| Industry | self-reliant working | precision | diligence | reliability | loadability | monotony endurance |
| Commerce/ sales/ services | communication skills | self-reliant working | precision | reliability | problem solving skills | client orientation |
| Engineering | problem solving skills | communication skills | precision | diligence | flexibility | teamwork |
| Finance/ Accounting | self-reliant working | communication skills | precision | flexibility | proactivity | loadability |
| Skilled/ phsyical labor | precision | diligence | reliability hatóság | self-reliant working | loadability | teamwork |
| Production/manufacturing/ transporting | precision | diligence | communication skills | teamwork | self-reliant working | loadability |

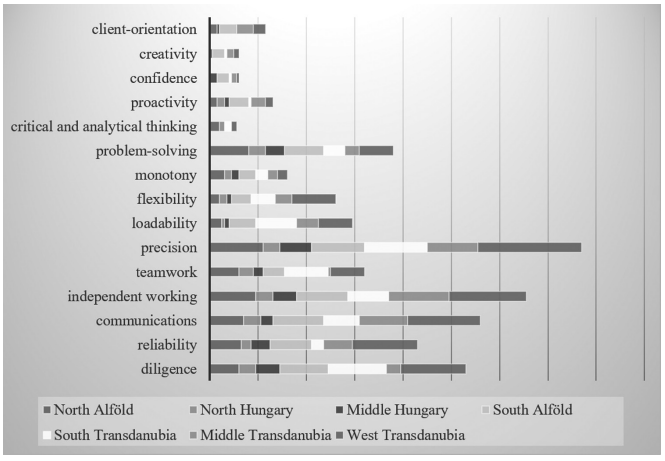
*Source: own construction based on the KSH (2022) and on the results of the research*

According to the various sectors and branches of national economy, the most frequently noted competences are precision, self-reliant working, good communication skills and diligence, which are also in accordance with the order of the most wanted competences listed by the job-seeking website. It can also be noticed that precision is recorded among the most desired skills by employers in all sectors, excluding building/real estate. The results of the job advertisement analysis performed by GYÖRGYI (2007) also corroborate the outstanding importance of good communication skills, self-reliant working, and problem-solving skills. SÓSKÚTI and HÉDERRIMA (2020) have received very similar results regarding to the importance of competences as well, whose believe that within intellectual scope of activities, problem-solving skills, communication skills and self-reliant working can be deemed as the most desired competences, in comparsion with physical labor, where expectations towards diligence and precision were higher. As for the research performed by KIS et al. (2019), it shows towering success for employees with great reliability, creativity and self-reliance. Beyond the most important competences, sporadical key competences appear at various special sectors, originated from the features and nature of the workplace. These may include creativity (building/real estate), proactivity (human resources, finance/accounting) and monotony endurance (industry).

According to the data of the Central Bureau of Statistics (KSH) (2021a, 2022), the number of employed people during the first quarter of 2022 (4 674 thousand) show a decreasement, compared to the last quarter of 2021 (4 688 thousand). These statistical values offered a great opportunity for a deeper research on the number of employed people divided by national economy sectors, whose results are recorded in Chart 1 under the classification titled „Specialty" with three different colours. The colour red marks those specialties, at which a dwindle could be experienced in regards of the number of employees, the colour yellow marks stagnation, whilst the colour green marks increasement of employees. Although it seems that the employment market was well prepared by the time the fifth wave of the coronavirus epidemic has spread across, decreased employment rates could be measured in more than half among the national economy sectors included in the sample. Furthermore, it can also be noted that the finance/accounting sector was the only one, where there was little to no change in the numbers of employees. However, job-seekers who venture into these territories must own special skills, such as flexibility, proactivity and loadability. Meanwhile, the common element for sectors with more favourable values (5) is ought to be good communication skills. As a conclusion, the role of constant communication as a competency can be crucial in the job advertisements for fields that are on the rise in terms of the number of employed individuals. This is because in our ever-changing world, possessing this competency and continuous adaptation have become indispensable for maintaining competitiveness.

Amongst other things, shortage of labour can be considered as one of the biggest challenges for the employment market (COHU, 2022; FOGG and HARRINGTON, 2009) along with the lack of competences demanded by the advancements in technology (SCHWAB, 2016). The former is supported by the statistical data provided by KSH (2021b) as well, according to which, the rate of vacant jobs have increased from 2% to 2,3% in 2021 nation-wide. The mid-section regions of Hungary could have been characterized as having the highest assortment of jobs (37487), whilst the least advertised jobs have been recorded at the Southern Transdanubian region (3660). And even though this own research is based on a much smaller collection of taken samples, still, the intention behind the classification and groupiong of the advertised jobs by regions was to perform an examination in regards whether or not a trend could be uncovered and defined in regards of employability and the required competences (figure 3).

**Figure 3: The most important competences recorded by regions**



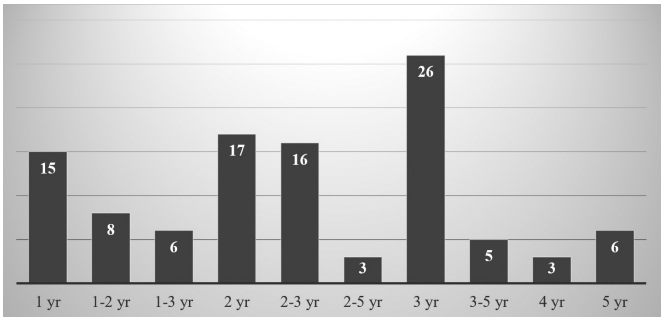

*Source: own construction based on the results of the research*

According to the results returned that employers file more competence claims towards the job-seekers at the more advanced Transdanubian regions than at any other regions. The most required competences in the job advertisements were also recorded at the West Transdanubian region (236). KOVÁCS and BIHARI (2006:54) pointed out that „the employment capacity of the dynamic center for Budapest and the middle-west Transdanubian region resulted in conceiving and realizing a constantly active (showing higher than standard economical activities) at the northwest quarter of the country, which became hyperactive near the country's borders and along the main traffic/transport lines". The gross average earnings are also the highest here in the entire Hungary (KSH, 2022); therefore, the demands towards employees working at these regions, and the amount of wages are proportional. In contrast, the Northern Hungarian region with a more detrimental employment market position (57) requires the existence of competences in the least amount. Within the examined region, employees with good communication skills, precision, self-reliance, diligence and precision can be deemed as the most desirable ones. So, it can be assumed that in the latter mentioned areas, only the possession of the most fundamental soft skills is expected, while hard skills are less important in the selection process for positions that require lower levels of education.

*Advantages and miscellaneous expectations*

Employers were given the opportunity to offer such advantages in their advertisements, which would greatly increase the chances of the job-seeker of being chosen upon possesssing them. According to the results, 57% of the advertisements have featured certain conditions which offered advantages. During offerings of the advantages, there was a possibility of multiple offerings as well, thus, there were 300 of such conditions were defined within the 232 job advertisements containing priorities. The sample yielded only 5 of such advantages; having professional knowledge (137), computer science knowledge (mostly Microsoft Office) (110), having a category-B drivers' license (38), inclination for travel (13) and a second foreign language knowledge (2). The research results of KISS (2015) corroborate the employee's successfulness at the employment market with additional knowledge (abroad or professional experience, high-leveled foreign language knowledge), as they seem to find an employment sooner than those employees who lack these skills. The reason for this is probably that employers surmise a higher production rate from a more qualified applicant, hence he shall get a more favorable adjudication during the selection process. The results of the survey performed by VARGA et al. (2017) within the sphere of employers seem to signify that demands for knowing foreign languages and having decent computer science skills have greatly increased in the past few years. As opposed to this, the research prepared by SÓS (2019) have established that possession of these skills are less significant during the actual work. Job advertisers have worded their demands of owning professional experience 105 times as a distinct requirement towards the job-seekers. In this case, they have specified this demand of theirs in years, which is represented at Figure 4.

**Figure 4: Distribution for the amount of expected professional knowledge**




*Source: own construction based on the results of the research*

In the light of the gathered data above, it can be noted that the most frequently expected amount of professional knowledge is usually 3 years (25). Generally speaking, employers rather demand less experience than requiring the job-seeker to have more. Summarizing all the results in regards of professional experience, we can clearly see that possessing professional experience is a requirement for 26% of the job vacancies in the taken sample, and it may also mean an advantage for 33% of the job vacancies during the selection process. This means, 41% of the job vacancies can be filled without having prior professional knowledge, which may prove to be a positive sign for career entrants. In regards of scholar qualifications, the results were more or less the same; professional experience emerges mostly at intermediate (50%) and college graduate (47%) qualifications, as a requirement, whilst at elementary qualification (3%), its presence is much less significant.

Foreign language knowledge shows up for 38% of the jobs at the taken sample, as a requirement. In the biggest rate, fluent English (89), intermediate English (26) and fluent German (84) could have been found within the advertisements. Besides elementary English (6) and intermediate German (3), in some cases, employers also demand the job-seeker to possess elementary and advanced English, elementary and advanced German, Serbian, French, Spanish, Romanian or other foreign language knowledge. And even though most of the job vacancies can be filled without prior foreign language knowledge, Livinski (2019) firmly establishes that job-seekers owning foreign language skills have a much greater advantage at the employment market.

It can be assumed that the conditions highlighted as advantages in job advertisements may become minimal expectations in the future labor market, or perhaps they already are, but for some reason, they are not treated as such. Consequently, young individuals should pay special attention to enhancing and developing their competencies during their studies, as these can have an impact on their future career success. Dual education programs can play a role in facilitating this, and their significance may become even more pronounced.

## SUMMARY

The research performed at the Spring of 2022 – during the end of pandemic – tried to make an effort on determining which competences' possession can ensure success for job-seekers at the employment market, furthermore, what other kinds of requirements employers may demand from the people applying for the job. According to the research results, precision, diligence, self-reliant working and good communication skills proved to be the most paramount competences, which were also highly in focus during the allocations for both national economy sectors and regions. Demands for special key competences (such as creativity, proactivity, monotony endurance) have only appeared sporadically, mostly pertaining to the special features of a certain sector. Moreover, the research have unveiled the Transdanubian employers' higher competence demands in accordance with the higher wages their job vacancies offer. In contrast, employers demand less competences from job-seekers at the economically and employment market-wise disadvantaged Northern Hungarian regions. Beyond the competences, however, several other factors (for instance, professional knowledge possession, computer science knowledge, category „B" drivers' license) may have an important role during the selection process of the job-seekers, even though the research did not corroborate the bigger success rate for job-seekers having foreign language knowledge. Summarizing all the obtained results, I believe that during the establishment of the employment market's demands,

we should highly prioritize those positive changes (for example, developing new company strategies, widespread usage of digitalized tools, home office expansion, emphasize training, supporting lifelong learning approach), which may – directly or indirectly – contribute to employability increasement.

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# HEDONIC PRICE OF FREE-RANGE EGGS IN COSTA RICA

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**Abstract:** *Eggs are a highly consumed animal product in Costa Rica. It is grown in different production systems and differentiation attributes, although there is little information about consumption and consumer preferences for grazing production. This study aimed to determine the effect of free-range on the price per kilogram of eggs paid by the consumer in Costa Rica. The results show a positive effect of 19.77% on price of eggs produced in free-range systems, but preference for other attributes such as nutritional fortification, egg size and brand names were also determined. Incorporating free-range technologies to replace caged poultry production can contribute to animal welfare and balance with nature, and producers can opt for differentiated prices in local markets.*

***Keywords:*** *Animal welfare, consumer preferences, cage-free*
(JEL code: C5, E3, Q12, Q57)

## INTRODUCTION

Eggs are a highly consumed animal product in Costa Rica, responding to consumer preferences for foods with high protein content, easy digestion, reasonable prices, and great versatility in culinary preparations. In Costa Rica, between 200 and 230 units of chicken eggs are consumed annually per person (Cardoza, 2016), which makes it the most recognized type of egg, surpassing others such as quail and duck eggs.

In Costa Rica, there are three distinct different laying hen production systems: battery-cages system, barn-system and free-range system. Pastured production refers to the laying hens being free-range, on the ground covered with pasture and forage, where they circulate and feed on seeds, minerals, insects, and plants cultivated for this purpose, although concentrated feed is also supplemented. Contrary to the confinement system, where hens remain in cages and are fed concentrates (Cruz-Bermúdez et al., 2021; Vargas et al., 2018).

Egg production farms must comply with the good poultry production practices required by Servicio Nacional de Salud Animal (SENASA), regardless of system type or technology adopted. These good practices are based on the guidelines on safety criteria recommended by the Codex Alimentarius of the Oficina Internacional de Epizootias[1](OIE).

Currently, in Costa Rica there are no official statistics on farms dedicated exclusively to pastured hens, nor data on the quantity of eggs traded in markets with this differentiation scheme. However, it is common to find pastured eggs in retail stores as part of the available supply.

Consumers recognize this purchase option under the perception of an animal-friendly production, exalting the animal welfare, the nutritional value free of contaminants and the conservation process more friendly to the body and the environment (Campbell et al., 2017; Coy, 2017). The advantage for producers consists of offering a better quality, safe and differentiated product with higher added value, which is generally traded in the market at higher prices than eggs obtained in conventional or confinement systems (Coy, 2017).

Battery-cages system is becoming a highly debated topic in different spheres including animal welfare advocates, researchers, producers, and consumers, who also value aspects of economic, environmental, human health and food safety sustainability (Molnár & Szollosi, 2020).

There are several studies focused on the production of organic, pastured, cage-free, fortified eggs, among others (Cruz-Bermúdez et al., 2021; Gómez, 2018; Marelli et al., 2021; Rentería, 2018; Rizzi & Chiericato, 2005). These studies demonstrate a worldwide trend for organic production,

[1]*World Organization for Animal Health*

which guarantees a captive demand on differentiated products in population segments that are constantly growing (Álvarez & Rojas, 2013).

Evidence clearly supports the notion that birds' wellbeing is higher in cage-free systems than in a typical cage system. Therefore, there is a clear link between production systems and animal welfare (Vukina & Nestic, 2020). Free-range is a form of cage-free production that promotes animal welfare and therefore generates a positive contribution to the environment.

In a study conducted in Sonora, Mexico, an Exploratory Factor Analysis (EFA) and a cluster analysis were applied to segment consumers according to their attitudes, values, and environmental beliefs in the purchase decision of organic products (Salgado, 2019). The results indicate that young and mostly educated people are more sensitive to the consumption of differentiated and environmentally friendly products (Salgado, 2019). Studies such as these contribute to provide recommendations to market players to design marketing strategies and include environmental education through public institutions to improve people's awareness.

Also in Mexico, a study was carried out to measure the trend in per capita egg consumption using a second-order, linear, non-homogeneous and moving average difference equation model, considering a study period from 1980 to 2013 (Mendoza et al., 2016). These results indicate that egg consumption in Mexican households has already reached its consumption limit, so future demand will only grow according to the rate of population growth. However, eggs with differentiation represent an opportunity for small and medium-sized producers, and for consumers they represent a healthy food according to specific needs (Mendoza et al., 2016).

The perception that pasture-based production is sustainable and animal-friendly was analyzed by Banaszewska et al. (2020), in whose study they also included the environmental and human benefits, in addition to the improvement in egg quality. These authors compared the eggs quality from organic and conventional farms, and the sodium (Na) and potassium (K) content, using a mean difference analysis. The findings of this research indicate a slightly better quality of eggs produced under organic farming compared to eggs in confinement; in addition to a higher Na and K content in albumen, yolk, and whole egg (Banaszewska et al., 2020).

The findings of Banaszewska et al. (2020) agree with Filipiak-Florkiewicz et al. (2017), who compared the quality of certified organic, nutraceutical (enriched in n-3 fatty acids) and conventional (cage-rearing system) farm eggs through a one-way analysis of variance (ANOVA), finding high levels of protein, potassium, and copper (Cu) content in the yolk of organic eggs; in addition to higher protein content in albumin.

Another research addressed a discrete choice approach to measure consumer preferences for eggs with differentiating attributes (Zakowska-Biemans & Tekień, 2017). The study revealed a strong preference for non-caged systems, even over organic and environmental production, with consumer education having a significant positive effect on willingness to consume (Zakowska-Biemans & Tekień, 2017). Product-differentiation questions can be examined through various methods, but the hedonic pricing approach, introduced by Rosen (1974), is recognized as one of the most appropriate. In this context, consumers make their purchases based on consumption preferences, then some attributes affect the price of the products, which are understood as the value that consumers attribute to the characteristics that differentiate the goods from other similar ones, limited by their budget and the available supply (Troncoso & Aguirre, 2006a).

To evaluate the value of the attributes to be paid by consumers, the hedonic price function is the way which relates the prices of a given good to its most visible and relevant attributes or characteristics (Rosen, 1974; Troncoso & Aguirre, 2006a).

Hedonic prices are based on the fact that the characteristics of a good are not homogeneous and it is assumed that its value can be broken down from its attributes, then it refers to an intrinsic value that is not normally taken into account in the price. market value (Jansson & Axel, 2000; Rosen, 1974).

The hedonic price function can be obtained Ordinary Least Squares (OLS) method and commonly uses dummy variables to isolate the qualitative attributes of the good. This method has been widely used with approaches to environmental analysis, real estate valuation, the agri-food sector and the like, by authors such as Aragón et al. (2018), Das et al. (2017), Gracia & Pérez (2004), Méndez et al. (2021), Ogwang & Wang (2003), Vukina & Nestic (2020), and Paniagua et al. (2021).

Other methodologies applied have been logistic regression models. Bejaei et al. (2015) analyzed attributes to predict the likelihood that a consumer would purchase a specific type of egg, including regular (white and brown), cage-free, free-range, pastured, organic, and nutrient-enhanced eggs. The results suggest a higher probability of purchase for non-caged eggs compared to the others (Bejaei et al., 2015). Authors such as Oviedo Álvarez (2016) and Cárdenas & Celeita (2015) analyzed the differentiation through additions of selenium, Omega 3, and other fortifying components, finding economic and commercial viability, since consumers accept the added value in a good way.

Due to the limited information available in Costa Rica, it is important to generate information bases that favor decision making by producers and consumers. Therefore, in this research, econometric methods were applied to determine the effect of the free-range attribute on the price per kilogram paid by the egg consumer in Costa Rica.

## MATERIALS AND METHODS

This is a quantitative research based on econometric procedures to model the price paid by consumers of chicken eggs in Costa Rica through the application of multiple linear regression techniques. Table 1 describes the variables used, with the unit price (PRICE) and number of eggs per package (UNITS) as quantitative variables, which can be log transformed. The remaining variables are qualitative, specifically binary, to capture the effect of presence or absence of the expected attributes.

We used the three main commercial egg brands present in the supermarkets visited; the other competitors are very small, and their brands are not representative.

**Table 1. Research variables details**

| Variable | Details |
|---|---|
| PRICE | Natural logarithm of price in local currency per kg (colones[2]) |
| UNITS | Natural logarithm of number of eggs per package |
| HIGHSIZE | Dummy variable that takes the value of 1 if eggs are labeled under a high size distinction and 0 otherwise |
| FREEGRAZING | Dummy variable that takes the value of 1 if eggs come from free-range system and 0 otherwise |
| ENRICHED | Dummy variable that takes the value of 1 if eggs are nutritionally enrichment and 0 otherwise |
| B1 | Brand 1 |
| B2 | Brand 2 |
| B3 | Brand 3 |

Data were collected through visits to supermarkets during September, October, and November 2021. A total 403 observations were collected, providing information about price and product attributes. This study focused on supermarkets in urban areas in the capital city of Costa Rica, San José province.

Inflation rate during this period was very close to zero, so observed prices behave as real prices for practical purposes.

The model proposed in this research is formalized by the following equation and corresponds to a semilogarithmic model:

$$lnP_i = \delta + \alpha FG_i + \sum_{k=1}^{K} \theta_k Z_{ik} + \sum_{m=1}^{M} \gamma_m T_{im} + u_i \quad (1)$$

Where, FG is the attribute of coming from free grazing or not for each i-th observation; Z are other attributes of importance that influence the price of the product up to the k-th attribute present in the i-th observation; T trademark of the i-th observation for the m-th outstanding brands in the market.

## RESULTS AND DISCUSSION

For the data sample used, an average package of 17 eggs sells for an average price of US$3.27. The price fluctuates over a range of US$ 2.23 to US$ 4.14, with the upper limit being the price reflecting the product with the highest distinguishing attributes. Table 1 shows the descriptive statistics for quantitative variables.

**Table 2. Summary statistics for quantitative variables (n = 403)**

| Statistic | UNITS | PRICE (¢)[3] | PRICE US$ |
|---|---|---|---|
| Mean | 17.27 | 2125.60 | 3.27 |
| Median | 15 | 2152.30 | 3.31 |
| Min. | 6 | 1450.30 | 2.23 |
| Max. | 30 | 2693.80 | 4.14 |
| Std. Dev. | 7.2537 | 260.82 | 0.40 |
| C.V. | 0.42 | 0.12 | 0.1227 |
| Skewness | 0.59244 | -0.44719 | -0.44719 |
| Ex. kurtosis | -0.2851 | -0.03719 | -0.03719 |

Regarding the qualitative variables, the free-range attribute was present in 13.4% of the observations analyzed, but the attribute with the highest presence was the enriched egg since it was present in 19.45% of the observations. For variables measuring the effect of trademarks on price, Brand 2 had the highest presence, while competitor brand 3 had the lowest presence. Table 2 shows the frequency distribution for binary variables.

**Table 3. Frequency distribution for qualitative variables (n = 403)**

| Variable | No | Yes |
|---|---|---|
| HIGHSIZE | 90.57% | 9.43% |
| FREE-RANGE | 86.60% | 13.40% |
| ENRICHED | 81.39% | 18.61% |
| B1 | 80.15% | 19.45% |
| B2 | 66.50% | 33.50% |
| B3 | 93.30% | 6.70% |

To model the price of eggs in Costa Rica based on the attributes described above, the multiple regression method was applied with the weighted least squares (WLS) technique to correct for heteroscedasticity in the residuals and table 4 shows the respective results.

Regression coefficients have signs consistent with economic theory. Likewise, the regression coefficients presented statistical stability according to Harvey-Collier test, while the residuals are free of heteroscedasticity (p-value = 0.0853) and present normality (p-value = 0.1682) at 8% and 16% statistical significance according to Breusch-Pagan and Jarque-Bera tests, respectively.

**Table 4. Weighted-Least Squares (WLS) results**

| Parameter | Coefficient | Std. Error | t-ratio | p-value |
|---|---|---|---|---|
| UNITS | -0.1546 | 0.0084 | -18.4300 | <0.0001*** |
| HIGHSIZE | 0.1144 | 0.0128 | 8.9610 | <0.0001*** |
| FREE-RANGE | 0.1977 | 0.0082 | 24.1200 | <0.0001*** |
| ENRICHED | 0.1039 | 0.0144 | 7.2250 | <0.0001*** |
| B1 | 0.0559 | 0.0103 | 5.4460 | <0.0001*** |
| B2 | -0.0153 | 0.0081 | -1.8900 | 0.0596* |
| B3 | 0.1357 | 0.0159 | 8.5110 | <0.0001*** |
| const | 8.0177 | 0.0258 | 310.8000 | <0.0001*** |
| Mean dependent var | 185.0776 | | S.D. dependent var | 59.0347 |
| Sum squared residuals | 912.1894 | | S.E. of regression | 1.5216 |
| R-squared | 0.9999 | | Adjusted R-squared | 0.9993 |
| F (8, 394) | 729 686.4000 | | P-value(F) | <0.0001 |
| Log-likelihood | -736.4398 | | Akaike criterion | 1 490.8800 |
| Schwarz criterion | 1 526.8700 | | Hannan-Quinn | 1 505.1280 |
| Breusch-Pagan test for heteroskedasticity - | | | | |
| Null hypothesis: heteroskedasticity not present | | | | |
| with p-value = P(Chi-square (9) > 16.744) = 0.0853 | | | | |
| Jarque-Bera test, p-value 0.1682 | | | | |
| CUSUM test for parameter stability - | | | | |
| Test statistic: Harvey-Collier t (393) = 1.3369 | | | | |
| with p-value = P t (393) > 1.33688) = 0.1820 | | | | |
| Mean Absolute Percentage Error 0.7507 | | | | |
| Root Mean Squared Error 1.5045 | | | | |
| Theil's U2 0.0198 | | | | |

*** The coefficient is statistically significant at a 1% error level, that is, the null hypothesis that this coefficient is equal to zero is rejected.

** The coefficient is statistically significant at a 5% error level, that is, the null hypothesis that this coefficient is equal to zero is rejected.

* The coefficient is statistically significant at a 10% error level, that is, the null hypothesis that this coefficient is equal to zero is rejected.

*[2]Exchange rate = 650 Costa Rican colones / 1 US$ | [3]Local currency of Costa Rica is "colon" (¢)*

This research focused on measuring the effect of the free-range attribute on price paid by consumers and the results indicate that the presence of this attribute, which must be duly accredited, generates a willingness to pay an additional 19.77% over the price of conventional eggs. This finding is higher than other researchers like Vukina & Nestic (2020), whom using retail price data in Croatia, found that there is a 7.8% premium in the price of eggs produced cage-free. Given this, it is important to mention that the free-range attribute can be considered broader than "being cage-free", since it implies grazing areas and interaction of birds with nature, generating a higher degree of animal well-being. Cage-free is also of lesser scope because it may be that the birds are always raised enclosed in space, without a cage, but enclosed.

On the other hand, this value is low compared to other authors like Chang, Lusk , & Norwood (2010), whom find that in the U.S. market, the consumer pays 62.9% for free-range eggs over conventional ones.

Systems adopting "more natural" production measures and providing animal welfare, increase their profitability through improvements in market price (Cruz-Bermúdez et al., 2021). In addition, growing consumer empathy and willingness to pay for animal welfare-related attributes is imperative, not only in egg production but in other agricultural products such as dairy and meat (Zakowska-Biemans & Tekień, 2017).

These preferences also lead to a greater likelihood of purchase by those consumers who are informed and more educated. For this reason, market segmentation at the marketing level is critical to empower those consumers and consolidate more profitable market niches (Bejaei et al., 2015).

Meanwhile, Lusk (2019) concluded a higher level of consumption preference for organic eggs than pastured eggs, in contrast to Zakowska-Biemans & Tekień (2017). Furthermore, their results show that most consumers are not willing to pay significantly higher prices. Chang et al. (2010) also concluded that market shares of these products in the United States of America are very small and the willingness to pay is lower than estimated. In this sense, according to Mair (2021), pastured and organic eggs are traded in small and specialized niche markets, so we can speak of specialty and value-added products.

Consumption preference for a grazing egg is also related to a better taste. The consumer has the perception that no chemicals and hormones are added in the hens' feed that may be present in the egg (Peña et al., 2011). For Yenice et al. (2016), protein content in the egg whites of pastured eggs is higher than eggs produced in cages in conventional systems.

In contrast to Yenice et al. (2016), other researchers found that conventionally produced eggs have better attributes of aroma, consistency, yolk color, flavor, and texture (Terčič et al., 2012). Even that the microbiological and dioxin counts of eggs produced under the pasture system are higher than those found in conventional eggs (Chilur Omkarappa et al., 2019; Guier-Serrano et al., 2022; Molnár & Szollosi, 2020), a situation that could affect the price in the retail market.

Price paid by consumers also includes other statistically significant. For example, our results suggest that egg price per kg tends to decrease 15.45% for each additional unit within the same package. This change is measured through the regression coefficient of UNITS variable. Larger egg size (more quantity, usually units, per package) provides more utility to consumers and is expected to have a higher shadow price than smaller egg size.

Regarding HIGHSIZE variable, the merchant offers the product at an 11.44% higher price compared to presentations without this distinction. These results can be contrasted with Yenice et al. (2016), in the sense that the weight of eggs in cage system was the highest, followed by the grazing system and the home type system, being that consumers prefer to consume larger eggs due to the perception of higher cooking yield.

On the other hand, Chang, Lusk , & Norwood (2010), also found a positive effect on the price of an increase in egg size but using quality variable like small, medium, high, jumbo among others.

The results show that nutritional fortification of eggs is a condition positively valued by the consumer, since an additional 10.39% in price is recognized. Cárdenas & Celeita (2015) also demonstrated a moderate marketing potential for fortified eggs, mainly in the bakery, confectionery, and food service products market.

The results of this research are closer to those obtained by Karipidis et al (2005), who found that the market price for enriched eggs is 46% higher than those that are not.

Chang, Lusk , & Norwood (2010), using the omega 3 content in the egg as a measure of fortified egg, found that the consumer pays a premium of 49.3% over the non-fortified egg.

Competitor 2's trademark (variable B2) had a downward effect on price compared to other brands with a lower share. This effect may be due to the power it has to offer better prices given its scale economies for being a large producer. Competitor 1's brand (variable B1) differentiates itself with a positive effect of 5.58% on price, while competitor 3's brand (variable B3) differentiates itself with a positive effect of 13.56% on price. This is to be expected since this brand follows a strong differentiation strategy in local markets.

To exemplify the effect of regressors on egg prices, the price of a 15-unit pack was projected, since this is a traditional sales unit in the Costa Rican market. The first simulation was made for a product without any of the attributes described and marketed under the B2 brand. The second simulation consists of a product with the attributes HIGHSIZE, FREEGRAZING and ERICHED, marketed under the brand name B3, which has the highest prices in the market. Both projections are obtained from the regression equation developed below:

(2)

$$lnP_i = 8.0177 - 0.1546\, lnUNITS + 0.1144 HIGHSIZE + 0.1977 FREEGRAZING + 0.1039 ENRICHED + 0.0559 B1 - 0.0153 B2 + 0.1357 B3$$

It should be noted that the regression equation presents variables in logarithmic form and to predict the price in monetary terms, the anti-logarithm should be applied when necessary. Table 5 shows the result of the price projection for the two types of products.

In this sense, a 15-unit pack produced in a conventional system, without any attributes and marketed under Brand 2, could have an average price of US$ 3.02. On the other hand, the aver-

age price of the same package with specialized attributes and marketed under Brand 3 is US$ 5.33. That is, its price increases about 76.30%. It should be noted that these predictions have a margin of forecasting error according to the homoscedastic variance of regression model (Gujarati & Porter, 2010).

**Table 5. Egg price forecast in Costa Rica**

| Variable | Egg without attributes | Egg with attributes |
|---|---|---|
| LN Price | 7.5837 | 8.1507 |
| Local price (colones) | 1 965.9590 | 3 465.9271 |
| Price US$ | 3.0246 | 5.3322 |
| Percent change | | 76.30% |

## CONCLUSIONS

The proposed econometric model was adequately adjusted to predict egg price Costa Rican local market, with quantitative and qualitative variables that reflect the effect of different attributes. In addition, the variable FREE-RANGE significantly measures the difference in price of an egg obtained in grazing and conventional systems.

The simulation of prices for two types of eggs (with and without differentiating attributes) reflects that the Costa Rican market recognizes a higher price for pastured eggs, in addition to effects due to commercial brands, the size of the egg and the fact that the product been enriched.

Markets are increasingly interested in offering differentiated products; however, the heterogeneity of information in several studies suggests that consumers tend to purchase eggs in the same proportion and at the same price, except when they are well informed about the benefits that the eggs provide. alternative production systems offer. In this way, consumers are free to decide whether they recognize a higher price due to differentiation that they would be willing to pay during the purchasing process.

It is recommended that local producers analyze the cost-benefit of incorporating free-range technologies to replace poultry production in cages and thus also contribute to better animal welfare and balance with nature, in addition to providing more information on the different production systems that allow consumers improve their purchasing criteria.

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# ASSESSMENT OF THE CONDITIONS OF THE FARMING HOUSEHOLDS IN NORTH COTABATO

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**Abstract:** *This study was conducted to assess the conditions of the farming households in North Cotabato as basis to reform the development of agri-preneurs in line with the country's thrust of transforming farmers as entrepreneurs. The research used the quantitative method approach to analyzed the conditions of the farming households in North Cotabato in relation to the crops they produce. Stratified random sampling was employed in the collection of data from four hundred (400) farming households using a self-constructed questionnaire validated by the panel. Data generated were analyzed descriptively and by inferential statistics using analysis of Variance (ANOVA). The research revealed that the primary commodity produced is rice, followed by rubber and coconut. Among the perceived conditions of the farming households, the study revealed that farmers agree on the conditions in terms of infrastructure facility, market information, managerial skills, and entrepreneurial skills. On the other hand, the farmers neither agree nor disagree on their conditions on market opportunity, access to credit facility, enabling environment, and government policies on entrepreneurial development. The result also found that significant differences arises when the conditions in terms of access to credit and the enabling environment were grouped based on the primary crop produced. Finally, the study also found that there was a significant difference as to access to credit facility, market intelligence, and entrepreneurial competencies when grouped based on the secondary crops produced.*

***Keywords:*** *Agribusiness, Farm Conditions; and Inclusive Business*
(JEL Code: Q10, Q12, & Q13)

## INTRODUCTION

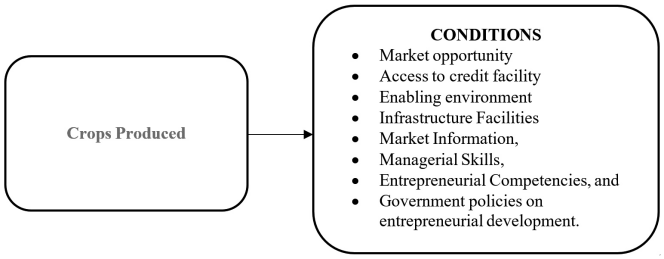
Farmers are considered the backbone of economy. In many developing agricultural countries, about one-third of the world's population depend on smallholder farming. Majority of the world's poor live in rural areas wherein smallholder farming is their only economic subsistence, that agricultural growth is important to be continuously carried out to attain agricultural growth which was identified as an effective mechanism in reducing poverty. Business organizations has a crucial role to play in integrating smallholder farmers within the company's value chain that would allow the access of goods, services, and livelihood opportunities in a commercially viable way to the base of the pyramid (BoP). Golja & Pozega (2012) states that the notion of inclusive business calls for additional focus and innovation in the way companies do business. It involves creating new forms of employment, new markets, and affordable products and services that will spur economic growth and encourages entrepreneurship. Hertveldt, Masuoka and Dixit (2012) defined inclusive business as a private sector approach in providing goods, services, and livelihoods on a commercially viable basis, either at the scale or scalable, to people at the base of the pyramid by making them part of the value chain of companies' core business as suppliers, distributors, retailers, or customers. According to Kennemer Foods International, Inc. (2015, May 04), the Philippine Business for Social Progress (PBSP) inclusive business operates at a higher scale and social impact, compared to social enterprises, SMEs and the traditional programs of corporate social responsibility as it is able to integrate over the long term the base of the pyramid segment into its value chain.

However, by looking at the approach in which inclusive business is used by different and various companies, it showed that the engagement of the business organizations to the farmers limit in the context of "business as usual", that the focus is basically to safeguard their supply requirement but does not

really allow the farmers to engage in the core of activities of the business organizations. In the Philippines, small farmers are exposed to an environment where they are susceptible to exploitations, and that agricultural growth and farmers' capacity to become an entrepreneur is determined based on these conditions. Recognizing the importance of entrepreneurs in the growth and development of any economy, the impact of farmers' engagement to inclusive business will need to be assessed to determine the current conditions of entrepreneurial development as perceived by the farmers of North Cotabato.

Specifically, the study seeks to know the Crops Produced; the conditions as perceived by the farmers in terms of Market Opportunity, Access to Credit Facility, Enabling Environment, Infrastructure Facilities, Market Information, Managerial Skills, Entrepreneurial Competencies, and Government Policies on Entrepreneurial Development; and finally test if there is a significant difference on the conditions when grouped based on the crops produced. These are further illustrated in the conceptual framework shown in figure 1:

**Figure 1. Conceptual Framework of the Study**




## MATERIALS AND METHODS

A quantitative approach was used in this study, particularly the descriptive-comparative approach. According to Ariola (2006), descriptive research is fact finding with adequate interpretation. It is something more and beyond just data-gathering, the true meaning of the data collected should be reported from the point of view of the objectives and the basic assumption of the project underway. Descriptive research as described and interpreted by Best and Khan (1989) is the answer to the "what is". Further, they explained it as a type of research concerned with conditions of relationships that exist; practices that prevail; beliefs, processes that are going on; effects that are being felt, or trends that are developing. In this study, the descriptive statistical tools such as frequency distribution (using mode) and mean was applied to compute for the distribution of crops produced and the perceived conditions of farming household, respectively.

On the other hand, a comparative research approach was also employed. According to Ariola (2006), it is a type of research that provides explanation about the extent of relationship between two or more variables. The statistical tool used to test the significant difference of the conditions as perceived by the farmers when grouped according to the crops they produce was the Analysis of Variance (ANOVA). They were, according to Gupta (1999), as the most used test statistics by statisticians for test of differences researches. As a guide for the use of ANOVA, a Test of Homogeneity of Variance was conducted to determine if the variances between the sub-groups are homogenous or not. This also becomes the basis on which Post Hoc test will be employed based on the results of the sig. value. A Tukey HSD and Tamhane's T2 for equal and not equal variances respectively were used. If Test of Homogeneity of Variance is $p<0.05$, then use Tamhane's T2 otherwise use Tukey HSD. After the Test of Homogeneity of Variance, an analysis was conducted on the results of the ANOVA test by looking at the sig. value. Only those factors that $p<0.05$ were considered for further analysis using the Post Hoc Test to determine the specific differences among the sub-groups.

Through the evaluation of the perceived conditions of the farming households, the study aimed to come up with a descriptive analysis on the crops produced of the farmers in the area, and further comparing on how their conditions differ based on the crops produced. Ultimately, through this descriptive-comparison study, a deeper understanding on the situation of farmers in North Cotabato.

Primary data were also used in this study from the responses of the farming households in North Cotabato, specifically in the seventeen (17) municipalities of Alamada, Aleosan, Antipas, Arakan, Banisilan, Carmen, Kabacan, Libungan, Magpet, Makilala, Matalam, Midsayap, M'lang, Pigkawayan, Pikit, President Roxas, Tulunan, and the city of Kidapawan. The researcher was involved in the process of conducting and gathering the primary source of data using the survey method through a self-constructed questionnaire validated by three technical experts with a consistency score of 0.956 using Cronbach's Alpha. It is typically impossible to access the whole population needed for the research, a representation of a larger population is necessary to generalize the population from with the sample was drawn, thus, the stratified random sampling technique was used in selecting the respondents for the study as shown in Table 1. According to Ariola (2006) stratified random sampling is a sampling procedure in which the population is divided or categorized into two or more subpopulation known as strata; the elements for the sample are then randomly selected from the strata. The researcher also used the Slovin's Formula in determining the number of respondents of the study:

Formula: $n = \frac{N}{(1+Ne^2)}$

Where: n = Number of sample size
N = Total population
e = 5 percent degree of error

$$n = \frac{271{,}784}{1+(271{,}784 * 0.05^2)} = \mathbf{400}$$

**Table 1. Respondents Sample Distribution per Area in North Cotabato using Stratified Random Sampling.**

| Location | Number of Population* | Percentage | Sample Households |
|---|---|---|---|
| **District 1** | | | |
| Alamada | 12,163 | 4% | 18 |
| Aleosan | 7,607 | 3% | 11 |

| | | | |
|---|---|---|---|
| Libungan | 10,080 | 4% | 15 |
| Midsayap | 29,883 | 11% | 44 |
| Pikit | 25,348 | 9% | 37 |
| Pigkawayan | 13,210 | 5% | 20 |
| **District 2** | | | |
| Antipas | 5,694 | 2% | 8 |
| Arakan | 9,207 | 3% | 14 |
| Kidapawan City | 28,898 | 11% | 43 |
| Magpet | 9,747 | 4% | 14 |
| Makilala | 17,233 | 6% | 25 |
| President Roxas | 9,753 | 4% | 14 |
| Tulunan | 12,004 | 4% | 18 |
| **District 3** | | | |
| Banisilan | 8,281 | 3% | 12 |
| Carmen | 17,683 | 7% | 26 |
| Kabacan | 17,836 | 7% | 26 |
| M'lang | 20,204 | 7% | 30 |
| Matalam | 16,953 | 6% | 25 |
| **TOTAL** | **271,784** | **100%** | **400** |

**Source: National Statistics Office, 2010 Census Population & Housing*

## RESULTS AND DISCUSSION

### *Primary Farm Production*

Table 2 revealed that 34 percent of the respondents produce "rice" which is followed by "rubber" at 29.30 percent, "coconut" at 18.75 percent, "corn" at 9.75 percent, "banana" at 5 percent, while "other production" such as palm oil, cacao, mango, mung beans, vegetable and sugar cane shared the 3.25 percent.

This shows that the direction of the several government agencies, non-government organization as well as business organization does not align to the primary commodity produced in the area. However, there a potential to encourage farmers to practice intercropping and mixed cropping to maximize land use and increase income.

**Table 2. Distribution according to Primary Crop Produced**

| Primary Crop Produced | | Respondents | |
|---|---|---|---|
| | | Frequency | Percent (%) |
| 1 | Coconut | 75 | 18.75 |
| 2 | Rubber | 117 | 29.25 |
| 3 | Corn | 39 | 9.75 |
| 4 | Rice | 136 | 34.00 |
| 5 | Banana | 20 | 5.00 |
| 6 | Others | 13 | 3.25 |
| | **Total** | **400** | **100.00** |

### *Secondary Farm Production*

Table 3 revealed that 45.75 percent of the respondents said they do not have secondary commodity produce in their farm, while 22.75 percent said they produce "coconut", followed by "rubber" at 10.25 percent, "rice" at 4.75 percent, "banana" at 4.25 percent "coffee" at 3.25 percent and "cacao" and "corn" at 2.50 percent, while "other production" such as palm oil, cacao, mango, mung beans, vegetable, sugar cane, livestock, gemilina, fish pond, calamansi, and flower shared the 4 percent. The 54.25 percent of the respondents who confirmed of having a secondary farm production shows an indication that farmers in North Cotabato are trying to find ways on how increase their income by tapping other market aside from the primary commodity they produce. The result is promising since the potential of intercropping and mixed cropping in maximizing land use is still possible.

**Table 3. Distribution according to Secondary Crop Produced**

| Secondary Crop Produced | | Respondents | |
|---|---|---|---|
| | | Frequency | Percent (%) |
| 1 | None | 183 | 45.75 |
| 2 | Cacao | 10 | 2.50 |
| 3 | Coffee | 13 | 3.25 |
| 4 | Coconut | 91 | 22.75 |
| 5 | Rubber | 41 | 10.25 |
| 6 | Corn | 10 | 2.50 |
| 7 | Rice | 19 | 4.75 |
| 8 | Banana | 17 | 4.25 |
| 9 | Others | 16 | 4.00 |
| | **Total** | **400** | **100.00** |

### *Conditions of Farming Households*

The conditions of farming households as perceived by the farmer respondents was measured in terms of market opportunity, access to credit facility, enabling environment, infrastructure facility, market information, managerial skills, entrepreneurial development, and government policies on entrepreneurial development as shown in Table 4. The 400 farmer respondents were identified as the key informants of the sample area which are assessed on the perceived conditions of the farming households.

**Table 4. Mean Scores of the Perceived Conditions of Farming Households.**

| Conditions of Farming Households | Mean | Interpretation |
|---|---|---|
| 1. Market Opportunity | 3.33 | Neither agree nor disagree |
| 2. Access to Credit Facility | 3.12 | Neither agree nor disagree |
| 3. Enabling Environment | 3.33 | Neither agree nor disagree |
| 4. Infrastructure Facility | 3.80 | Agree |
| 5. Market Information | 3.48 | Agree |
| 6. Managerial Skills | 3.86 | Agree |
| 7. Entrepreneurial Competencies | 3.95 | Agree |
| 8. Government Policies on Entrepreneurial Development | 3.23 | Neither agree nor disagree |

The mean score for "market opportunity" is 3.33 which is interpreted as neither agree nor disagree. With this, suppliers need to clearly understand what the market wants, the best way to produce so they can deliver suitable products to

the market. In this case, the farmers may or may not agree on the opportunities available in the market. Next result revealed that the mean score for "access to credit facility" is 3.12, interpreted as neither agree nor disagree. This could mean that there is no clear indication that the farmers are able to access financing from bank, and other lending institution available in their area. Access to finance has become a key to inclusive economic growth and that liquidity constraints have substantial effect on entrepreneurial behavior, taking this into consideration, this confirmed the result on why majority of the respondents do not have non-farming activities. As for "enabling environment" the mean score is 3.33, also interpreted as neither agree nor disagree which mean that the environment is not that strong to empower farmers to become self-sufficient. Enabling environment through business reforms has been acknowledged as an important pre-requisite for unleashing a private sector response.

The "infrastructure facility" got a mean score of 3.80, interpreted as agree. This means that the basic facilities such as electricity, water, telecommunication, farming machineries and road network is available in North Cotabato. When it comes to "market information", the mean score is 3.48, interpreted as agree. This means that the farmers are informed of the materials, facts, figures, intelligence needed for their production, and that of the market. However, the result of the condition in terms of market opportunity, is not aligned with market information as the availability of market opportunity is interpreted as neither agree nor disagree. The result of the study could further mean that information received by the respondents may not be of their interest considering that commodities that have global demand such as cacao and coffee were not their priority, and that there were few if not no value adding activities allowed to coconut and rubber farmers. The "managerial skills" also got an "agree" interpretation based on its 3.86 mean score. This means that the respondents believed to possess the skills of manager to run their farms and other endeavors. Another condition that got an "agree" interpretation is the "entrepreneurial competencies" with a mean score of 3.95. This means that the respondents believed to acquire the characteristics of becoming an entrepreneur, this could further mean that, if given a chance the farmers of North Cotabato can make things happen. Finally, "government policies on entrepreneurial development" mean score is 3.23, interpreted as neither agree nor disagree. This could mean that there are no clear economic incentives given by the government to motivate the farmers in becoming an entrepreneur, thus, the uncertainly of this condition may have been the resulted on why few farmers are engaged in non-farming activities.

### *Test of difference of the Conditions of Farming Households when Grouped According to the Top Three (3) Primary Crop Produced*

As determined by one-way ANOVA, Table 5 hypothesized that there is a significant difference in the condition in terms of access to credit facility (p=0.028) and enabling environment (p=0.008) when grouped according to primary commodity of farm production, thus rejecting the null hypothesis. A Tukey HSD test was used to determine what made a significant difference in the condition in terms of access to credit facility (p=0.028), while Tamhane's T2 test was used to determine the significant difference in the condition in terms of enabling environment (p=0.008).

Access to Credit Facility. The Post Hoc test revealed a significant difference in the condition in terms of "access to credit facility" is between coconut and rubber with a sig. value of 0.028. By looking at the result of the survey as found in Table 5, the average mean score of access to credit facility of coconut farmers is 2.88 while rubber farmers revealed a mean score of 3.27, both interpreted as neither agree nor disagree. Pena (2014) in a news article published by EDGE Davao, the demand for various kinds of coconut by-products has been rising in the domestic and world markets such as coco sugar, coco cream, and coco chunks. Mangahas (2010) reported in the Asian Development Bank that Mindanao is the sole producer of rubber in the Philippines and suggested to capitalize on its development potential to take advantage of the market opportunities amidst large demand for this agricultural commodity. However, PBSP revealed that Philippines has the smallest rubber in the world market dominated by the ASEAN countries. According to the National Economic Development Authority (NEDA) in 2011, the Philippine Development Plan 2011-2016 is focused on inclusive growth that is anchored in the social contract between the government and the population. The direction of different concerned government agencies, non-government and business organizations may not be aligned in the situation of North Cotabato. The credit system offered by banks in the globe is focused on guaranteed return, that if the risk is too high the bank will normally decline the loan application which affects the condition "access to credit facility". This could impact opportunities available in the market as the farmers will not be able to take advantage of the available opportunities.

Enabling Environment. The primary commodity on farm production revealed a significant difference in the condition in terms of enabling environment with sig. value of 0.008 for "coconut to rice". By looking at the result of the survey as shown in Table 5, the average mean score of enabling environment of rice farmers is 3.45, interpreted as agree compared to coconut farmers whose mean score is 3.00, interpreted as neither agree nor agree. According to Konig, Da Silva, & Mhlanga (2013) the competitiveness of an enterprise and the creation of its value activities are shaped depending on the environment, they further emphasized that enabling environment is closely associated with private sector development and generally refers to the business-friendly conditions that must be in place to propel private sector dynamism. According to Islam (1999), rice is a subsistence crop, and rice farming is practiced monoculture, while coconut is a multipurpose commercial crop and that many other crops such as banana, papaya, lanzones, and coffee are intercropped in it. In consideration to the situation on the agricultural requirements and value-adding activities needed by two commodities, the condition in terms of enabling environment for rice and coconut technically differs which resulted to a difference between the two commodities.

**Table 5. Difference in the Conditions of Farming Households When Grouped According to the Top Three (3) Primary Commodity of Farm Production**

| Conditions of Farming Households | Primary Crop Produced | Mean | F | Sig. Value |
|---|---|---|---|---|
| 1. Market Opportunity | Coconut | 3.25 | 1.239 | 0.291 |
| | Rubber | 3.48 | | |
| | Rice | 3.34 | | |
| 2. Access to Credit Facility | Coconut | 2.88 | 3.598 | 0.028* |
| | Rubber | 3.27 | | |
| | Rice | 3.04 | | |
| 3. Enabling Environment | Coconut | 3.00 | 4.874 | 0.008* |
| | Rubber | 3.28 | | |
| | Rice | 3.45 | | |
| 4. Infrastructure Facility | Coconut | 3.74 | 1.508 | 0.223 |
| | Rubber | 3.78 | | |
| | Rice | 3.92 | | |
| 5. Market Information | Coconut | 3.42 | 0.918 | 0.401 |
| | Rubber | 3.40 | | |
| | Rice | 3.55 | | |
| 6. Managerial Skills | Coconut | 3.71 | 1.523 | 0.220 |
| | Rubber | 3.81 | | |
| | Rice | 3.94 | | |
| 7. Entrepreneurial Competencies | Coconut | 3.83 | 0.455 | 0.635 |
| | Rubber | 3.93 | | |
| | Rice | 3.94 | | |
| 8. Government Policies on Entrepreneurial Development | Coconut | 3.30 | 2.443 | 0.088 |
| | Rubber | 3.25 | | |
| | Rice | 2.99 | | |

**Significant at 0.05*

## *Test of difference of the Conditions of Farming Households when Grouped According to the Top Five (5) Secondary Crop Produced*

As determined by one-way ANOVA, Table 6 hypothesized that there is a significant difference in the conditions in terms of enabling environment (p=0.041), market information (p=0.029) and entrepreneurial competencies (p=0.039) when grouped according to secondary crop produced, thus rejecting the null hypothesis. A Tukey HSD test was used to determine what made a significant difference in the condition in terms of enabling environment (p=0.041), market information (p=0.029) and entrepreneurial competencies (p=0.039).

Enabling Environment. One-way ANOVA revealed a significant difference in the condition in terms of "enabling environment" (p=0.041). By looking at the result of the survey as found in Table 6, the average mean score of enabling environment of rice farmers is 2.95, interpreted as neither agree nor disagree while banana farmers revealed a mean score of 3.86, interpreted as agree. This means that the enabling environment between rice and banana will need to be reviewed as it could be an indicator for a shift in direction that is slowly felt by the respondents in the region. According to the official website of the Philippine Statistics Authority (PSA), banana in 2002 recorded the biggest with 41.1 percent of the commodity produced in North Cotabato, this is unlikely in the current situation considering that rice shown to be the top primary crop produced in the region. The direction of the concerned government agency that is working to create an enabling environment for the farmers may have focused on rice in line with the governments thrust in making Philippines a rice sufficient country.

Market Information. The secondary crop produced results revealed a significant difference in the condition in terms of "market information" with sig. value of 0.029 for rice to banana. By looking at the results of the survey as found in Table 6, the average mean score of market information of rice farmers is 3.03, interpreted as neither agree or disagree while banana revealed a mean score of 4.02, interpreted as agree. According to the Department of Agriculture (2015), banana is still promising, banana farmers' organization and cooperative are well organized which resulted to a much clearer direction for the banana farmers, and that information relevant to the market demand is clearer in this perspective. Accordingly, the goal of the government and business organization in tapping the huge global demand for high value crops such as cacao and coffee and the direction of the government in making Philippines a rice sufficient country may have confused the respondents which resulted to a significant difference in the condition in terms of "market information".

Entrepreneurial Competencies. Results revealed a significant difference in the condition in terms of "entrepreneurial competencies" with sig. value of 0.039 for rice and coconut to banana. By looking at the result of the survey as found in Table 6, the average mean score of entrepreneurial competencies of banana farmers is 4.39, interpreted as strongly agree, this means that banana farmers are keen to agree that they are ready to become an entrepreneur compared to coconut farmers whose mean score is 3.75 and rice farmers mean score of 3.64, both interpreted as agree. The vast potential for value adding for these two commodities such as virgin coconut oil, and coco sugar for coconut and banana chips, vacuum packed turon for banana it will somewhat create an assumption of the entrepreneurial competencies between them.

According to Phelan and Sharpley (2012) there are two key uses of the term competency, first, as the behavior one demonstrates and secondly, as minimum performance standard. Datukan's (2015) study mentioned that there are certain behavioral patterns that contribute towards the success of an

**Table 6. Difference in the Conditions of Farming Households When Grouped According to the Top Five (5) Secondary Commodity of Farm Production**

| Conditions of Farming Households | Primary Crop Produced | Mean | F | Sig. Value |
|---|---|---|---|---|
| 1. Market Opportunity | Coffee | 3.74 | 2.036 | 0.091 |
| | Coconut | 3.58 | | |
| | Rubber | 3.22 | | |
| | Rice | 3.11 | | |
| | Banana | 3.22 | | |
| 2. Access to Credit Facility | Coffee | 3.57 | 1.777 | 0.136 |
| | Coconut | 3.27 | | |
| | Rubber | 3.14 | | |
| | Rice | 2.74 | | |
| | Banana | 3.43 | | |

| | | | | |
|---|---|---|---|---|
| 3. Enabling Environment | Coffee | 3.80 | 2.556 | 0.041 |
| | Coconut | 3.29 | | |
| | Rubber | 3.48 | | |
| | Rice | 2.95 | | |
| | Banana | 3.86 | | |
| 4. Infrastructure Facilities | Coffee | 3.77 | 2.238 | 0.067 |
| | Coconut | 3.79 | | |
| | Rubber | 3.67 | | |
| | Rice | 3.24 | | |
| | Banana | 4.07 | | |
| 5. Market Information | Coffee | 3.59 | 2.761 | 0.029 |
| | Coconut | 3.43 | | |
| | Rubber | 3.70 | | |
| | Rice | 3.03 | | |
| | Banana | 4.02 | | |
| 6. Managerial Skills | Coffee | 3.87 | 0.723 | 0.577 |
| | Coconut | 3.72 | | |
| | Rubber | 3.58 | | |
| | Rice | 3.45 | | |
| | Banana | 3.94 | | |
| 7. Entrepreneurial Competencies | Coffee | 4.07 | 2.583 | 0.039 |
| | Coconut | 3.75 | | |
| | Rubber | 3.87 | | |
| | Rice | 3.64 | | |
| | Banana | 4.39 | | |
| 8. Government Policies on Entrepreneurial Development | Coffee | 3.71 | 1.889 | 0.114 |
| | Coconut | 3.05 | | |
| | Rubber | 3.12 | | |
| | Rice | 2.99 | | |
| | Banana | 3.75 | | |

*Significant at 0.05*

individual and these behavioral patterns will make things happen. According to the condition confirmed that banana farmers are more organized in the perspective of export development as revealed by the High Value Crops of the Department of Agriculture which they mention it is still the leading fruit grown in the Philippines and a consistent top dollar earner, compared to rice and coconut.

## CONCLUSION

When the conditions were grouped based on the primary crop produced, it was observed that there was a significant difference in terms of access to credit and the enabling environment, as well as access to credit, market information, and entrepreneurial competencies for secondary crops.

Despite result which revealed that farmers in North Cotabato have the appropriate competencies to become an entrepreneur, the conditions showed a significant difference which could mean that the opportunities available for the farmers are affected by their ability to borrow money to expand operation. Farmers are faced with financial issues that limit their potential for growth and development. The global banking system in terms of credit facility favors investment with relatively assured return which has become a constraint for farmers who would like to take on the available opportunities. Enabling environment depends on the type of commodity, direction of the various concerned government agencies and focus of different business organization in pushing forward various initiatives that meet global requirement which affects the market information received by farmers as these directions do not align in the commodity produced in the area.

## RECOMMENDATION

Based on the findings and conclusions of the study, the following recommendations were presented:

First, in order to align the crop production in the region with that of the national thrust, the Provincial Government of North Cotabato through their seventeen municipalities and one city will have to revisit their Comprehensive Land Use Plan (CLUP) to reestablish their direction aligned with the strategic direction of the National Government. This is to address the difference in the development plan between the national and local government. Relative to this, they will have to establish a list of land inventory along with soil composition to determine the best commodity that should be planted in the area that will produce volume and quality grade commodities to meet the global requirement.

Second, the Provincial Government of North Cotabato in collaboration with different concerned agencies like the Department of Agriculture (DA), should establish a guide for agricultural investment. This will allow the maximization of opportunities through intercropping and mixed cropping, through this business organization will be able to tap on areas that has existing crops but has areas to grow globally demanded commodities like coconut which can be intercropped with cacao or coffee.

Third, an inventory of the commodities per land utilization must be available to further determine the intervention and appropriate direction of the government. This will allow business organization to further determine the possibility of intercropping, mixed cropping, and other business opportunities. Further, this will allow the realistic computation of yield per hectare to address supply requirement as well as identify appropriate technology needed to maintain or increase productivity.

Fourth, this research recognized certain boundaries and areas of concern may have been overlooked, hence further studies may be done using other statistical tool, and combining other factors.

And lastly, to further prove the result of the study, and provide a more comprehensive rationalization on the conditions of the farming households in North Cotabato, further study on the impact of the per farming engagement in the conditions perceived by the farmers is therefore recommended.

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# THE EFFECT OF FARMER BUSINESS SCHOOL ON HOUSEHOLD WELFARE: EVIDENCE FROM COCOA FARMERS IN ATWIMA NWABIAGYA NORTH DISTRICT, GHANA

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**Abstract:** *The purpose of the study is to examine the effect of Farmer Business School (FBS) on household welfare among cocoa farmers in the Atwima Nwabiagya North District of Ghana. FBS is an educational programme aimed at improving the knowledge and skills of farmers in various aspects of agriculture, including financial management and marketing. Data was collected from a sample of 330 cocoa farmers, 200 of whom participated in the FBS programme and 103 who did not. The study employed a range of statistical techniques to investigate the effect of Farmer Business School (FBS) on cocoa farmers, including the perception index, binary probit model, independent samples t-test, and Kendall's Coefficient of Concordance. The results of the study suggest that participation in the FBS programme has a positive and statistically significant effect on household welfare. Cocoa farmers who participated in the programme experienced a significant increase in income and yield, as well as improved overall well-being compared to those who did not participate. The findings of this study provide evidence that FBS programmes can play an important role in improving the welfare of farmers, particularly in developing countries where agricultural livelihoods play a critical role in poverty reduction and economic growth. The study highlights the importance of investing in education and training programmes for farmers to improve their knowledge, skills, and overall well-being.*

## INTRODUCTION

There are different concepts and approaches in extension being implemented to provide technical assistance and support to improve smallholder farmers' livelihood and productivity in the agricultural sector (Chilemba and Ragasa, 2018). Extension activities are widely applied to stimulate change in the agricultural sector. For many years, extension was based on the linear top-down transfer of technology, in which technology was developed and validated by researchers, communicated by extension agents, and adopted by farmers (Knook et al., 2018). The linear top-down transfer of technology was subjected to critique, and it did not address the needs of farmers; hence, various alternative extension approaches were designed where farmers play a great central role in the acquisition of knowledge, change of practices, and exchanging of various ideas between farmers and extension agents.

The Farmer Business School is one of the participatory approaches being used in the agricultural sector to assist farmers, such as cocoa farmers in Ghana. Farmer Business School is a comprehensive adult learning participatory mutual approach that targets changing the mindset of smallholder farmers by sensitising them to market opportunities and possibilities to improve productivity, income, nutrition, or farm commercialization (GIZ, 2012; FAO, 2011). The FBS seeks to empower farmers, enhance trust, and foster collaboration between farmers, value chain actors, and other stakeholders to make lasting contributions to the livelihood and productivity of targeted households (CGIAR, 2022).

The Farmer Business School takes place at the village level and can be started by any number of individuals or agencies, including public sector extension services, farmer associations, cooperatives, and others. Farmers meet at a time of convenience, usually for an entire season, to synchronise their learning with the various stages of a given production cycle. Farmers' capacity for entrepreneurial and management skills is built through a learning-by-doing approach, and farmers can better plan farm operations, follow a more efficient cropping calendar, and, most importantly, realise what they have been missing in making agriculture a profitable business like any other (Verma, 2019). Extension officers and lead farmers are trained as facilitators and organise seasonal training courses, where farmers work in small groups at their own pace using materials that have been specifically designed for the schools (FAO, 2011; Verma, 2019). It is not primarily about lecturing, but the exchanging of information and knowledge is facilitated through the meetings, with observations, dialogues, and discussions. Some of the key characteristics of Farmer Busi-

ness School (FBS) include a focus on content, not the training facility, experiential learning (learning by doing), farmer-to-farmer learning, and matching the farm season (FAO, 2011).

Capacity building among farmers and a learning framework where they may learn from their own and others' experiences are required for the efficient handling of complex farm management possibilities and challenges in production and marketing (Verma, 2019). This is where Farmer Business School also sets in, where farmers are empowered to establish the linkages between production and market, thus enabling farmers to better evaluate their farm business enterprises through a participatory learning approach or learning forum. The Farmer Business School has helped to empower farmers, enhance farmers' trust, and improve collaboration between farmers and actors as well as other stakeholders within the value chain, thereby making significant contributions to the livelihood and productivity of targeted households (CGIAR, 2022).

Since its introduction, farmer business schools in Africa have witnessed rapid expansion through adaptation to a wide range of crops such as cotton, rice, sesame, horticultural products, cocoa, and cashews, among others (Verma, 2019). The farmer business school (FBS) concept was first developed for smallholder farmers producing cocoa in Nigeria, Ghana, Ivory Coast, and Cameroon by the GIZ Sustainable Cocoa Business Project in 2010, and later in 2012, the Ghana Cocoa Board partnered with GIZ to further introduce it in the cocoa sector (Tham-Agyekum et al., 2021; GIZ, 2012). Since its inception, over 1,300,000 smallholder farmers in various countries have been trained in the FBS approach (GIZ, 2015).

Three theories can be advanced to support the idea of the FBS. The theory of learning examines the observable impacts on behaviour and how people establish habits in a systematic way (Goldhaber, 2000). Pavlov (1960) demonstrated that behaviour may be learned, adjusted, and suppressed by changing the circumstances (including immediate stimuli) in which it happens. Once a behaviour is linked to a reward or punishment, the chance of the action continuing changes. As a result, learning theories suggest that business literacy may be learned, which supports the concept of Farmers' Business School programmes. This theory was chosen because it connects how people may learn to be financially sound and how they can improve their living conditions. The exchange theory proposed by Robson and Ladner (2006) claims that procedural, interactional, interpersonal, and informational variables play a role in learning. According to this theory, the manner of knowledge exchange, the degree of contact, the nature of the information, and the methods used to obtain it all affect people's financial literacy levels. The theory of planned behaviour is a belief-behaviour linkage theory. An individual's behavioural intents and behaviours are shaped by their attitude towards conduct, subjective norms, and perceived behavioural control (Ajzen, 1985; Maton and Martin, 2010).

Studies already advanced in the area of the farmer business school are numerous. For instance, Chilemba and Ragasa (2018) investigated the influence of farmer business schools (FBS) on smallholder farmers' crop revenues in central Malawi's Dedza area. Crop revenues from two groups of farmers were assessed using propensity score matching and difference-in-difference techniques: FBS participants and non-participants, as well as FBS graduates and dropouts. The study discovered that FBS participation had a minor but favourable influence on crop income and production (US $20 per year on average) and that there was no significant difference in crop income and production between farmers who graduated from FBS and those who dropped out.

Boer (2013) researched to determine the condition of entrepreneurial orientation (BO) and market orientation (MO) among Rwandan potato farmers, as well as the inadequacies that a farmer's business school strategy could address. Farmers' attitudes towards entrepreneurship were overwhelmingly positive. Kahiu (2016) conducted a descriptive study on the effect of farmers' education on livestock productivity. The study found a high link between livestock productivity, socio-economic status, farmer knowledge of livestock rearing, and Farmer Field School (FFS). Jones (2008) measured the correlation between productivity and education using the Cobb-Douglas relationship. For weekly earnings, he used ordinary least squares (OLS). In his findings, he discovered a link between production and education.

In Ghana, Tham-Agyekum et al. (2021) studied how to enhance the market orientation of cocoa farmers in Ghana through the FBS and found that participants in the FBS were more competitor-oriented, customer-oriented, and had more inter-functional coordination than non-participants. Bannor et al. (2022) examined cocoa farmers' participation in Farmer Business Schools (FBS) in Ghana, the impacts of livelihood outcomes (human, physical, financial, and social capital) on participation, and the implications of participation on productivity and per capita expenditure. They found that participation in FBS had a positive impact and a heterogeneous effect on cocoa farmers' productivity and per capita expenditure. Tham-Agyekum et al. (2022b) argued that participation in the Farmer Business School indeed gives cocoa farmers three key advantages: market orientation, entrepreneurial proclivity, and livelihood outcomes.

The discussions so far prove that the FBS model can churn out great outcomes. This assertion is also supported by studies conducted by MOFA (2013), FAO (2011), Chilemba and Ragasa (2018), and GIZ (2015), who showed that the FBS can help to increase farmers' productivity in a manner that enhances their competitiveness. Nonetheless, there is an empirical gap because few studies on the FBS in Ghana have looked at its relations with household welfare. It is against these premises that this study is being conducted to examine the effect of Farmer Business School on the production of cocoa farmers in the Atwima Nwabiagya North District, Ghana. Specifically, the study sought to: 1. analyse cocoa farmers' perceptions of Farmer Business School 2. Assess the factors influencing cocoa farmers' participation in Farmer Business School. 3. examine the effect of cocoa farmers' participation in Farmer Business School on their household welfare. 4. Examine the challenges cocoa farmers encounter during Farmer Business School.

## METHODOLOGY

The present study was undertaken in the Atwima Nwabiagya North District in the Ashanti region of Ghana. The Atwima Nwabiagya North District is one of the forty-three districts in the Ashanti Region, Ghana. It was formally part of the then-larger Atwima Nwabiagya District until the northern part of the district was split off to create Atwima Nwabiagya North District on March 15, 2018, while the remaining part was renamed Atwima Nwabiagya Municipal District when it was elevated to municipal district assembly status that same year. The Atwima Nwabiagya North District is located in the western part of the Ashanti Region and has Barekese as its capital town.

A research design refers to the plan, structure, and strategy for doing research that is structured to address research questions and manage variance, as well as the glue that holds the study together. It forms the framework within which a study is conducted. The research design provides an overview of how the research topics will be addressed. A study design also encompasses the researcher's objectives, the sources from which he or she plans to obtain information, and inescapable restrictions like data access, time, location, and money, as well as ethical concerns (Saunders et al., 2007).

In this study, a cross-sectional survey design was used. A survey design, according to Tanny (2018), is defined as a method for collecting data from a sample or a target population of persons using questionnaires to explain a group's views, beliefs, actions, or traits. A critical part of any research is the timeline for completion. The choice of the cross-sectional design was because respondents were contacted only once throughout the data collection process. This study made use of a quantitative approach, where numerical data were gathered and analysed quantitatively. This enabled the researcher to gather measurable information about the target audience for statistical inference through data analysis.

The population can be defined as all the units of interest from which a sample is chosen. In this present study, the population covered all registered cocoa farmers in the Atwima Nwabiagya North District who have participated in the Farmer Business School in the past two years. Sample size refers to the actual number of respondents chosen from within the target population. The sample size for this study was calculated from a total of 1,250 registered cocoa farmers in the Atwima Nwabiagya North District who have participated in FBS in the past two years. Since the sample frame is known (that is, 1250), the Yamane formula was used to calculate the sample size. Out of the 1250 registered, 200 participants (i.e., the treatment group) of the FBS were selected, while a control group of 103 cocoa farmers in the district were selected. Therefore, the study focused on 303 respondents (cocoa farmers).

The sampling technique in this study involved a multistage process; thus, in the first stage, a purposive sampling technique was used to select the three operational areas in the district. In the second stage, a simple random sampling technique was used to select two cocoa communities in each of the three operational areas in the district, making a total of six cocoa-growing communities. In the third stage, a simple random sampling technique was also used to select the respondents in the selected communities. The study gathered data from two main sources, namely, both primary and secondary sources. The primary data were obtained through the use of a structured questionnaire focusing on research objectives, while the secondary data were obtained from the Cocoa Health and Extension Division (CHED) office in the district as well as the review of relevant literature such as journal articles and the internet, among others.

The questionnaire was self-administered to enhance participants' privacy. The researcher collected data through the use of structured questionnaires. The questionnaires were the most appropriate method for this research since they allowed respondents to understand and respond to the questions at their own pace.

To make meaning out of the data collected, the data was entered into the Statistical Package for Social Sciences (SPSS) software. The entered data was further cleaned to ensure uniformity, among other things. Different analytical tools were used to analyse the various specific objectives of the study.

In analysing cocoa farmers' perceptions towards Farmer Business School, the perception index was used. This involved presenting statements to the farmers to be rated on a three-point Likert scale (1=disagree, 2=neutral, and 3=agree). The mean scores of these statements were determined by multiplying the frequencies of each response by the corresponding numerical value on the scale and dividing by the number of respondents. The overall perception index was calculated by summing up the mean scores of each statement and dividing by the total number of statements. The overall perception index was calculated using the formula:

$$P = (\Sigma (Fi \times Mi)) / N$$

Where: P = Perception index, Σ = Summation of all the mean scores, Fi = Frequency of the ith statement, Mi = Numerical value assigned to the ith statement on the three-point Likert scale, N = Total number of statements. By calculating the perception index, the study was able to determine the overall perception of the farmers towards the Farmer Business School and whether their perception was positive, neutral, or negative. The higher the perception index, the more positive the farmers' perception towards the FBS, and vice versa.

In assessing the factors influencing cocoa farmers' participation in Farmer Business School, the binary probit model was used. The binary probit model is a statistical model that is used to analyse binary outcome data, such as the participation or non-participation of farmers in the Farmer's Business School (FBS). The model assumes that the outcome of interest (participation or non-participation) is caused by a set of independent variables that are related to the latent variable in a straight line. The latent variable is not seen and has a normal distribution. The relationship between the independent variables and the latent variable can be represented mathematically as follows:

$$y = \beta 0 + \beta 1X1 + \beta 2X2 + ...+ \beta kXk + \varepsilon$$

where y is the latent variable, β0, β1, β2, ..., βk are the coefficients of the independent variables X1, X2, ..., Xk, and ε is the error term. The error term is assumed to be normally distributed with a mean of 0 and a constant variance.

The latent variable y is then transformed into a binary outcome (participation or non-participation) using the cumulative normal distribution function, which gives the probability of the latent variable being less than or equal to a certain value:

$$Pr(y <= 0) = \Phi(-(\beta 0 + \beta 1X1 + \beta 2X2 + ...+ \beta kXk))$$

where Φ(.) is the cumulative normal distribution function. The value of y <= 0 represents the threshold between participation and non-participation. If Pr(y <= 0) is greater than 0.5, the farmer is predicted to not participate in the FBS, and if it is less than 0.5, the farmer is predicted to participate in the FBS.

The coefficients of the independent variables can be estimated using maximum likelihood estimation, which involves finding the values of the coefficients that maximise the likelihood of observing the data given the model. The estimates of the coefficients can then be used to make predictions about the probability of participation in the FBS based on the values of the independent variables.

In conclusion, the binary probit model is a useful tool for analysing binary outcome data, such as the participation or non-participation of farmers in the FBS. By considering the effect of various independent variables on the likelihood of participation, the binary probit model can help researchers and policymakers better understand the factors that influence farmer participation in the FBS and how to improve the design and implementation of programmes like the FBS to support the sustainable development of rural communities and improve the lives of farmers.

**Table 1: Variable Measurement in the Binary Probit Model**

| Independent variables | Measurement | Aprior. Exp |
|---|---|---|
| Sex | Sex (1=Male and 0=Female) | +/- |
| Age | Age (years) | + |
| Education | Years of formal education | + |
| Household size | Number of people in household | + |
| Farm size | Size of farm (acres) | +/- |
| Farming Experience | Years of experience in cocoa farming | + |
| Access to credit | Access to credit (1=Yes and 0=No) | +/- |
| Marital status | Marital status (1=Married and 0= Others) | +/- |
| Religion | Religion (1=Christian and 0=Others) | +/- |
| Land Tenure System | Land tenure (1=Owner and 0=Others) | +/- |
| Membership in cooperative society | Membership in cooperative society (1=Yes and 0=No) | +/- |

The independent samples t-test was used to analyse the effect of FBS participation on household welfare outcomes (yield and income). A comparison was made between participants and non-participants of the Farmer Business School. This style was adopted by Tham-Agyekum et al., (2022a). In examining the challenges cocoa farmers encountered during Farmer Business School, Kendall's Coefficient of Concordance was used. The Kendall's Coefficient of Concordance is given as:

$$W=\frac{12(\sum D^2)}{m^2(N)(N^2-1)};$$

where D = R-A

N= total number of challenges being ranked

M= total number of respondents

R= sum of ranks given to a particular challenge

$$A=\frac{\sum R}{n}$$

## RESULTS AND DISCUSSION

### *Socio-demographic Profile of the Respondents*

**Table 2: Profile of Respondents (Discrete Variables)**

| Participation | Sex of the Respondent | | Total |
|---|---|---|---|
| | Female | Male | |
| Non-participants | 33 | 70 | 103 |
| Participants | 66 | 134 | 200 |
| **Marital status of the Respondent** | | | |
| | Others | Married | |
| Non-participants | 45 | 58 | 103 |
| Participants | 81 | 119 | 200 |
| **Religion of the Respondent** | | | |
| | Others | Christianity | |
| Non-participants | 20 | 83 | 103 |
| Participants | 41 | 159 | 200 |
| **Land Tenure System** | | | |
| | Others | Owner | |
| Non-participants | 90 | 13 | 103 |
| Participants | 173 | 27 | 200 |
| **Access to credit facilities** | | | |
| | No | Yes | |
| Non-participants | 71 | 32 | 103 |
| Participants | 136 | 64 | 200 |
| **Membership in cooperative society** | | | |
| | No | Yes | |
| Non-participants | 19 | 84 | 103 |
| Participants | 33 | 167 | 200 |

*Source: Field Survey, 2022*

There are different concepts and approaches in extension being implemented to provide technical assistance and support to improve smallholder farmers' livelihood and productivity in the agricultural sector (Chilemba and Ragasa, 2018). Extension activities are widely applied to stimulate change in the agricultural sector. For many years, extension was based on the linear top-down transfer of technology, in which technology was developed and validated by researchers, communicated by extension agents, and adopted by farmers (Knook et al., 2018). The linear top-down trans

**Table 3: Profile of Respondents (Continuous Variables)**

| Variable | Description | Participants (n=200) | Non-Participants (n=103) | Total |
|---|---|---|---|---|
| Age | Mean | 58 | 61 | 59 |
| | SD | 13.9 | 10.6 | 12.7 |

| | | | | |
|---|---|---|---|---|
| Years of Formal Education | Mean | 6.22 | 8.88 | 7.11 |
| | SD | 5.04 | 4.65 | 4.91 |
| Household size | Mean | 4.23 | 7.21 | 5.24 |
| | SD | 2.56 | 2.76 | 2.63 |
| Farm size (acres) | Mean | 8.57 | 7.77 | 8.3 |
| | SD | 3.64 | 4.08 | 3.8 |
| Farming Experience (Years) | Mean | 18.33 | 15.50 | 17.37 |
| | SD | 8.89 | 5.09 | 7.60 |
| Yield (Bags per acre) | Mean | 6.23 | 2.66 | 5.01 |
| | SD | 2.24 | 0.79 | 1.74 |
| Annual Income (GH₵) | Mean | 5349.55 | 3945.79 | 4872.36 |
| | SD | 5821.83 | 3200.04 | 4930.59 |

*Source: Field Survey, 2022*

In Table 3 (three), the average age of the respondents was 59 years old. This means that cocoa farming in the study area is undertaken by elderly people. The implication is that the youth are not interested in cocoa farming. The low participation of the youth is a result of the unattractiveness of the cocoa industry and the scarcity of cocoa farming lands. This is very alarming and tends to support the findings of Baah et al. (2010), who stated that the cocoa industry is populated by the ageing group. Therefore, youth engagement is necessary for agriculture to contribute to farmers' livelihoods and rural development.

The mean or average years of education indicate that farmers level of education is very low, and this can have an impact on how they make decisions and gather and use information because educated people are assumed to be more capable of performing certain tasks and roles with greater competency, as well as gathering and transforming available information and differentiating between favourable and unfavourable investment areas (Bawa et al., 2014).

The average household size for respondents was five (5). The average household size of the non-participants is similar to that of Osarenren et al. (2016), who found an average household size of seven (7) in their study in Edo State, Nigeria. However, an average household size of five is relatively large, and therefore there is a high probability of labour available for farming practices.

The average farm size of the respondents was 8.3 acres. According to the Ghana Statistical Service (2014), small-scale farmers have farms of less than 12 acres (5 hectares). This means that the majority of the farmers are small-scale farmers, although some of the farmers are into large-scale farming. This is due to Ghana's agricultural land tenure structure, which is mostly based on inheritance. As a result, most farmlands are shared equally among family members and passed down from generation to generation. This reduces the amount of acreage that can be cultivated. In addition, families with larger households utilise some of their resources to care for their children and other household needs. As a result, the amount of resources available for expanding farm size or migrating from small to medium or large-scale farming is reduced (Donkor and Owusu, 2014; Kwapong et al., 2021). Also, most smallholder farmers are generally poor and do not have large landholdings, so they tend to cultivate small areas, while some smallholder farmers also cultivate small areas due to limited access to credit for farm expansion (Anang et al., 2019).

The farming experience of the respondents was 17.37 years. The average farming experience among participants and non-participants indicates that farmers have rich experience in the cultivation of cocoa and hence could affect how they do things, make certain decisions, and access information from other sources directly and indirectly (Kwapong et al., 2021). Participants average income (GH₵ 5349.55) was higher than that of non-participants (GH₵ 3945.79). This could be attributed to an increase in the average yield per acre of participants (6 bags per acre) and also to the various skills training participants receive during Farmer Business School to enhance their production and improve their income (Bannor et al., 2022).

## *Perception Of Cocoa Farmers (Participants) Towards Farmer Business School*

**Table 4: Perception of cocoa farmers**

| Perception Statements | Mean | SD |
|---|---|---|
| Farmer Business School facilitates easy access to loan | 2.06 | 0.918 |
| Farmer Business School helps farmers to improve their production | 2.11 | 0.901 |
| Farmer Business School promotes easy access to extension services | 2.25 | 0.881 |
| Farmers Business School helps to provide knowledge and information on how to diversify farmers' cocoa farm | 2.46 | 0.784 |
| Farmer Business School facilitates easy access to fertilizers and agro-chemicals | 2.52 | 0.693 |
| Farmer Business Schools help to teach farmers how to accurately measure their farmlands | 2.54 | 0.830 |
| Farmer Business Schools enlighten farmers to deploy appropriate techniques on their farms and post-harvest practices that guarantee the quality of cocoa | 2.60 | 0.658 |
| Farmers Business School promotes interaction/among farmers | 2.65 | 0.649 |
| Farmer Business School increases farmers' income, profit and standard of living | 2.65 | 0.612 |
| Farmer Business School has encouraged the registration of farmers' group | 2.73 | 0.545 |
| Farmer Business School upgrades cocoa farmers' business knowledge and Skills | 2.74 | 0.789 |
| Farmer Business School helps our community to grow into a small closely knitted group with common interests and it creates a feeling of belonging among the farmers | 2.83 | 0.476 |
| Farmer Business School allows farmers to know the right market for cocoa beans | 2.86 | 0.549 |
| Farmer Business School helps farmers to know how profitable Agric business is and agriculture in general using the right practices | 2.94 | 0.790 |
| General Perception Index | 2.57 | 0.719 |

*Source: Field Survey, 2022*

The farming experience of the respondents was 17.37 years. The average farming experience among participants and non-participants indicates that farmers have rich experience in the cultivation of cocoa and hence could affect how they do things, make certain decisions, and access information from other sources directly and indirectly (Kwapong et al., 2021). Participants average income (GH₵ 5349.55) was higher than that of non-participants (GH₵ 3945.79). This could be attributed to an increase in the average yield per acre of participants (6 bags per

acre) and also to the various skills training participants receive during Farmer Business School to enhance their production and improve their income (Bannor et al., 2022).

## *Factors Influencing Participation in Farmer Business School*

**Table 5: Factors Influencing Farmers' Participation in Farmer Business School**

| Socio-Economic Variables | Coefficient | Marginal effect | Z - value |
|---|---|---|---|
| Sex | 0.529 | 0.188 | -2.74*** |
| Age | -0.122 | -0.004 | -1.86* |
| Education | 0.039 | 0.0138 | 2.25** |
| Household size | 0.083 | 0.030 | 1.51 |
| Farm size | 0.282 | 0.099 | 1.94* |
| Farming Experience | 0.142 | 0.050 | 1.69* |
| Access to credit | 0.321 | 0.117 | 3.84*** |
| Marital status | -0.006 | -0.002 | -0.38 |
| Religion | 0.059 | 0.091 | 0.52 |
| Land Tenure System | -0.104 | 0.277 | 1.71 |
| Membership in cooperative society | 0.043 | 0.003 | 1.06* |

*Source: Field Survey, 2022.*

*Log likelihood -165.765, Pseudo R2 = 0.147, LR chi2(8) = 56.91****
*NB: * significant at 10%; ** is significant at 5%; *** is significant at 1%*

Table 5 (five) presents the binary probit model results of the factors that influence cocoa farmers (participants and non-participants) to participate in Farmer Business School. Sex, age, education, farming experience, access to credit, and farm size were the factors that influenced farmers' participation in Farmer Business School.

The result shows that the sex of farmers was significant (at 1%) and positive. This means that males are more likely to participate in Farmer Business School than female farmers in cocoa production. The marginal effect showed that the likelihood of males participating in Farmer Business School increased by 18%. This indicates that men are more active in public activities than females, and female farmers are mostly involved in reproductive roles or domestic roles such as child care, cooking meals, washing and cleaning, and others, thereby reducing the time available for them to participate in various extension services or farmer groups or associations (Awunyo-Vitor et al., 2016). The results contradict the findings of Bannor et al. (2022), which indicate that sex does not influence cocoa farmers' participation in Farmer Business School. The results indicate that as the age of farmers increases, farmers are less likely to participate in Farmer Business School. The marginal effect showed that as the age of farmers increased, participation in Farmer Business School decreased by 0.4%. This means that as farmers age, they lose the desire to participate in the Farmer Business School, and there might also be issues with their health and physical strength to move to various meetings of FBS. In other words, the youth are likely to involve themselves, and the youth are characterised by innovative activities, less risk aversion, little fear of failure, less conservation, higher physical strength, and a larger willingness to acquire information and improve their skills. Education was significant (at 5%) and positive. This means that years of formal education enhanced cocoa farmers' participation in Farmer Business School. The marginal effect showed that a year increase in formal education enhanced the likelihood of participating in Farmer Business School by 1.38%; other factors held constant. Educated cocoa farmers could better access information through different sources than those less educated or those without formal education (Avane et al., 2022). This makes the educated farmer more knowledgeable about agricultural information, such as training programmes like Farmer Business School.

Farming experience in cocoa production was significant (at 10%) and positive. This indicates that experience in cocoa production improves the probability of participating in Farmer Business School. The marginal effect revealed that an increase in production experience by a year boosted the probability of participating in Farmer Business School by 5%; other factors held constant. The plausible reason could be that, for many years, farmers who produced cocoa might have attended several other farm management training programmes and workshops, and hence, knowing the importance of such training programmes, they were more likely to join Farmer Business School. Their extended stay in the cocoa industry will also improve their relationship with agricultural extension agents, who play an important role in advising farmers to participate in training programmes such as Farmer Business School.

Access to credit, farm size, and membership in cooperatives were significant (at 1%, 10%, and 10%, respectively) and positive. This implies that farmers who had access to credit, those with large farm sizes, and those who were members of cooperative societies were more likely to participate in Farmer Business School. Large-scale farmers could be more business-minded. These farmers could be interested in learning and acquiring knowledge that enhances productivity (Bannor et al., 2022).

## *The Effect of Farmer Business School on Yield of Cocoa Farmers (Participants and Non-Participants)*

**Table 6: Independent T-Test (Effect of FBS on Yields of Participants and Non-Participants of Farmer Business School)**

| Levene's Test for Equality of Variance | | t-test for Equality | | | | | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|---|---|
| Yield | F | Sig | T | Df | Sig (2-tailed) | Mean Difference Std. | Error Difference | Lower | Upper |
| | | | | | | | | 3.121 | 4.019 |
| | | | | | | | | 3.221 | 3.918 |
| Equal variance assumed | 182.053 | .000 | 15.637 | 301 | .000 | 3.569 | .228 | | |
| | 3 | 0 | 7 | | | | | | |
| | | | | 274.69 | .000 | 3.569 | .176 | | |
| Equal variance not assumed | | | 20.20 | 9 | | | | | |
| | | | 4 | | | | | | |

*Source: Field Survey, 2022*

The results from Table 6 (six) indicate that there is a statistically significant difference in the yield (bag/acre) of participants in the Farmer's Business School (FBS) and that of non-participants. Levene's test p-value of 0.000 suggests that this difference is unlikely to have occurred by chance. This finding is supported by the work of Bannor et al. (2022), who also found that participation in the FBS leads to an increase in the average yield per acre of participants. This suggests that the education and training provided through the FBS have a positive impact on the agricultural productivity of participants, allowing them to achieve higher yields from their farms. These results highlight the potential of the FBS to not only improve the financial well-being of farmers but also to increase the efficiency and sustainability of their farming practices. By equipping farmers with the necessary skills and knowledge, the FBS can play an important role in promoting food security and improving the livelihoods of rural communities.

**Table 7: Independent T-Test (Effect of FBS On Income of Participants and Non-Participants of Farmer Business School)**

| Levene's Test for Equality of Variance | | t-test for Equality | | | | | 95% Confidence Interval of the Difference | | |
|---|---|---|---|---|---|---|---|---|---|
| Income | F | Sig | T | Df | Sig (2-tailed) | Mean Difference Std. | Error Difference | Lower | Upper |
| | 21.34 | .00 | - | 301 | .000 | - | 1837.210 | - | - |
| Equal variance assumed | 3 | 0 | 3.55 | 346.85 | .000 | 6524.167 | 1516.990 | 10136.0 | 2912.31 |
| | | | 1 | 4 | | - | | 17 | 6 |
| | | | - | | | 6524.167 | | - | - |
| | | | 4.301 | | | | | 9507.82 | 3540.508 |
| Equal variance not assumed | | | 1 | | | | | 5 | 5 |

*Source: Field Survey, 2022*

**Table 8: Challenges Participants Face During Farmer Business School**

| Constraints | Mean | Ranks |
|---|---|---|
| Farmer Business School content does not address the needs of farmers | 2.02 | 1st |
| No follow-up visits after training | 2.71 | 2nd |
| Farmer Business School certificates were not issued to graduating farmers | 3.26 | 3rd |
| Farmer Business School facilitators were not present to facilitate the training sessions, leading to farmers dropping out | 3.99 | 4th |
| There were no field visits (visiting fellow Farmer Business School participants in other districts to learn what other Farmer Business School farmers are doing) | 4.47 | 5th |
| Farmers were not allowed to ask questions | 5.49 | 6th |
| Farmer Business School facilitators not providing participating farmers with manuals | 7.00 | 7th |
| No promotion of peer interaction through an exchange program | 7.73 | 8th |
| Farmers had no access to loans | 8.36 | 9th |
| Kendall's Wa=0.69 | | |
| Chi-Square=1103.40 | | |
| P-value=0.000 | | |

*Source: Field Survey, 2022*

The results from Table 7 (seven) show that the difference in income between participants and non-participants of the Farmer's Business School (FBS) is statistically significant. This is indicated by the low p-value (0.000) of Levene's test, which is a test for equality of variances. A low p-value suggests that the variances between the two groups (participants and non-participants) are significantly different, and therefore the difference in income between the two groups is likely to be real and not due to chance. This conclusion is supported by the findings of a similar study by Bannor et al. (2022), which also found that participation in the FBS increases the income of participants. These findings suggest that participating in the FBS has a positive impact on the financial well-being of farmers, as they can increase their income as a result of their participation. Overall, the results from Table 7 (seven) and the study by Bannor et al. suggest that participation in the FBS is an effective way to improve the financial well-being of farmers, as it results in a statistically significant increase in income.

### *Challenges Participants Face During Farmer Business School*

The three (3) most pressing constraints, as indicated in the table, were: farmer business school content does not address the needs of farmers (mean = 2.02); there are no follow-up visits after training (mean = 2.71); and farmer business school certificates are not issued to graduating farmers (mean = 3.26). The least three constraints were: farmer business school facilitators not providing participating farmers with manuals (mean = 7.00); no promotion of peer interaction through the exchange programme (mean = 7.73); and farmers having no access to loans (mean = 8.36). Kendall's Coefficient of Concordance analysis showed that 69% of the farmers were in agreement with each other on the ranking of the constraints that impeded participants who attended Farmer Business School, and this represents a strong level of agreement in the ranking process. This study is similar to Chilemba and Ragasa's (2018) findings, which revealed that Farmer Business School content did not address the needs of farmers, no follow-up visits after training, and Farmer Business School certificates not being issued to graduating farmers were some of the major challenges smallholder farmers in Malawi face in their participation in Farmer Business School. Therefore, there is a need to work on and address these challenges since they can go a long way towards negatively affecting the participation of farmers in the Farmer Business School.

## CONCLUSION

Based on the results of the study, it can be concluded that Farmer Business School (FBS) has a positive impact on cocoa farmers and their households. The study found that FBS participation influenced farmers' yield and income, suggesting that it can contribute to improving their overall welfare. Furthermore, the results of the study indicate that farmers have positive perceptions of FBS and that certain factors, such as sex, age, education level, farm size, farming experience, access to credit, and membership in a cooperative society, play a

significant role in determining farmers' participation in FBS. However, the study also revealed certain challenges that farmers face during FBS participation. The results showed that the FBS content does not always address the needs of farmers, there are insufficient follow-up visits after training, and certificates are not issued to graduating farmers. These challenges can negatively impact the effectiveness of the FBS programme and limit its potential to improve the welfare of cocoa farmers.

This study recommends that there should be regular review and updating of FBS content to ensure that it meets the changing needs and requirements of farmers, as well as the introduction of regular follow-up visits after training to monitor farmers' progress and provide ongoing support and guidance. There should be the implementation of a system to issue certificates to graduating farmers, as this can increase their motivation to participate in FBS and improve their livelihoods. The farmers should be encouraged to provide feedback on the FBS programme to help identify areas for improvement and ensure that the programme remains relevant and effective. In conclusion, FBS has the potential to positively impact the lives of cocoa farmers, but it is essential to address the challenges faced by farmers during the program. The above recommendations, if implemented, can help ensure that FBS achieves its full potential as a tool for improving the welfare of cocoa farmers.

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# TREND ANALYSIS OF UGANDA S COFFEE SECTOR

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**Abstract:** *Coffee (Coffea arabica and C. canephora) is an important commercial crop globally, and the second most traded global commodity by developing nations after oil. Uganda is among the top 10 coffee exporters worldwide, and second in Africa. The total export amounted to 301,366 tons of "green" coffee in 2021, forming the second-largest commodity export, and contributing about 12.4% to Uganda's total formal exports. However, the country's overall performance over time remains unclear given the fluctuations in production and export prices. This study aimed to evaluate the production and export trends of Uganda's coffee sector by: (i) defining the overall direction of coffee production and export value, (ii) assessing the market variability, and (iii) evaluating the global cross-cutting issues regarding coffee production and export. Data was extracted from FAOSTAT and Uganda Coffee Development Authority (UCDA) databases. Trends were analysed using the Mann-Kendall and Sen's Slope test, while market variability was analyzed using the fixed base index (FBI) and coefficient of variation. VOSviewer software was used to analyze literature from the Web of Science database to highlight cross-cutting issues. Results indicated a significant positive increase in coffee production and export value (p = 0.0001, Slope = 1736.67 tons and p = 0.001, Slope = 4.44 million USD) respectively. Among the top ten coffee producers, Uganda presented the third worst unstable coffee export value with a 20.1% coefficient of variation. Fairtrade, climate change, and certification were the most outstanding global cross-cutting issues. Market stabilization mechanisms should be developed through value addition by establishing coffee processing and roasting plants, as well as strategic governance and policy support to counter emerging global challenges such as climate change.*

***Keywords:*** *coffee, market variability, sector analysis, trends, Uganda*
(JEL code: Q02, Q13, Q17)

## INTRODUCTION

Coffee (Coffea arabica and C. canephora) is a high-value commercial crop worldwide, and the second most traded global commodity by developing nations after oil (Trade-Map, 2021), and also a major income source for many smallholder farmers within developing nations. (Sarmiento-Soler et al., 2020). Africa's coffee exports were estimated at about USD. 2 billion in 2020, a rise from USD.1.99 billion in 2019 (Trade-Map, 2021). Over the years, Uganda has maintained a strong coffee production position globally, and dominance in Africa as the second producer behind Ethiopia. (ICO, 2021b).

Evidently, coffee is a historical and most important cash crop, and a key source of foreign exchange, generating about 15% of Uganda's overall export revenue every year in the past decade. It is also Uganda's second most exported commodity whose revenue accounted for 12.6 percent of total exports generating about US$ 50 million in 2021 (UBOS, 2021). Uganda mainly produces Robusta coffee which forms about 80% of the total coffee exports. A bit of Arabica coffee is cultivated in the highland parts, mainly on the slopes of mountains like Rwenzori and Elgon. While the Arabica coffee variety is known to have originated from Ethiopia, Uganda merits itself in being the birthplace of Robusta coffee, which was long grown around Lake Victoria. Several wild Robusta coffee trees can still be found growing naturally around Mount Rwenzori and are gathered for niche markets in the form of Kibaale wild eco-coffee (UCDA, 2020b).

Uganda's long history of coffee production has been cherished and embraced with extensive advancements in the production of high-quality coffee, consequently rated third best globally by the Coffee Quality Institute (CQI) (Bean-Poet, 2020). According to UCDA (2020a), coffee farmers in Uganda are grouped into three major categories including smallholder farmers, commercial farmers, and plantation farmers. The smallholder farmers comprise subsistence farmers with

low organizational ability, practicing intercropping by growing coffee (about 1000 trees), bananas, beans, and other staple food crops. The commercial farmers are relatively organized into cooperatives and farmers' associations, growing coffee as a main cash crop (1000-10,000 trees), and some bananas for partial shade. The last category is the plantation farmers, which constitute the private sector agribusiness enterprises growing coffee as a monocrop with more than 10,000 trees.

Essentially, the coffee sector's contribution to livelihoods and economic development is undoubtable. However, the country's overall performance over time is not clear given the fluctuations in production and export prices. This study aimed to evaluate the production and export trends of Uganda's coffee sector by: (i) defining the overall direction of coffee production and export value, (ii) assessing the market variability, and (iii) evaluating the global cross-cutting issues regarding coffee production and export.

## MATERIALS AND METHODS

A mixed methodology approach involving the use of qualitative and quantitative methods was adopted for this study. Qualitative data was gathered through content review of multiple coffee resource documents, while quantitative statistical data was obtained from the Uganda Coffee Development Authority (UCDA), Uganda Bureau of Statistics (UBOS), FAOSTAT and Statista databases. A descriptive analysis was done to evaluate the status quo of Uganda's coffee sector in comparison to other top-producing countries.

Mann-Kendall and Sen's Slope test was utilized to define the overall direction of coffee production and export value, with the aim of determining whether it was a significantly increasing or decreasing trend for both production and export value.

Simple linear regression was done to analyze the correlation between area harvested and quantity harvested, where the area harvested was the independent variable, while quantity harvested was the dependent variable, using the equation $y = b0 + b1 * x$, Where: y is the value of the dependent variable, x is the value of the independent variable, b0 is the intercept of the line (the value of y when x is zero), and b1 is the slope of the line (the change in y per unit change in x). Fixed base index (FBI) was used to calculate the relative price changes, while the coefficient of variation was used to estimate the market risk variability.

A bibliometric analysis was done to analyze the global cross-cutting issues regarding coffee production and export. Bibliometrics analysis helps in the logical investigation of recorded discourse (Rousseau et al., 2018). A total of 215 English documents published between 1975 to 2022, were retrieved from the Web of Science database using the following search string: ((Coffee and (production or productivity) and (export or "export value" or "export prices")). The search was limited to the topic (title, abstract, author keywords, and keywords plus). VOSviewer 1.6.18 software was used to analyze the different research publications. The main unit for analysis was the cooccurrence of keywords plus, and link strengths. This helped to analyze the published content in a broader sense rather than a narrow representation based on only author keywords. A minimum threshold level of 4 cooccurrences was used.

## RESULTS AND DISCUSSIONS

### *Changes in coffee area harvested and quantity harvested*

The average coffee area harvested was 252,751 ha between 1961 and 2006. Interestingly, the area has more than doubled in the past decade, with a steady increase from 285,000 ha to 692,553 ha between 2007 and 2021 (Figure 1). This can be attributed to the revamped role of Uganda Coffee Development Authority, that was established in 1991 by the act of parliament (UCDA, 2023), as well as various agricultural initiatives by the government of Uganda through "operation wealth creation" that have highly promoted planting of coffee through giving of coffee seedlings to farmers to establish new plantations (OWC, 2023). On the other hand, the earlier years between 1961 and 2006 highlight the impact of the lack of sector prioritization from the government, as well as the initial years after the establishment of the Uganda Coffee Development Authority (UCDA), representing the organizational capacity development phases.

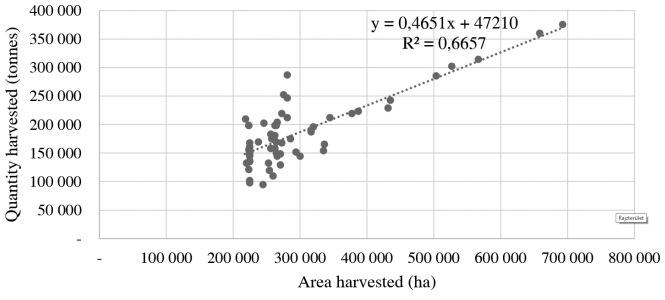
**Figure 1: Coffee area harvested in Uganda (ha)**


*Source: Author's own editing with data from FAO*

Besides, intensive research has also been undertaken by the National Agricultural Research Organization (NARO) to enhance productivity and disease resistance of the various coffee varieties in Uganda. As a result, about 7 new varieties with resistance to Coffee Wilt Disease (CWD) have been developed (Mulindwa et al., 2022). However, there is no significant improvement in the yield per hectare between the two periods, that is 1961-2006, and 2007-2021. The average yield for 1961-2006 was 6,569 hg/ha, while that of 2007-2021 was 5,809 hg/ha, indicating a slight reduction. Nonetheless, a moderate correlation has been established between the area harvested and the quantity harvested ($R^2 = 0.6657$). Furthermore, the area harvested has been found to have a positive effect on the quantity harvested (Figure 2).

Since coffee is a perennial crop, understanding the area harvested and yield dynamics requires analysis of a wide range of factors such as variety, growth conditions and the likely impact of the tree age on productivity. Notably, studies do not indicate a clear correlation between the age of coffee trees and the technical efficiency of their productivity (Nalunga, 2021). This complicates the attempt to compare and account for the changes in the quantity of coffee harvested with changes in the area harvested over time.

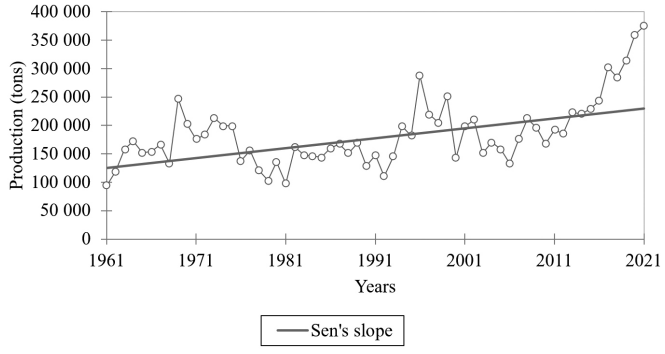
**Figure 2: Correlation between area harvested and quantity harvested (1961-2021)**




*Source: Author's own editing with data FAO (2023)*

The trend analysis using the Mann-Kendall and Sen's Slope test indicates a significant positive increase in coffee production (p = 0.0001, Slope =1,736.68 tons) (Figure 3).

**Figure 3. Trend of Uganda's coffee production (1961-2021)**

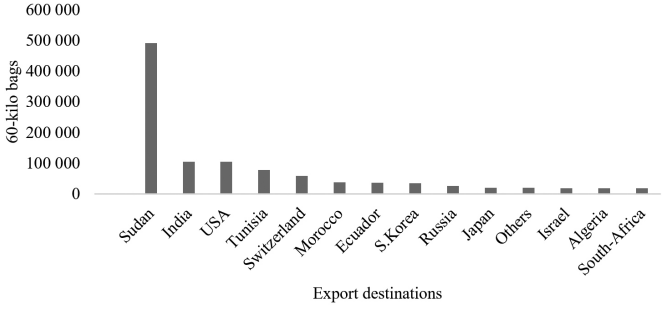



*Source: Author's own editing with data from FAO (2023)*

## *Coffee trade dynamics*

Previously, Uganda's major coffee trade partners were Sudan, India, and USA (Figure 4). However, the trend has since changed in the recent past with a shift to European markets taking a larger market share (58%), for example in January 2022, Uganda's main destination for coffee export was Europe with Italy holding the largest market share (30%). Other major destinations were Sudan, Germany, Belgium, and Spain with each purchasing 17.02%, 10.15%, 6.34% and 5.61% respectively. African market share accounted for only 24%, with Sudan as the main actor plus a few other countries such as South Africa, Morocco, Kenya, and South Sudan (UCDA, 2022). Given the current political instability in Sudan (Nima et al., 2023), the African market share for Uganda's coffee is expected to decline in 2023.

**Figure 4: Average coffee exports by destination 2007-2008 to 2016-2017**

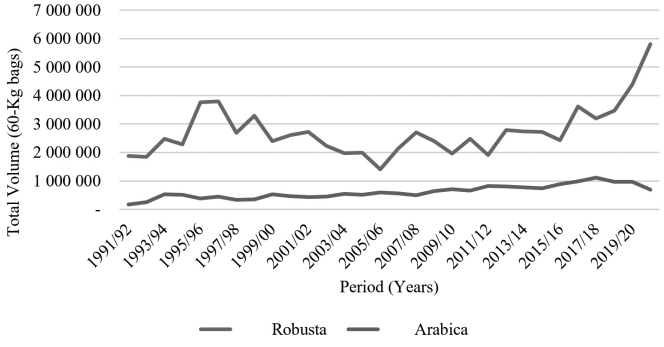



*Source: Author's own editing with data from UCDA (2022)*

Amidist several challenges including, climate change impacts, Uganda's coffee exports have continued to grow both in volume and value (Nakaweesi, 2017). However, the export volumes are mainly comprised of Robusta coffee and very low Arabica coffee. Most parts of Uganda have the desirable conditions for growing Robusta coffee, that is a soil pH range of about 5.5-6.5, altitude range of 900-1,500 m above sea level, and rainfall between 1,200 mm - to 1,800 mm evenly distributed for at least 9 months every year (UCDA, 2019a). This has favored more production and export of Robusta coffee as opposed to Arabica coffee, with the favorable growth conditions in a few parts of the country. Arabica coffee requires a higher elevation of about 1,500-2,500 m above sea level, and cooler temperatures between 150C – 240C, which are only available in a few highland areas of the country (UCDA, 2019b). None the less, Uganda remained among Africa's top two coffee exporters and 8th globally by 2021 (FAO, 2023).

Evidently, progressive growth has been registered in the export of Robusta coffee with the current annual export above 6 million (60kg-bags), compared to Arabica coffee, where the export volume has remained slightly below 1 million (60kg-bags) from 1991 to 2020 (Figure 5).

**Figure 5. Uganda's coffee exports by type since liberalization by coffee year**




*Source: Author's own editing with data from UCDA (2020)*

Interestingly, non-coffee producing countries like Germany, export more coffee than some producing countries such as Uganda and Ethiopia, for example, in 2021, Germany exported 343,911 tons of coffee-green, performing better than Ethiopia and Uganda that exported 303,679, and 301,366 tons respectively. Germany coffee market relies on importation from producer countries and re-export to other countries. It is not surprising that in 2021, Germany was the second global coffee importer after the USA, importing 1,112,216.52 tons of coffee-green (FAO, 2023). It is also evident that the market power is concentrated within the importing countries rather than the producing countries (Figure 6). Only Brazil has a substantial amount of revenue

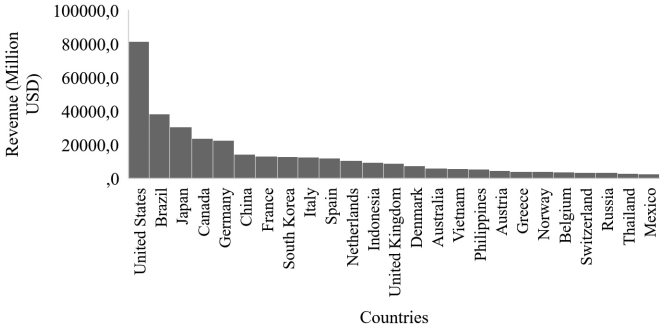
due to the exportation of much higher volumes compared to other producing countries (Table 1). It can also be asserted that the exportation of raw coffee by most producer countries limits their revenue potential from the coffee trade.

**Table 1.Top 10 Coffee Exporting countries (Coffee, Green) 2021**

| Position | Country | Quantity (tons) | % share |
|---|---|---|---|
| 1 | Brazil | 2,282,846 | 29.23 |
| **2** | Viet Nam | 1,218,370 | 15.60 |
| **3** | Colombia | 687,866 | 8.81 |
| **4** | Honduras | 387,661 | 4.96 |
| **5** | Indonesia | 380,348 | 4.87 |
| **6** | Germany | 343,911 | 4.40 |
| **7** | Ethiopia | 303,679 | 3.89 |
| **8** | Uganda | 301,366 | 3.86 |
| **9** | Belgium | 265,116 | 3.39 |
| **10** | India | 263,401 | 3.37 |
| **-** | Others | 1,375,810 | 17.62 |
| **-** | Total (World) | 7,810,374 | 100.00 |

*Source: Author's own editing with data from FAO (2023)*

**Figure 6: Global coffee market revenue by country in 2021**




*Source: Own editing - With data from Statista (2023)*

Notably, a country's export value is determined by two major factors including the coffee variety and value addition. Uganda majorly exports green coffee which is of low value compared to other leading exporters like Germany and Italy that are the top exporters of roasted coffee (FAO, 2023). Robusta coffee fetches lower export value due to its low prices on the international market, compared to Arabica coffee which has higher prices. For example, the unit price for Robusta was USD. 1.40/kg, while Arabica was bought at USD. 2.48/kg in the financial year 2020/21. Considering 2015/2016 base year, Robusta coffee prices reduced twice between 2019 to 2021 at a percentage relative price change of -3.37% and -8.96%, while Arabica prices increased by 10.02% and 25.12% in the same periods (Table 2). On average, both Robusta and Arabica coffee prices increased in the past 5 years at 4.29% and 12.12% respectively.

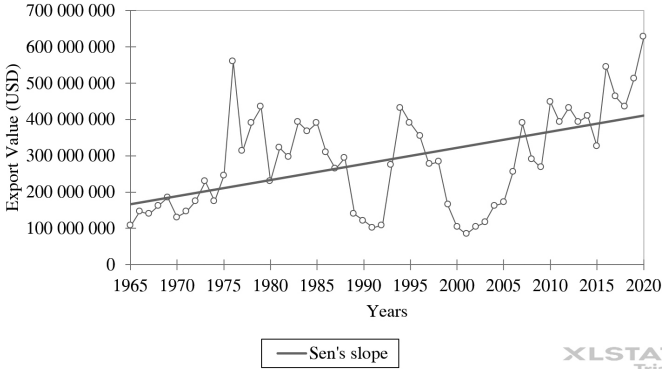
The trend analysis of Uganda's coffee export value indicates a significant positive growth at ($p = 0.0001$, Slope = 4.44 million US $). However, the output value is marred by constant fluctuations especially between 1990 to 2010 (Figure 7). The drastic reductions were not only due to price fluctuations, but also drops in the quality and quantity of coffee produced. Rampant outbreaks of Coffee Wilt Disease (CWD) and Coffee Berry Disease (CBD) between 1990 and 2000 affected coffee production, for example, more than 40% reduction in coffee production around the 2000s was associated with Coffee Wilt Disease (CWD) (Baffes, 2006).

**Table 2: Average price changes per coffee type from FY 2015/16-FY 2020/21 (US $/kg)**

| GRADE | Country | Quantity (tons) | % share | Position | Country | Quantity (tons) | % share |
|---|---|---|---|---|---|---|---|
| Robusta weighted Price | 1.54 | 1.83 | 1.75 | 1.57 | 1.49 | 1.40 | 1.60 |
| Relative price change | - | 118.54 | 113.58 | 101.68 | 96.63 | 91.04 | 104.29 |
| Relative price change (%) | - | 18.54 | 13.58 | 1.68 | -3.37 | -8.96 | 4.29 |
| Arabica weighted Price | 1.98 | 2.35 | 2.13 | 1.97 | 2.18 | 2.48 | 2.18 |
| Relative price change | - | 118.38 | 107.55 | 99.54 | 110.02 | 125.12 | 112.12 |
| Relative price change (%) | - | 18.38 | 7.55 | 0.46 | 10.02 | 25.12 | 12.12 |

*Source: Own editing with data from UCDA (2021)*

**Figure 7.Value of exports, as a function of unit export prices (1965-2020)**




*Source: Author's own editing with data from UCDA (2022)*

Global coffee consumption trends indicate that coffee is among the world's most preferred beverages. For example, around 166.63 million 60-kg coffee bags were consumed globally in 2020/2021, an incremental from 164 million 60-kg coffee bags in the year before (Statista, 2023). Furthermore, those in the coffee business are always inventing new and creative techniques for preparing and serving coffee such as single cup brewing techniques that provide an instant, clean, and hassle-free method for producing one coffee cup minus the effort of brewing a whole pot. (ICO, 2021a). Such innovations present several opportunities for coffee producing countries like Uganda

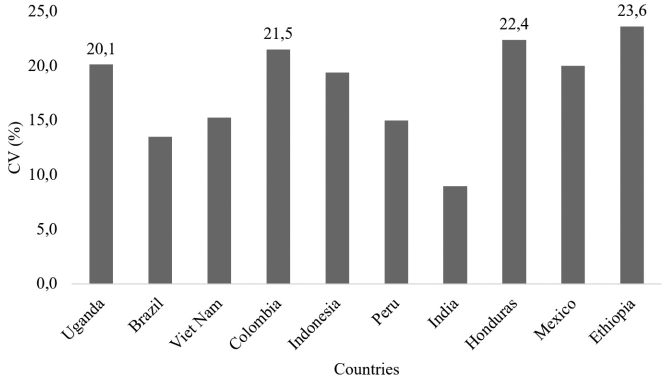
to improve their returns from coffee business. For a country to benefit, strategies must be laid to increase production efficiency as well as maintaining/improving the quality to compete favorably on the world market.

Additionally, the domestic coffee value chain should be enhanced through promotion of local coffee brewing and consumption. This was evident from Uganda's low coffee consumption per capita of only 2.23kg/capita/year, compared to other top consuming countries such as Luxembourg with a consumption per capita of 25kg/capita/year (FAO, 2023). A report by UCDA (2021) indicated that 10% domestic consumption of the total coffee produced could add up to $2.3 billion annually to Uganda's economy.

## *Risk factors and Variability of the coffee sector*

From a worldwide perspective, considering the top 10 top coffee exporting countries (only producers) as ranked by FAOSTAT, there is a high degree of variability in terms export earnings from coffee exports implying a huge difference in the stability of the earnings between different countries. It is worth noting that Uganda's earnings are highly unstable compared to the other top 10 exporting countries with a percentage coefficient of variation of 20.1% only below Colombia, Honduras, and Ethiopia with 21.5%, 22.4% and 23.6% respectively (Figure 8). The variability can be attributed to the unstable export volumes and the fluctuation in the world prices.

**Figure 8: Risk Variability based on export value of top exporting countries (2011-2021)**




*Source: Own editing with data from FAO (2023)*

## *Global cross-cutting issues regarding coffee trade*

According to the bibliometric analysis of keywords plus for published literature regarding coffee production and trade from the Web of Science database between the years 1975 to 2022, the most outstanding areas of global research focus included the "impact" of "climate-change", and the role of "fair trade" and "certification" on the global coffee trade, each with a total link strength of 20, 16, 15, and 14 respectively (Table 3).

**Table 3. Cooccurrence of keywords plus**

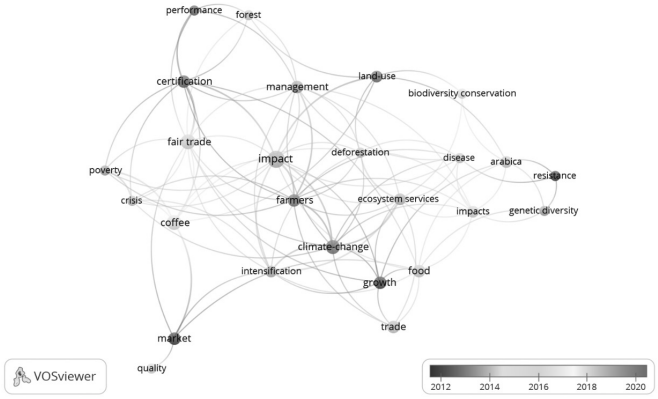
| Id | Keyword | Occurrences | Total link strength |
|---|---|---|---|
| 1 | Impact | 11 | 20 |
| **2** | Coffee | 8 | 10 |
| **3** | Fair trade | 8 | 15 |
| **4** | Climate-change | 7 | 16 |
| **5** | Certification | 6 | 14 |
| **6** | Farmers | 6 | 15 |
| **7** | Food | 6 | 9 |
| **8** | Growth | 6 | 8 |
| **9** | Management | 6 | 13 |
| **10** | Market | 6 | 6 |

*Source: Author's own editing with data from the Web of Science*

The connection between the keywords indicates that the latest areas of interest are certifications and land use, represented by the deep red circles (Figure 9). Certification is a fundamental prerequisite for access to specific global markets including niche markets such as organic markets. Questions remain on whether this is an enabler or barrier, especially for producer countries whose capacity to adjust to new market standards might be limited by resource constraints. For example, according to the Uganda Coffee Development Authority, export certification is highly bureaucratic involving a 13 steps licensing process (UCDA, 2020a). This has led to the concentration of market power among the very few certified exporters, thus unfair trade since there is limited competition. Besides, coffee farmers must accept the set prices by the few registered exporters despite the unfair low prices in certain circumstances.

Interestingly, there has been a steady increase in the number of export companies from 54 in 2016 to 88 by 2020, despite the very low number of value addition service providers such as, hullers, washing stations, roasters and grading plants (UCDA, 2021).

**Figure 9: Overlay visualization of the keywords' connections**




*Source: Author's own editing with data from the Web of Science*

## CONCLUSION

A significant positive trend in coffee production and output value has been established, indicating a remarkable and strategic importance of the coffee sector to Uganda's economy. However, the risk variability analysis indicates a high level of fluctuation in output value which is associated with price instabilities, exportation of more Robusta coffee with low prices at the world market, limited value addition and low domestic consumption. The government Uganda through the Uganda Coffee Development Authority must be credited for the tremendous support to the coffee sector, although more must be done to improve the returns from the sector by promoting value addition through establishment of coffee processing and roasting plants, promoting domestic consumption, further research to counter emerging global challenges such the negative impacts of climate change on coffee production, and capacity development to enhance compliance to global standards and certifications. There is also a need to alter the global Robusta market preposition through better marketing and promotion campaigns.

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# EXPLORING THE NEXUS BETWEEN SUSTAINABLE CONSUMPTION BEHAVIOR AND ORGANIC FOOD PURCHASE: A COMPREHENSIVE REVIEW

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**Abstract:** *The growing popularity of organic food has sparked interest in understanding the role of sustainable consumption behavior in driving this trend. This study investigated the impact of sustainable consumption on organic food purchases using a qualitative synthesis of 43 articles identified through a PRISMA-guided search. Our findings reveal a positive and direct relationship between sustainable consumption behavior and organic food purchases. Consumers motivated by health, environmental concerns, perceived quality, trust, and food safety are more likely to choose organic options. However, price remains a significant obstacle for some, and limited knowledge about organic food can hinder purchase decisions. These findings offer valuable insights for producers, retailers, and policymakers. Producers can emphasize diverse value propositions beyond environmental benefits, while retailers can implement clear labeling strategies. Policymakers can promote educational initiatives and facilitate access to affordable organic options. Future research can explore moderating and mediating factors, the impact of external influences, and variations in consumer behavior across different demographic groups. Ultimately, this research contributes to advancing sustainable and healthy food consumption patterns.*

***Keywords:*** *Sustainable consumer behavior, sustainable consumption, sustainable consumption behavior, food consumption, organic food, and PRISMA.*
(JEL code: Q01, Q13, Q56)

## INTRODUCTION

Growing concerns about the environmental impact of food production and consumption have fueled the rise of sustainability-focused product categories, particularly organic food. However, understanding the complex relationship between consumer behavior and sustainable choices, like purchasing organic food, remains crucial. While technological advancements in agriculture have boosted production, their long-term impact on rural communities and ecosystems demands reevaluation. Current consumption patterns, especially in developed nations, push planetary boundaries, prompting calls for sustainable consumption (Steffen et al., 2015). Sustainable Development Goal 12 emphasizes responsible consumption and production, acknowledging the role of consumer choices in driving change (United Nations, 2020). Many consumers associate organic food with sustainability, health benefits, and superior quality (Govender & Govender, 2016). While re-

search on sustainable consumer behavior spans multiple disciplines, including psychology, marketing, and environmental science, its depth varies across different areas (Kumar & Polonsky, 2017). Notably, understanding the factors influencing consumers' willingness to purchase organic food remains an active research area. Organic farming demonstrably reduces the environmental impact of food production compared to conventional methods (Müller et al., 2017). Furthermore, studies suggest potential health benefits associated with lower pesticide and antibiotic use in organic agriculture (Mie et al., 2017). However, research indicates that consumers' primary motivation for purchasing organic food stems from perceived health benefits, rather than solely environmental concerns (Federal Office for Agriculture and Food, 2020; Rana & Paul, 2020). Building on this foundation, this study aims to critically examine the relationship between sustainable consumption behavior and organic food purchase behavior. Recent studies highlight the need for further research in this area. To address this gap, we used a systematic literature review using the PRISMA framework to analyze recent and representative research on this topic. Our central research question is: To what extent does sustainable consumption behavior influence consumer decisions to purchase organic food? By investigating this question through a qualitative synthesis of the literature, we aim to unravel the intricate interplay between consumers' environmental consciousness, their broader buying habits, and their specific choices regarding organic food purchase. This analysis will be based on a selection of 43 academic journal articles retrieved from the Scopus database. Additionally, we will develop a framework (Figure 1) that visually represents the key factors influencing this relationship, informed by the reviewed literature. This investigation seeks to shed light on the complex motivations and decision-making processes behind consumer choice in the context of organic food and sustainable consumption. Ultimately, our findings aim to contribute to developing strategies that encourage more sustainable purchasing behaviors and support a resilient food system for the future.

## RESEARCH PROCESS AND METHOD

This article adopts a qualitative research synthesis by (Page et al., 2020). The researcher uses a three-step procedure to gather the research that is most related to our research goals.

### *Identification:*

To ensure we captured relevant existing reviews, we initially searched across multiple databases, including Scopus, Web of Science, and Google Scholar, using our key terms (Sustainability, sustainable consumption behavior, consumer decision-making buying behavior, and organic food). This comprehensive approach helped us gain a deeper understanding of the research landscape and avoid duplicating existing efforts. According to (Page et al., 2020), authors can spend less time getting acquainted with literature by using this method. It also enables the writers to understand the justification for conducting the literature review, such as whether the subject needs updating, whether a fresh theory may be established, or whether the prior literature study contained methodological problems. The stage of the data collection process was carried out from the online library of the University of Debrecen from the Scopus database. First, the query TITLE-ABS-KEY ( sustainab* AND consumption AND behavior OR purchasing AND organic ), has been used to address the study question. This step aimed to gather a huge descriptive group of original research that might make it possible for this study to get an important conclusion since hundreds of article results were pulled from the Scopus database based on the Advanced Document Search. A total of 499 articles were found during the initial phase of the search to have pertinent data on the area of sustainable consumption behavior and purchasing organic goods. Due to the substantial quantity of prior research that may be reviewed and the depth of their literature, the already-identified inclusion criteria were applied. There were several articles that have been excluded, which was 94 articles because the search was made by choosing the year 2015-2023, and the sample of publications that were chosen was reduced to 405 articles. This period has been selected because the concept of sustainable consumption behavior has been around for countries, but it has gained more attention in recent years. There are lots of articles about it but mostly are updated once.

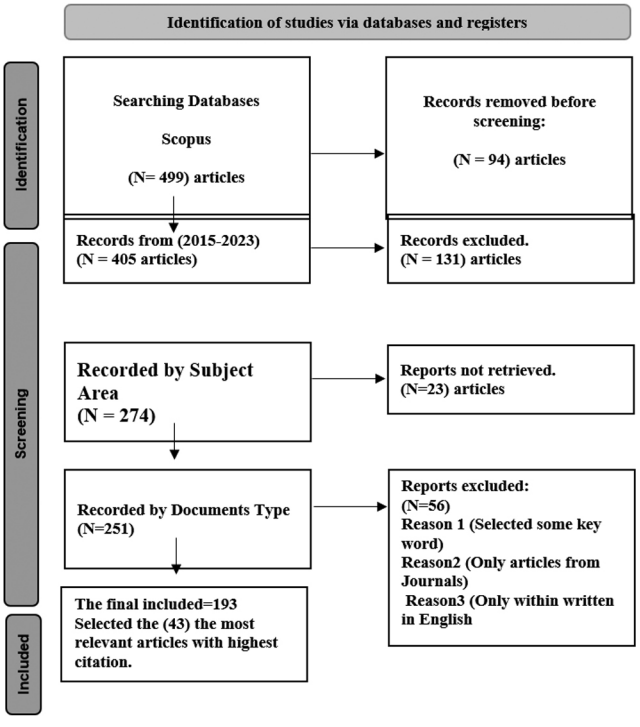
### *Screening*

Following the initial search, we concentrated on the Scopus database due to its comprehensive coverage of our chosen subject areas, including Environmental Science, Business Management and Accounting, Economics, and relevant subfields of Social Sciences like Psychology and Marketing. By focusing on these disciplines, we aimed to capture research directly addressing our research question regarding the relationship between sustainable consumption behavior and organic food purchase decisions. Additionally, most of the papers published in these publications are original studies with quantitative or qualitative research methods. The researcher identified the keyword searches for the various sub-areas of sustainable consumption behavior in relation to organic goods. The keywords linked with sustainable consumption behavior and purchasing organic foods are particular to that region. They are crucial in ensuring that all relevant elements are investigated, and the analysis's main issues are thoroughly covered. Nevertheless, after the first stage, which is (Identification,) the search was sorted by subject area (Environmental Science, Business Management and Accounting, Economics, Econometrics and Finance, Art and Humanities, Health Professions) has been chosen because there are more relative to the research topic. The total number of documents found based on the subject area that has been mentioned above was 274. The number of research was reduced to 251 articles because the search was done based on the Documents type, which both Article and Review Articles were chosen because they already existing knowledge can be nicely recognized.

### *Included*

Finally, to ensure the selected articles directly addressed our research question and offered high-quality insights, we used multiple criteria beyond citation count for example thematic relevance we carefully assessed the article content to ensure alignment with our specific research focus on sustainable consumption behavior. In this stage, the search was based on the keyword's selection, there are some important keywords that are related to the research topic have been selected, which are (Sustainability, Consumption Behavior, Organic Food, Sustainable Development, Sustainable Consumption, Consumer Behavior, and Article) 195 articles were chosen based on those keywords. Only journals from the source type were selected, and 195 articles were published in journals. Finally, written papers in English were chosen, and the number of articles was 193, then they were exported to RefWorks database manager, it makes researcher to make bibliographic references easily and saving time. The last inclusion criterion was the highest number of citation papers with the most relevant to the research topic, which reduced the sample to 43 articles. Figure 1, a (PRISMA) flow diagram below, shows the sampling procedure and how the number of articles was reduced from 499 to 43 articles.

**Figure 1 The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) by Page et al., (2020).**




## RESULTS AND DISCUSSIONS

The analysis of the chosen paper conceded a result based on the article, author, and the year of publication; methods and results are shown in Table 1 in the appendix. This research finds the following Findings:

### *Environmental cognitions have a significant impact on purchasing organic food.*

Consumers who exhibit biospheric values that show concern for the environment and animal well-being are more likely to purchase organic food. This is supported by the findings of (Van Doorn and Verhoef, 2015) and (Laureti & Benedetti, 2019), who found that those who care about deforestation, soil contamination, and animal welfare are more likely to purchase organic products regularly. The study by (Rahnama & Rajabpour, 2017) also highlights that environmental value and epistemic value are the primary determinants of customer decision behavior for green products. Food suppliers have recognized the importance of addressing climate change and have included environmental goals in their policy statements; retailers also urge customers to buy seasonal, local, and organic foods and reduce food waste, (Tjärnemo & Södahl, 2015).

(Moser, 2016) emphasized that the advantages of buying organic goods must be appreciated and understood by consumers. Self-interest and environmental concerns are both potent motivators that present marketing opportunities. (Chu et al., 2018) found that consumers' intentions to purchase organic goods will be further reinforced by a more positive attitude toward them. However, they also found that there was no discernible effect of marketing pricing or communication on customers' attitudes toward organic foods. (Maaya et al., 2018) reported that environmental and charitable sentiments have a considerable impact on willingness to pay for both organic and fair-trade coffee labels. Overall, understanding the motivations and values of consumers can help companies to target their marketing strategies more effectively to keep their customers and attract new ones to buy their organic food.

### *Health, quality, and food safety have a significant impact on purchasing organic food.*

According to several studies, quality and health concerns are the primary drivers of organic product purchasing. (Nguyen et al., 2019) found that customers' attitudes toward buying organic beef were greatly influenced by their concerns about their health, the safety of their food, and their understanding of organic food. (Oroian et al., 2017) identified weight issues, sensory appeal, sustainable consumption, and health concerns as the primary justifications for consuming organic food products. (Tobi et al., 2019) reported that organic labeling was the most desired quality, and many consumers view food labeling programs that emphasize environmental and social responsibility favorably. (Liu et al., 2019) also found that consumers' willingness to pay for organic products is highest for those with traceability, organic, graded, ecologically friendly, and fair-trade certificates. Consumers' purchasing decisions are influenced by various factors, including functional and emotional values. According to (Von Meyer-Höfer et al., 2015) sustainable consumers, who are more likely to be women, are particularly interested in food quality and exhibit a higher willingness to promote sustainability through their consumption patterns. (Mauracher et al., 2019) believe that individual purchasing choices have an impact on the sustainability of society as a whole; younger customers have

a more favorable perception of wine with sustainable qualities and are willing to pay a higher price for it. Eating sustainably produced food is not only good for the environment but also for our health, according to (Petrescu et al., 2017). Quality plays a crucial role in establishing and upholding trust among producers and retailers, which in turn influences consumer trust. The use of emotional appeals, such as the health argument made by an expert or the authenticity argument delivered by a producers' union, can foster trust among consumers. In terms of environmental concerns, social value has the most significant impact on consumer attitudes toward green products, according to (Mohd Suki, 2015). Therefore, it is essential for producers and retailers to consider these factors when marketing sustainable and environmentally friendly food products.

### *Financial Values have an impact on purchasing organic food.*

Research has shown that cost can be a significant obstacle for consumers interested in purchasing organic products. (Nguyen et al., 2019) found that high prices for organic meat were a barrier for many consumers. However, (Rahnama & Rajabpour, 2017) discovered that the functional value-price of green products had a positive impact on consumer choice. Consumers who care about environmental and quality issues are often willing to pay more for high-quality food, as seen in the findings of (D'Amico et al., 2016). While price and convenience have a significant impact on customers' purchase intentions, this determinant has a negative impact on those planning to buy organic goods (Basha & Lal, 2019). Financial incentivization has been found to be an effective way of encouraging sustainable consumption, according to (Lavelle et al., 2015). Furthermore, research by (Gerini et al., 2016) found that the market segment that purchases the most organic food is willing to pay significantly more for organic eggs, while most consumers who rarely buy organic items aren't willing to pay more for organic eggs than for eggs with improved animal welfare. The analysis by (Olson et al., 2017) found that the high price of organic food was a concern for some consumers, who believed that it offered little to no health benefits. (Migliore et al., 2020) found that the number of sulfites, income, and attitudes toward healthy food could also influence consumer preferences. Nevertheless, customers have shown a willingness to pay a premium price for sustainable and organic products, such as sustainable fish and organic extra virgin olive oil, according to (Maesano et al., 2020) and (Rizzo et al., 2020), respectively. (Moser, 2015) found that willingness to pay was a significant predictor of environmentally conscious shopping behavior, followed by personal norms. (Moser, 2016) also discovered that customers' purchase decisions often reflect their environmentally conscious attitudes. Finally, (Kamenidou et al., 2020) found that while consumers across all demographic cohorts have favorable attitudes toward organic food, the economic crisis has had an impact on their purchasing behavior. Additionally, (Mauracher et al., 2019) found that consumers who prioritize cost when choosing wine are less likely to pay for organic wine, and that those with a lower consumption frequency are more likely to be willing to pay a premium price for it.

### *Knowledge has an impact on purchasing organic food.*

Several studies have identified key predictors of organic food consumption and purchase intentions. According to (Mann et al., 2020), recent consumption changes, health-related attitudes, and social norms, perceived behavioral control, environmental values, income, and education level are among the most significant predictors of organic food consumption. Financial and environmental arguments also play a role in non-organic food purchases. Access to knowledge, information, and money, as well as time to prepare meals, are important factors for achieving healthier and more ecologically friendly food consumption. Trust in organic certification, recognition of differences between organic and conventional foods, and perceived obstacles to purchasing organic food may hinder the adoption of organic food consumption (Torres-Ruiz et al., 2018). (Roh et al., 2022) found that consumer attitudes and subjective norms have a positive impact on purchase intentions, while trust in the product decreases purchase intention. Knowledge about organics also positively influences attitudes and trust. (Testa & Sarti, 2018) noted that subjective norms have a detrimental impact on actual purchase behavior, while purchase intentions are positively influenced by customer knowledge about organics. (Nosi et al., 2020) discovered that political values have a negative impact on consumer attitudes toward purchasing organic quinoa-based meals, while ecological welfare and retailer CSR reputation have a positive impact. Consumer attitudes are a key indicator of behavioral intention.

## CONCLUSION

In conclusion, the present research investigated the relationship between sustainable consumption behavior and the act of buying organic food. By implementing the PRISMA standards to analyze 43 papers, we found a clear and beneficial relationship between the two variables. Important factors which affect the decisions regarding purchasing organic products are environmental values, concerns for animal welfare, emotional and functional value propositions, and successful labeling strategies. Younger consumers and women demonstrate a stronger desire for purchasing organic products. Although cost might be a barrier to some individuals, factors such as perceived value, quality, and financial incentives can serve as drivers for promoting sustainable consumption. Furthermore, knowledge plays an essential part, highlighting the importance of educational activities and easily available information. Producers and retailers could achieve advantages by promoting several value propositions besides just environmental benefits, using specific labeling, and focusing on certain customer segments, considering these findings. Policymakers can contribute by encouraging educational initiatives, maintaining cheap access to organic alternatives, campaigning for responsible advertising, and considering financial incentives. In addition, future studies may examine additional moderating and mediating variables, the impact of external factors, the influence of specific value propositions, continuous patterns, and global disparities in consumer behavior. Ultimately, by combining these findings, we can promote healthier and beneficial dietary habits for everyone.

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**Table 1 Characteristics of the Sampled Studies**

| No | Article | Author and the year of publication | Methods | Results |
|---|---|---|---|---|
| 1 | Thinking green, buying green? Drivers of pro - Environmental purchasing behavior. | Moser (2015) | The data (n = 12,113) from the household panel survey that was conducted in 2012 by the German market research firm GfK were provided. | Willingness to pay (WTP) was the most accurate predictor of environmentally conscious shopping behavior, followed by personal norms. |
| 2 | Drivers of and Barriers to Organic Purchase Behavior. | Van Doorn & Verhoef (2015) | For 1,246 of the more than 4,000 homes in the GfK household panel, researchers got these survey data. | Organic food is more likely to be purchased when consumers have biospheric values that show their care for the environment and the well-being of animals. Moreover, quality and health concerns the primary drivers of organic product purchasing. Egotism and a focus on cost might be hurdles to purchasing organic products. |
| 3 | Exploring environmental consciousness and consumer preferences for organic wines without sulfites. | D'Amico et al (2016) | An investigation of survey data using an ordered logit model. A survey of 201 Sicilian organic customers was conducted between May and September 2012 on a random sample. | Consumers who care about environmental and quality issues are prepared to pay more for high-quality food, and that effective price differentiation requires more information about wine without added sulfites. |
| 4 | Consumers' purchasing decisions regarding environmentally friendly products: An empirical analysis of German consumers. | Moser (2016). | Data for seven different product categories in the industry of products for daily necessities were collected from a national panel of respondents (n=1760), and they included survey data and retail scanner data. | Customers are environmentally conscious and that their purchase decisions reflect these attitudes (self-reported). Strong determinants of SRB are norms and willingness to pay in particular. |
| 5 | Organic food purchases in an emerging market: The influence of consumers' personal factors and green marketing practices of food stores. | Nguyen et al (2019) | Data were gathered from a sample of 609 consumers of organic beef at four food establishments in Hanoi using a designed and validated survey tool. | Customers' attitudes toward buying organic beef were greatly influenced by their concerns about the environment, their health, the safety of their food, and their understanding of organic food. On the other hand, the high cost of organic meat was undoubtedly a barrier to genuine organic meat purchases. |
| 6 | The role of consumers in transitions towards sustainable food consumption. the case of organic food in Norway. | Vittersø & Tangeland (2015) | Based on the findings of two consumer surveys conducted in 2000 and 2013, the article explores the observed changes in Norwegian consumers' perceptions of the barriers to purchasing organic food. | The perceptions, had shifted to a more unfavorable position for other elements like consumer confidence in the labeling system and the caliber of organic foods. Most significantly.More customers in 2013 did not see any advantages to purchasing organic food. |
| 7 | Indian consumers' attitudes towards purchasing organically produced foods: An empirical study. | Basha & Lal (2019) | 1300 questionnaires, mostly with closed-ended questions, were randomly handed to shoppers in these cities' main supermarkets. | The price and convenience, these had a significant impact on customers' purchase intentions, while this determinant had a negative impact on those of consumers who planned to buy organic goods. |
| 8 | Consumers' willingness-to-pay for sustainable food products: The case of organically and locally grown almonds in Spain. | De-Magistris & Gracia (2016) | In the fall of 2011, the RCE experiment was carried out in the Spanish region of Aragon's capital. 171 consumers made up the entire sample size. | Customers were willing to pay more for almonds that were grown locally and organically, as these cause less greenhouse gas emissions. |
| 9 | Are green consumers really green? Exploring the factors behind the actual consumption of organic food products. | Testa & Sarti (2019) | This study is based on a sample of 79 Italian customers' self-reported information combined with data from actual purchases. | Subjective norms have a detrimental impact on actual purchase behavior while purchasing intentions have a favorable impact. It is discovered that customer knowledge about organics influences purchase intentions. |

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| 10 | Exploring pro-environmental food purchasing behaviour: An empirical analysis of Italian consumers. | Laureti & Benedetti . (2018) | Using the Italian National Statistical Institute's 2014 Aspect of Daily Life Survey | People who care about deforestation, soil contamination, and animal welfare are more likely to regularly purchase organic goods. |
| 11 | Profiles of sustainable food consumption: Consumer behavior toward organic food in southern region of Brazil. | Feil et al. (2020) | A quantitative technique and surveyed organic food consumers in the Rio Grande do Sul state of southern Brazil in 1997. | Despite particular socioeconomic and demographic characteristics, the consumer profile is interrelated with a collection of intentional and attitudinal behavioral aspects. Theoretical implications underline the significance of evaluating more sustainable consumption forms in accordance with consumer profile particularities when looking at organic food as a method to achieve a more sustainable food production and consumption system. |
| 12 | Perceived value, trust and purchase intention of organic food: a study with Brazilian consumers. | Watanabe et al. (2020) | 274 Brazilian consumers of organic food participated in a survey. | Both functional and emotional values have a beneficial impact on consumer trust, but only emotional value influences consumers' desire to make a purchase. |
| 13 | Towards sustainable consumption: Keys to communication for improving trust in organic foods. | Vega-Zamora et al. (2019) | 800 people were enrolled in an experiment to test 36 different therapies. | Three variables under consideration have strong interactions, and they point to the following combinations as being the most successful in fostering trust: the health argument made by an expert, the authenticity argument delivered by a producers' union, the elitist argument made by an expert, and finally, the social argument delivered by a public authority, all of which use an emotional form of appeal. |
| 14 | How stable is the value basis for organic food consumption in China? | Thøgersen et al. (2016) | In Guangzhou, China, outside supermarkets selling organic food, two surveys of common Chinese consumers were conducted in 2009 (n = 529) and 2012 (n = 478). | The value Schwarz refers to as "universalism" is associated with the attitude toward purchasing organic veggies, and that when universalism is controlled, no other values increase explained variation. For organic veggies, the associations between value and attitude and between attitude and behavior are both significant and do not alter significantly between the two time points. The observed behavior (purchasing organic veggies) is significantly associated to fundamental values. |
| 15 | Consumers' attitudes towards organic products and sustainable development: A case study of Romania. | Oroian et al. (2017) | Data from 568 respondents were gathered, and descriptive and inferential statistics were used to analyze the results. | The primary justifications for consuming organic food products are weight issues, sensory appeal, sustainable consumption, and health concerns. The "gourmand," "environmentally concerned," and "health worried" categories were found to be the three main customer groups of organic food. |

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| 16 | Consumption values and consumer environmental concern regarding green products. | Mohd Suki. (2015) | the use of a questionnaire that is self-administered. 200 respondents who committed to living sustainably and making at least one green purchase per week, such as organic veggies, filled out this survey. | The PLS technique, social value had the biggest impact on consumer environmental concerns about green products. This result demonstrated the importance of peer opinion in shaping people's perceptions of green products and their willingness to buy them. The epistemic value of buying eco-friendly products is the previous crucial element. |
| 17 | Different shades of green? Unpacking habitual and occasional pro-environmental behavior. | Lavelle et al.(2015) | Investigating household consumption using data from a survey of 1500 families in the Republic of Ireland and Northern Ireland that created behavioral and attitudinal indicators | Families reporting habitual pro-environmental conduct differ considerably from those reporting occasional pro-environmental behavior in terms of sociodemographic and attitudinal features. The financial incentivization of sustainable consumption is one area where this has a clear impact on environmental and sustainability policies. Significant social sustainability difficulties also occur, with rewards for one-time actions favoring better-off households more than others while those who participate in regular pro-environmental conduct typically incur higher expenses. |
| 18 | The defining role of environmental self-identity among consumption values and behavioral intention to consume organic food. | Qasim et al. (2019) | Through the use of a standardized questionnaire, the information was gathered from 406 organic food buyers in Lahore (Pakistan) | Consumers' behavioral intention to consume organic food is significantly positively influenced by conditional value, emotional value, epistemic value, and functional value quality. The researcher also demonstrate that the structural relationship between consumption values and the behavioral intention to eat organic food is significantly mediated by environmental self-identity. |
| 19 | Increasing organic food consumption: An integrating model of drivers and barriers. | Hansmann et al. (2020) | 620 Swiss households were polled in the survey. | The most significant predictors were recent consumption changes, health-related attitudes and social norms, perceived behavioral control, environmental values, income, and education level. These were followed by financial and environmental arguments for purchasing non-organic food. The participants believed that in order to achieve more ecologically friendly and healthier food consumption, it was crucial to have access to more knowledge, information, and money. Additionally, they believed that having more time to make meals on one's own was crucial for achieving healthy food consumption. |
| 20 | Organic food consumption: The relevance of the health attribute. | Rizzo et al. (2020) | in order to ascertain customers' Willingness to Pay (WTP) for organic extra virgin olive oil, a multiple price list (MPL) methodology is used (EVOO). | Findings reveal that the average premium price for organic EVOO is determined in part by the health characteristic, which accounts for 78.9% of the premium price overall. |

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| 21 | Identifying effective factors on consumers' choice behavior toward green products: the case of Tehran, the capital of Iran. | Rahnama & Rajabpour. (2017) | the survey questionnaires | The choice of green items was highly influenced by the functional value-price, functional value-quality, social value, epistemic value, and environmental value; conditional value and emotional value had little bearing on this decision. It was determined that environmental value and epistemic value were the primary determinants of customer decision behavior for green products. |
| 22 | Sustainable consumption in organic food buying behavior: the case of quinoa. | Nosi et al. (2020) | Data from an intercept survey of 158 people in Italy that was done at specialist organic retailers was analyzed using structural equation modeling (SEM). | Political values have a negative impact on consumer attitudes toward purchasing organic quinoa-based meals, notwithstanding the favorable effects of ecological welfare and a retailer's CSR reputation. Additionally, it is discovered that consumer attitudes are a key indicator of behavioral intention. |
| 23 | Swedish food retailers promoting climate smarter food choices-Trapped between visions and reality? | Tjärnemo & Södahl. (2015) | Interviews with 17 Swedish food store representatives served as the foundation for the empirical data. | Food suppliers address climate change in their environmental policy statements and have environmental goals for their retail operations, including trash recycling and energy and transportation efficiency. Additionally, retailers urge customers to buy seasonal, local, and organic foods and to reduce food waste. |
| 24 | Organic- and Animal Welfare-labelled Eggs: Competing for the Same Consumers? | Gerini et al. (2016) | We run a choice experiment with 900 consumers from Norway and undertake behavioral segmentation depending on how frequently they buy organic food. | As would be predicted, the market segment that buys the most organic food is willing to pay significantly more for organic eggs than eggs that just exhibit improved animal welfare. The majority of consumers, who rarely buy organic items, aren't willing to pay more for organic eggs than for eggs with improved animal welfare. |
| 25 | The rationalization and persistence of organic food beliefs in the face of contrary evidence. | Olson et al. (2017) | Using content analysis, 710 reader comments on stories about the Stanford study results are divided into "organic-skeptic" and "pro-organic" reader comments. | The most frequently cited benefit of eating organic food, particularly when it comes from small, local farms, continues to be health benefits. The analysis also reveals that the Stanford findings support the beliefs of organic skeptics that food produced organically offers little to no health benefit to justify its high price. |
| 26 | Sustainable diet dimensions. Comparing consumer preference for nutrition, environmental and social responsibility food labelling: A systematic review. | Tobi et al. (2019) | PRISMA | Organic labeling was the most desired quality, and it is likely that this has health implications. The majority of consumers view food labeling programs that emphasize environmental and social responsibility favorably. Combination labeling has potential because a variety of sustainable diet characteristics seem to be well-liked. |

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| 27 | Mediating influences of attitude on internal and external factors influencing consumers' intention to purchase organic foods in China. | Chu et al. (2018) | This empirical study is based on a sample of 1421 Chinese customers who answered an online questionnaire. | Consumers' intents to purchase organic goods will be further reinforced by a more positive attitude toward them, although there was no discernible effect of marketing pricing or communication on customers' attitudes about organic foods. The findings also indicate that the three exogenous dimensions of environment awareness, health consciousness, and subjective standards were fully or completely mediated by intention. |
| 28 | Trading off nutrition and education? A panel data analysis of the dissimilar welfare effects of Organic and Fairtrade standards. | Meemken et al. (2017) | We address these issues by comparing the results of two of the most widely used sustainability standards, namely Organic and Fairtrade, using panel data from small-scale coffee producers in Uganda. | Both organic and fair trade have a favorable impact on overall consumption spending. In contrast, significant variations are seen in the other results. Although organic farming improves nutrition, it has no impact on schooling. For Fairtrade, the situation is completely reversed. |
| 29 | Traditions, health and environment as bread purchase drivers: A choice experiment on high-quality artisanal Italian bread. | De Boni et al. (2019) | The objectives of this study were to examine through two direct surveys, namely, I opinions of experts and stakeholders on bread qualities to define its sustainability performances and ii) opinions of consumers on bread attributes. | Consumers and professionals alike preferred the customary Altamura bread, gave a deeper understanding of how consumer traits and bread qualities affect demand, and proposed ways to encourage the consumption of sustainably produced foods. |
| 30 | Measuring consumer preferences and willingness to pay for coffee certification labels in Taiwan. | Liu et al. (2019) | 650 questionnaires were filled out by people who regularly bought coffee beans in Taiwan. | The respondents' WTP features that are listed best to lowest include traceability, organic, graded, ecologically friendly, and fair-trade certificates. |
| 31 | Sustainability through food and conversation: the role of an entrepreneurial restaurateur in fostering engagement with sustainable development issues. | Moskwa et al. (2015) | an exploratory case study | The findings show the need of deep local embedding as a means of achieving lasting sustainability. |
| 32 | Factors affecting consumer preferences for “natural wine”: An exploratory study in the Italian market. | Migliore et al. (2020) | The experimental study examined the purchasing intentions of 613 consumers of Italian wine. | A higher WTP for natural wine is positively correlated with consumption frequency and occasion, organic production method, the amount of sulfites, income, and attitudes toward healthy food and the environment. |
| 33 | Effect of environmental and altruistic attitudes on willingness-to-pay for organic and fair trade coffee in flanders. | Maaya et al. (2018) | A discrete choice experiment (DCE) was used | Environmental and charitable sentiments have a considerable impact on WTP for both organic and fair trade coffee labels. |
| 34 | Sustainable Consumption: Proposal of a Multistage Model to Analyse Consumer Behaviour for Organic Foods. | Torres-Ruiz et al. (2018) | Using a personal digital assistant, or PDA, 800 in-person interviews were used to gather information. Six different regions—Madrid, Barcelona, Seville, Salamanca, Oviedo, and Valencia—were used for the interviews. .. | The findings show that the model suggested can be adopted, and that the issues preventing adoption include a lack of trust in organic certification, a failure to recognize the differences between organic and conventional foods, and the impression of obstacles to their purchase. |
| 35 | Generational differences toward organic food behavior: Insights from five generational cohorts. | Kamenidou et al. (2020) | A qualitative and quantitative research methodology is used, and during a nine-month period, the field research produced 1562 valid surveys. | Consumers across all demographic cohorts have favorable attitudes toward organic food, and they point to the economic crisis as a cause of consumers' less frequent purchases. |

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| 36 | Unveiling ways to reach organic purchase: Green perceived value, perceived knowledge, attitude, subjective norm, and trust. | Roh et al. (2022) | To analyze our study model with 251 samples, a partial least square structural equation method (PLS-SEM) was used. | Purchase intention is highly positively impacted by consumer attitudes and subjective norms. As an extended TRA, GPV dramatically increases trust, and trust substantially decreases purchase intention. Perceived knowledge also effects attitude and trust favorably. |
| 37 | Characterising convinced sustainable food consumers. | von Meyer-Höfer et al. (2015) | Based on information gathered through an online consumer survey, this study. | Sustainable consumers are more likely to be women than males, and they believe that their individual purchasing choices have an impact on the sustainability of society as a whole. Through their consumption patterns, they exhibit a higher willingness to promote sustainability. In contrast to persuaded typical consumers, they are particularly interested in great food quality and are less influenced by commercials and offers while making buying decisions. |
| 38 | The role of environmentally conscious purchase behaviour and green scepticism in organic food consumption. | Golob et al. (2018) | Data on a sample of 462 Slovenian consumers were gathered using an online poll. The relationships that had been hypothesized were examined using structural equation modeling. | Consumption of organic foods is positively impacted by ECPB and negatively impacted by green skepticism. Additionally, ECPB is influenced favorably by consumer sustainability orientation, perceived availability, and personal and social norms. It's interesting to note that societal standards have the biggest indirect impact on consuming organic food. |
| 39 | How product attributes and consumer characteristics influence the WTP, resulting in a higher price premium for organic wine. | Mauracher et al.( 2019) | An online survey of Italian wine drinkers (N = 317) was conducted, and an ordinal logistic regression model was generated using the cumulative probability distribution. | Younger customers have a more favorable perception of wine with sustainable qualities, and the research shows that consumers under 50 have higher WTP. Another element that influences preferences for organic wine is price: people who say that cost is very important in choosing a bottle are less likely to pay for it. The WTP for organic wine is higher among consumers who are known for having a low consumption frequency. |
| 40 | The role of trust in the relationship between consumers, producers and retailers of organic food: A sector-based approach. | Ladwein & Sánchez Romero (2021) | 316 French consumers of organic food participated in an online questionnaire survey that we conducted. | The crucial position of quality as a tactic for establishing and upholding trust among producers and retailers. They demonstrate for the first time the beneficial effect of producer trust on retailer trust. |
| 41 | Perception of organic food consumption in Romania. | Petrescu et al (2017) | This empirical study is based on a survey with a sample of 672 customers and analyzes their intentions toward sustainable food products using a questionnaire. | Customers' purchasing intents will be further strengthened by a more positive attitude toward organic food products, but the level of organic consumers' consumption will have no bearing on those consumers' propensity to buy organic food goods. According to statistics, eating sustainably produced food is good for your health, and doing business in Romania can be lucrative. |

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| 42 | The role of credence attributes in consumer choices of sustainable fish products: A review. | Maesano et al (2020) | Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA). | Customers, on the whole, have favorable opinions of sustainable fish products and are willing to pay a premium price for the sustainability trait. |
| 43 | Buying organic – decision-making heuristics and empirical evidence from Germany. | Moser (2016) | The use of structural equations is made. A countrywide panel of data (n = 1,760) was used to collect survey and scanner data for five different food categories. | The advantages of buying organic goods must be appreciated and understood by consumers. Self-interest and environmental concerns are both potent motivators that present marketing opportunities. |

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# IMPACT OF CLIMATE CHANGE ON PEOPLES LIVELIHOOD AND LIVESTOCK PRODUCTION IN UGANDA

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**Abstract:** *Livestock sector in Uganda contributes significantly towards individual household income and food security and even though peoples' dependance on livestock production for survival in Uganda is a reality, it's also undeniable that livestock, which provides food and revenue on a worldwide scale, would be vulnerable to the direct or indirect consequences of climate change. Agriculture contributed 24.1% of the Uganda's GDP in the financial year (FY) 2021–2022 and according to the Uganda bureau of standards (UBOS), agriculture employs over 70% of Uganda's working population. The purpose of this present study was to to evaluate the impact of climate change on peoples' livelihood and livestock production in Uganda. Bibliometric analysis was the quantitative technique used for reviewing and describing published publications that assisted in evaluating academic works from secondary data obtained on digital databases in the context of this study. The VOS viewer software was used as a tool to perform the co-occurrence analysis, and then to realize the visualization of the impact of climate change on peoples' livelihood and livestock production in Uganda using articles analysed on platform research with associated references from the Web of Science database. The visualisation highlighted topical areas that reflect the impacts of climate on peoples' livelihood and livestock such as diseases, drought, coping strategies, greenhouse gases, drought, vulnerability, dry lands, mobility among pastoral communities, low productivity, reduced forage resources, elevated temperature extra all of which negatively affects the economic levels of individuals and the national income from livestock either directly or directly. Conclusively, interventions that are aimed at improving climate smartness in Uganda's livestock farming communities may have significant food security and income benefits for different livelihoods.*

***Keywords:*** *climate, livestock animals, livelihood, income*

## INTRODUCTION

Climate change and its effects worldwide is becoming more and more practically visualized with evidenced increasing change in the climatic conditions. Africa is already warming faster than the rest of the globe, and the 4th Intergovernmental Panel on Climate Change (IPCC) assessment report (IPCC, 2007) predicted that this trend will continue. Peoples' dependance on livestock production for survival in Uganda is a reality. It is also undeniable that livestock, which provides food and revenue on a worldwide scale, would be vulnerable to the direct or indirect consequences of climate change. Livestock animal performance in terms of growth, milk production, wool production, and reproduction are directly impacted by air temperature, humidity, wind speed, and other climatic parameters (Rust & Rust, 2013). It is also notable that a decline in agricultural income from dry land crops (1.9%) and livestock (5.4%) is unavoidable when the temperature rises in Uganda (Ekiyar et al., 2012) and correspondingly, water distribution in Uganda is unequal, with certain areas of the nation being semi-arid with cyclical and growing frequency of droughts which have a negative impact on the quantity as well as the quality of water supplies and consequently, a lack of water for human consumption and livestock may result from increased heat and decreased rainfall which might lead to more conflict between various groups over water, especially in drought-prone areas yet with drier circumstances, cattle fodder may become limited as well. Heavy rains forecast in the medium and high-altitude zones could however speed up soil erosion and land degradation as well as harm communication infrastructure (Victor et al., 2005).

Despite Uganda's high susceptibility to rainfall variability and climatic shocks such as droughts and floods, there are little micro-level farm research on how various farmers interpret these changes. Most of the research examining the impacts of climate change on African agriculture is regional or national, while adaptation is site-specific and necessitates the employment of site-specific tactics (Okonya et al., 2013). Additionally, it's unclear whether the population comprehends the impact of climate and therefore the motivation for this study is to evaluate the influence of climate change on peoples' livelihood and livestock production in Uganda.

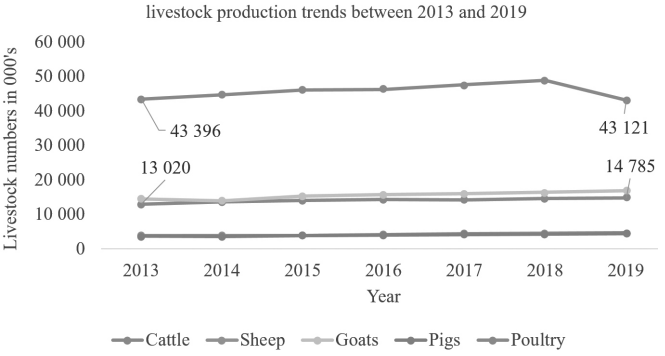
## *The effect of climate change on livestock production*

Whereas livestock is one of the known drivers of climate change accounting for a total of 14.5% of human-made or anthropogenic greenhouse gas (GHG) emissions, climate change is virtually likely raising temperatures and, as a result, increasing heat stress and decreasing cold stress however, it has been observed that livestock animals experience negative impacts from heat stress and due to the fact that heat stress happens when animals cannot expel enough heat to maintain homeothermy, which has been found to result into increased respiration, pulse, and heart rate, as well as increased body temperatures, which can cause changes in mortality and immune system function and subsequently decrease feed intake, milk production, and reproduction efficiency (Cheng et al., 2022). Similarly, Baumgard et al., (2012) argued that the biological process by which heat stress influences production and reproduction can be partially explained by decreased feed intake, but also consists of altered endocrine circumstances, decreased rumination and the absorption of nutrients, and higher maintenance demands, resulting into a general reduction in nutrient/energy availability for production. Owing to this justifies that animals under heat stress lose a significant amount of body weight, which is explained by the fact that this reduction in energy directly causes a decline in energy balance.

The findings of Baumgard et al., (2012) suggested that global livestock production is under growing pressure due to severe environmental consequences, notably greenhouse gas (GHG) emissions and with higher temperatures, possibly influenced by GHG, are anticipated to impair the economic abilities of individuals through affecting the dairy output, weight gain of the animals, reproduction, and conversion of feed efficiency in warm locations and similarly disease outbreaks in livestock animals are projected to be impacted by climate change, since most diseases and illnesses are transmitted by vectors such as ticks and flies whose development phases are frequently and majorly dependent on ambient temperature. Correspondingly temperature increase cause severe damage to forage and fodder crop production, physiology, metabolism, and animal health. It is also imperative to note that changing patterns of precipitation and increasing aridity could influence the availability of animal feed since desertification lowers rangelands' carrying capacity as well as the buffering ability for pastoral and agro-pastoral systems (Nardone et al., 2010).

The severe environmental consequences like higher temperatures directly affects livestock by slowing production levels and increasing morbidity among livestock animals and this is reflected in the slow increasing and decreasing patterns of livestock numbers for example over years the sheep numbers in Uganda are almost negligible, the poultry numbers dropped between 2018 and 2019 and similarly cattle, goats and swine numbers had not registered a reasonable increase in number by the year 2019 (Figure 1).

**Figure 1: Livestock production trends in Uganda**




*Source: Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), and Uganda Bureau of Statistics*

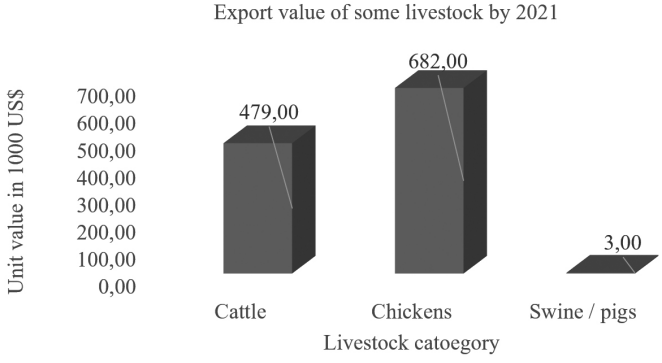
## *Effect of climate on livelihood and income in Uganda*

Climate change continues to be highlighted as an existential threat to human health around the globe, and variations in precipitation and rising temperatures have varying effects on health throughout various regions of the world, some effects or risks are direct due to mortality and morbidity, while others are indirect due to environmental change, ecosystem changes, and associated modifications to social systems. Key risks include increased exposure to infectious diseases, increased water and food insecurity, natural disasters, and population displacement and migration (Labbé et al., 2016). Additionally, Bagamba & Kuyvenhoven, (2022) concluded that despite livestock acting as a buffer against food insecurity, a distal indicator of health, and being crucial in reducing economic vulnerability at the household level, the livelihoods of Uganda's smallholder farmers are projected to suffer as a result of climate change, with between 70 and 97% of them being affected and unable to adapt due to the small farm sizes and restricted access to alternate sources of income besides farming, the Southwest is anticipated to be the region most severely impacted by climate change.

The study by Boyce et al.,(2020) revealed that an elevated level of poverty is the socioeconomic factor most frequently cited as causing susceptibility to serious climatic conditions-related health risks in diverse areas however, Uganda's poor and socioeconomically marginalized populations are expected to be most vulnerable to the health effects of climate change, which will be influenced by existing burdens of ill-health, climate-sensitive infrastructures, dependence

on climate-sensitive livelihoods, inadequate technological capability, poor public service infrastructures weak institutions, and political inequalities. Consequently, an examination of the environmental, social, and economic conditions and processes that limit the security of livelihoods in the context of climate stressors could possibly therefore reveal significant aspects of Uganda's susceptibility and since most of the population in Uganda is self-employed, a change in climate could have a negative impact on the performance of the country's agricultural sector, which can account for up to 40% of GDP. This, therefore could result into may be a rise in food costs, a decline in domestic tax revenues, and an increase of the deficit in the current account as a result of a reduced amount of export profits, more significant inflation, and rising foreign debt that directly impacts many livelihoods (Victor et al., 2005). An example of reduced export profits due to the impacts of climate change on livestock production can be associated with the export value of livestock products like swine that scored a low export value of 3000 US$, cattle at 479000 USS$ by 2021 (Figure 2).

**Figure 2: Export value of cattle, chickens, and swine**




*Source: Authors own editing of data from Foastat*

## METHODOLOGY

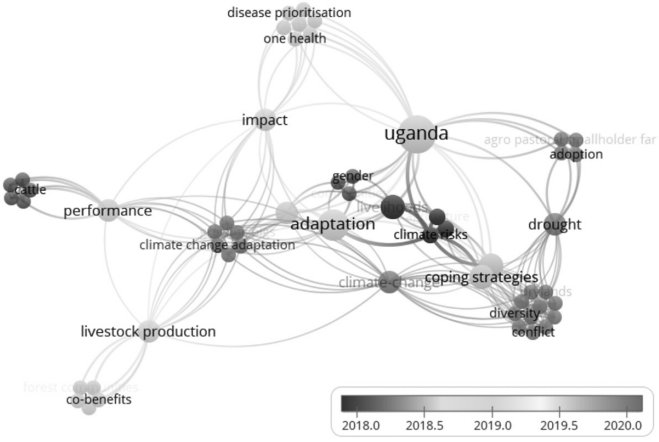
### *Bibliometric analysis*

Bibliometric analysis is a quantitative technique as well as a tool for reviewing and describing published publications that can assist academics evaluate academic works in a certain topic. Bibliometric analysis analyses secondary data obtained on digital databases from a quantitative and objective standpoint, allowing it to create a systematic, transparent, and repeatable review process, and so improve the reliability and quality of review (Ding & Yang, 2022). In this study, the VOS viewer software was used as a tool to perform the co-occurrence analysis, and then to realize the visualization of the impact of climate change on peoples' livelihood and livestock production in Uganda. A total of 9 articles were analysed on platform research with associated references from the Web of Science database using the identified search string as ("Climate change" AND ("livestock production" OR "animal production") AND "Uganda").

### *Results and discussion*

This section describes the analysis on web of science platform research publications, authors, journals, institutions, and the country in context and additionally, an evolution study utilizing time co-occurrence analysis on keywords to acquire an overall picture about the impact of climate change on peoples' livelihood and livestock production in Uganda.

**Knowledge mapping of the impact of climate change on peoples' livelihood and livestock production in Uganda: a visual analysis**




*Source: Author's own editing with data from web of science*

Among the clusters, livestock production, climate change and adaptation, climate risks and health, are closely inter-connected, while the co-benefits and disease prioritisation are the peripheral clusters because of loose connection. The studies around 2018 concentrated on climate risks, livelihoods, gender, and cattle however by the year 2020 studies drew more focus on drought, climate change, climate change adoption and adaptation to mention but a few. The visualisation also highlights topical areas that reflect the impacts of climate on peoples' livelihood and livestock such as diseases, drought, coping strategies, greenhouse gases, drought, vulnerable, dry lands, mobility among pastoral communities, low productivity, reduced forage resources, elevated temperature extra all of which negatively affects the economic levels of individuals and the national income from livestock.

## CONCLUSION

This study researches and uncovers impacts of climate on peoples' livelihood and livestock in Uganda by bibliometric analysis. According to 9 articles achieved from the web of science, identification of important publications, authors, journals, institutions in Uganda was done, and the analysis of the network reflects climatic potential tendencies in the future. This study achieves some insights from the literature review and summarizes the existing studies. Therefore, interventions that are aimed at improving climate smartness in Uganda's livestock farming communities may have significant food security and income benefits for different livelihoods.

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# POSITIVE EFFECTS OF CULTIVATION TECHNOLOGIES BASED ON GEOREFERENCED DATA ON THE ECONOMIC SUSTAINABILITY OF WINTER WHEAT PRODUCTION

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**Abstract:** *Elements of precision farming, such as auto-steer navigation, section control and variable rate application, can have a positive impact on farming performance, yet the uptake of these technologies has been slow and farmers are not convinced that they can achieve additional benefits by switching to them. Therefore, the authors considered it important to examine the impact of precision farming on winter wheat yields based on data from Hungarian farms. Yield data from farms with a yield map in the MyJohnDeere database from 2018-2022 and yield and cost data from 48 farms with Variable Rate Application (VRA) from 2018-2022 were evaluated and compared to the national average. MyJohnDeere and VRA farms had significantly higher yields in all years. Despite the cost saving from the introduction of precision farming, such as non-overlapping input application, the total costs of the examined VRA farms were higher, which can be explained by more intensive production beyond precision farming. It can also be argued that the additional inputs of the VRA farms were outweighed by the additional production value, with their specific incomes being higher than the national average in all years. In conclusion, the profitability of winter wheat production - and thus its resilience to a changing economic environment - can be increased at farm scale by adapting precision farming. Technological change by farmers, in particular the widespread adoption of variable rate application, could also increase the sustainability of winter wheat production at the farm scale.*

***Keywords:*** *farm-scale profitability; precision farming; variable rate application*
(JEL Code: Q1)

## INTRODUCTION

Precision farming influences farming efficiency through both precise operation and better adaptation to production site conditions [1-5]. While the former includes the possibilities offered by the use of navigation, such as auto-steer navigation or section control, the latter involves variable rate application based on soil mapping or fertility mapping.

The use of automatic steering itself also saves money by turning the machine back next to its previous track, rather than onto the already cultivated area. In extreme cases, reduction in fuel consumption could lead to saving 25-27% of fuel costs [6], while Controlled Traffic Farming (CTF) can also increase yields by 5-10% [6-8].

The use of section control results in further significant input material savings. The simplest example is sowing as a working operation. Thanks to section control, there is noneed to worry about overlapping or skipping at the turns at the field borders and in irregularly shaped sections within the field, which reduces input material consumption by 5-7% [9]. In recent decades, precision farming has developed in a com- plex and diverse way, with variable rate application (VRA) becoming increasingly important. Today, we have the possi- bility to apply virtually all agricultural inputs in a precision and variable manner within the field, from fertilizer to seed and irrigation water [10].

Soil mapping has provided the basis for variable rate input use. While initially soil measurements based on grid sampling was the main source of information, nowadays soil sampling is typically performed by zones [11]. Zones can be delineated using satellite imagery representing the heterogeneity of the field, field sensor measurements, yield measurements, topography data, or a combination of these [12-19]. The resulting zones are correlated with yield data [19, 20] and can be used

as a basis for the variable rate application of fertilization [19, 22] and even irrigation [23, 24]. In particular, topography as a soil-forming factor plays an important role in the development of heterogeneity within the field, therefore the digital elevation model (DEM), the derived topographic parameters (slope, curvature) and parameters characterizing the probability of water accumulation, such as "potential drainage density" [25-27], help to delineate soil patches more accurately in the design of zones, thus improving the nutrient use efficiency of the fertilizer.

Although variable rate input application can also result in input savings [28], the main benefits of this technology are the increase in production intensity and efficiency resulting from the distribution of inputs according to site conditions and the improvement in yield quality [1].

In the current economic environment, with strong and turbulent effects in the bulk commodity sector, including the trade in cereals, cereal farmers are increasingly exposed to the external economic environment, both at global and European level. However, the resilience of farms to changes in the mar- ket environment can be improved through the application of precision farming [1]. In addition, in the European Union, the legislative environment, such as the environmental require- ments set out in the Green Deal [29], can only be met through better input use without reducing yields. For this reason, the spread of variable rate input application would be desirable. Nevertheless, the uptake of precision farming technologies, in particular the adaptation of variable rate input application, faces barriers [1, 30, 31]. One of the typical problems is that there is little whole-farm level profitability analysis available in the literature [2], therefore the benefits of adopting the tech- nology are not proven to farmers. The aim of this paper is to investigate the impact of precision farming on the productiv- ity, cost and profitability of winter wheat production on sev- eral Hungarian farms.

## MATERIALS AND METHODS

### *Database*

The first database is the field-level yield data available in the MyJohnDeere database. The operational data of farmers with intelligent tractor and implement connections, in particular combine harvesters for yield mapping and geo-documentation, are stored on a web-based platform (MyJohnDeere) via a wireless data link, where they are stored in a well-structured and easily understandable way for farmers. Thanks to the digitalization of agriculture, the amount of documented data is growing dynamically, providing a reliable statistical basis for data analysis at national level. Our analysis included MyJohnDeere farms that used smart harvesting tools and documented the harvesting process between 2018 and 2022. The majority of these farms do not yet use variable rate application and only benefit from navigation.

The second database contains data from 48 farms that not only practice precision winter wheat production, but also use variable rate application of inputs, thus implementing site-specific cultivation technology. The farms are located in different areas of Hungary (Figure 1) and their data were used anonymously.

**Location of the 48 Hungarian farms using variable rate applications which were involved to the questionnaire research.**


In addition to yield data, the targeted farms provided cost of production data for the analyses for the period 2018-2022 in a questionnaire survey. Data on the following costs were requested from farmers:

- Seed cost
- Cost of fertilizers
- Pesticide cost
- Irrigation cost
- Cleaning costs
- Drying cost
- Direct insurance cost
- Other direct variable costs
- Cost of organic manure
- Machinery costs (variable costs, fuel and lubricants, repairs, etc.)
- Cost of external mechanical services
- Wages
- Public charges on wages and salaries
- Land rent
- Depreciation and amortisation
- Other costs
- Overhead cost of the activity
- Economic overheads

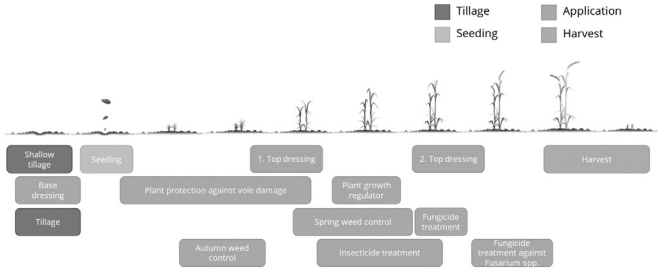
### *Economic analysis*

Investigating the economical efficiency of precision winter wheat cultivation technology is of paramount importance for the wider adoption of precision farming.

When calculating income, it is worth taking into account all the elements of the production technology in order to demonstrate the impact of precision farming on the natural and economic efficiency. The steps of winter wheat production technology are similar for both conventional and precision farmers (Figure 2), the difference lies in the design, implementation and timing of the different technological elements, which have a fundamental impact on the natural

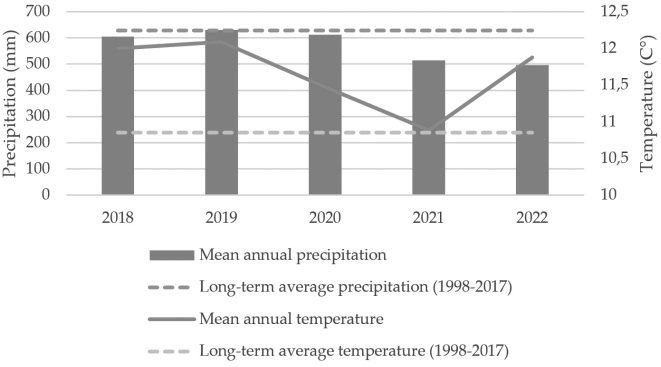
and economic efficiency of winter wheat production and the sector. Of particular importance among the costs are those of seeds, fertilizers and pesticides, which determine the intensity of the technology.

**Figure 2. Elements of the winter wheat agrotechnology.**




The econometric analysis was carried out for 5 years to reduce the bias due to the crop year effect. Precipitation and temperature conditions for the period 2018-2022 are shown in Figure 3.

**Figure 3. Mean annual temperature and precipitation of Hungary from 2018 to 2022 [32].**




The specific income (profitability, Pw , EUR/ha) of winter wheat (Equation (1)) was calculated on the basis of the production value (revenue, Rw ) less subsidies and the total cost (TCw ) less land rent.

$$P_w = R_w - TC_w \quad (1)$$

The production value (Rw ) was determined on the basis of the yield (Yw ) and the annual winter wheat sales prices (Table 1) provided by the Institute of Agricultural Economics, Market Price Information System [33].

**Table 1. Wheat prices (EUR/t) in Hungary according to the Institute of Agricultural Economics, Market Price Information System [33].**

| Year | Price (EUR/t) |
|---|---|
| 2018 | 148.78 |
| 2019 | 146.94 |
| 2020 | 151.24 |
| 2021 | 201.54 |
| 2022 | 326.28 |

Costs and sales prices are also collected in HUF, converted into EUR at the Hungarian Central Bank's yearly average exchange rate (Table 2).

**Table 2. Yearly average exchange rate according to the Hungarian Central Bank (MNB).**

| Year | Yearly average exchange rate (HUF/EUR) |
|---|---|
| 2018 | 318.87 |
| 2019 | 325.35 |
| 2020 | 351.17 |
| 2021 | 358.52 |
| 2022 | 391.33 |

Yield data were compared with the national winter wheat yield averages published by the Hungarian Central Statistical Office [34] (Table 3), and the costs determined from the Farm Accountancy Data Network maintained by the Institute of Agricultural Economics [35] were used as a benchmark for the cost and income analysis.

**Table 3. Wheat production of Hungary from 2018 to 2022 according to the Hungarian Central Statistical Office [34] and total costs according to the Institute of Agricultural Economics, Farm Accountancy Data Network [35]**

| Year | Harvested area (ha) | Yield (t/ha) | Total Costs (EUR/ha) |
|---|---|---|---|
| 2018 | 1 026 151 | 5.12 | 614.58 |
| 2019 | 1 015 640 | 5.29 | 637.82 |
| 2020 | 936 624 | 5.47 | 631.59 |
| 2021 | 892 794 | 5.93 | 685.78 |
| 2022 | 950 632 | 4.40 | 821.21 |

## *Statistical analysis*

The yield, cost and income data were weighed by the field area for the MyJohnDeere farms and by the farm area for the VRA farms. Weighting, descriptive statistics and 95% confidence intervals were calculated in IBM SPSS Statistics.

## *Results*

### Evaluation of additional yield

The field level winter wheat yields of MyJohnDeere farms (Table 4) and the farm-level winter wheat yields of the 48 farms included in the questionnaire survey (Table 5) were evaluated by area weighting for the period 2018 to 2022.

It can be concluded that the two data series show similar trends over time, with the highest yield year being 2021 and the lowest yield in the extremely drought year of 2022. However, in absolute terms, the average yield of farms with variable rate input application (VRA) was significantly higher in all years at the 95% confidence interval.

**Table 4. Area-weighted winter wheat yield (t/ha) of MyJohnDeere farms in Hungary from 2018 to 2022.**

| Year | Area (ha) | Mean yield (t/ha) | SD* | Std. Error** | 95% Confidence Interval for Mean Yield (t/ha) | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| 2018 | 20460 | 5.84 | 1.95 | 0.01 | 5.81 | 5.86 | 1.00 | 15.83 |
| 2019 | 25651 | 5.71 | 1.77 | 0.01 | 5.68 | 5.73 | 1.04 | 13.72 |
| 2020 | 35351 | 5.94 | 1.93 | 0.01 | 5.92 | 5.96 | 0.51 | 17.05 |
| 2021 | 44314 | 6.52 | 2.10 | 0.01 | 6.50 | 6.54 | 0.63 | 19.83 |
| 2022 | 59336 | 4.94 | 2.06 | 0.01 | 4.93 | 4.96 | 0.50 | 18.94 |

**SD: standard deviation, **Std. Error: standard error*

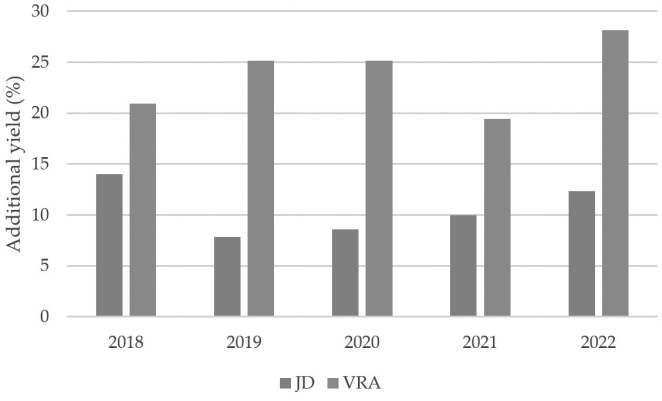
**Table 5. Area-weighted winter wheat yield (t/ha) of 48 Hungarian farms using variable rate applications from 2018 to 2022.**

| Year | Area (ha) | Mean yield (t/ha) | SD* | Std. Error** | 95% Confidence Interval for Mean Yield (t/ha) | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| 2018 | 11732 | 6.19 | 0.81 | 0.01 | 6.18 | 6.21 | 4.50 | 9.00 |
| 2019 | 12507 | 6.62 | 0.85 | 0.01 | 6.60 | 6.63 | 4.00 | 8.50 |
| 2020 | 12499 | 6.85 | 1.18 | 0.01 | 6.83 | 6.87 | 4.50 | 9.55 |
| 2021 | 11800 | 7.08 | 1.08 | 0.01 | 7.06 | 7.10 | 4.84 | 9.00 |
| 2022 | 12528 | 5.64 | 1.81 | 0.02 | 5.61 | 5.67 | 2.63 | 9.11 |

**SD: standard deviation, **Std. Error: standard error*

The average annual winter wheat yields were also compared to the national average yield [34]. Figure 4 shows that both the winter wheat yields of farms in the MyJohnDeere system and those with variable rate input application exceeded the national average. The former by 7.9-14%, while the farms that opted for VRA by 19.5-28.1%.

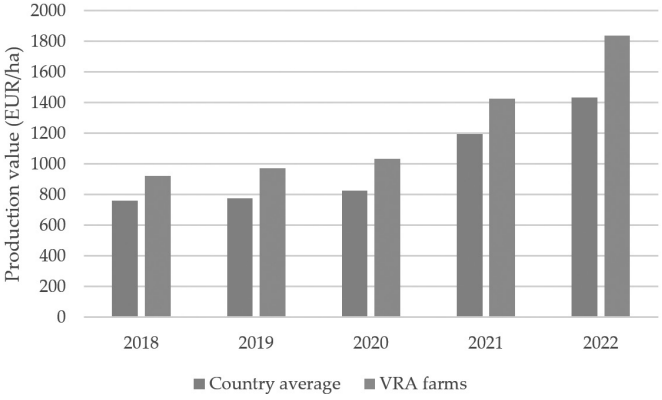
**Figure 4. Additional winter wheat yield compared to the average yield of Hungary [34] (JD: MyJohnDeere farms, VRA: 48 Hungarian farms using variable rate applications.**




## Evaluation of additional production value

For farms that use variable rate applications, the production value was calculated and plotted on Figure 5 together with the production value based on the national average yields. The production value shows a trend increase for both data sets, reaching its highest value in 2022, the year with the lowest yield, due to high sales prices (Table 1).

**Figure 5. Production value of winter wheat production (Country average: calculated from country average yield according to the Hungarian Central Statistical Office [34], and prices according to the Institute of Agricultural Economics [33], VRA: calculated from the average yield of 48 Hungarian farms using variable rate applications and prices according to the Institute of Agricultural Economics [33].**




## Evaluation of costs

### Input costs

The technological tools of precision farming can lead to efficiency gains in the whole production cycle, as input and fuel savings, labour efficiency are all points that also lead to production cost reductions. At the same time, the introduction of precision farming on individual farms is often accompanied by intensification, which increases costs.

The annual area-weighted average of input costs (seed, fertilizer, pesticide) provided by VRA farms is presented in Table 6.

**Table 6. Area-weighted winter wheat input costs of 48 Hungarian farms using variable rate applications from 2018 to 2022.**

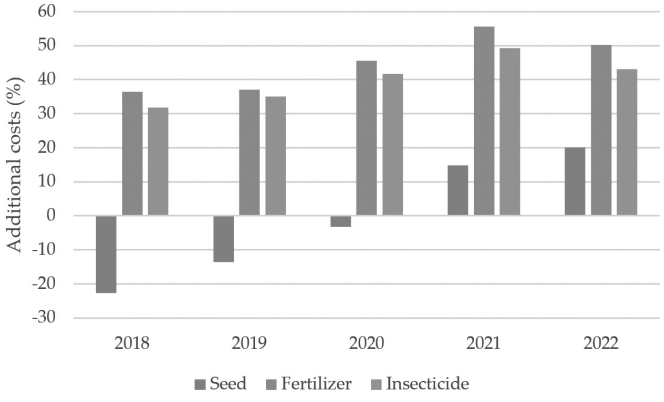
| Year | Area (ha) | Mean yield (t/ha) | SD* | Std. Error** | 95% Confidence Interval for Mean Yield (t/ha) | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Seed cost (EUR/ha) | | | | | | | | |
| 2018 | 49.08 | 19.24 | 0.18 | 48.73 | 49.43 | 7.84 | 94.08 | 9.00 |
| 2019 | 56.00 | 18.77 | 0.17 | 55.67 | 56.33 | 30.18 | 93.78 | 8.50 |
| 2020 | 61.99 | 21.65 | 0.19 | 61.61 | 62.37 | 31.47 | 128.14 | 9.55 |
| 2021 | 75.37 | 26.80 | 0.25 | 74.89 | 75.86 | 39.29 | 167.35 | 9.00 |
| 2022 | 87.30 | 48.61 | 0.43 | 86.45 | 88.15 | 22.51 | 195.49 | 9.11 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Fertilizer cost (EUR/ha) | | | | | | | | |
| 2018 | 183.15 | 64.31 | 0.59 | 181.99 | 184.32 | 81.54 | 313.61 | 9.00 |
| 2019 | 180.69 | 65.92 | 0.59 | 179.53 | 181.85 | 89.13 | 431.84 | 8.50 |
| 2020 | 196.53 | 88.64 | 0.79 | 194.98 | 198.09 | 56.95 | 427.14 | 9.55 |
| 2021 | 229.07 | 97.99 | 0.90 | 227.30 | 230.83 | 73.36 | 502.06 | 9.00 |
| 2022 | 357.03 | 131.19 | 1.17 | 354.73 | 359.33 | 102.22 | 638.85 | 9.11 |
| Pesticide cost (EUR/ha) | | | | | | | | |
| 2018 | 96.47 | 36.27 | 0.33 | 95.81 | 97.12 | 0.00 | 219.53 | 9.00 |
| 2019 | 102.87 | 43.43 | 0.39 | 102.10 | 103.63 | 0.00 | 233.59 | 8.50 |
| 2020 | 108.30 | 39.93 | 0.36 | 107.60 | 109.00 | 0.00 | 227.81 | 9.55 |
| 2021 | 122.97 | 45.02 | 0.41 | 122.15 | 123.78 | 0.00 | 251.03 | 9.00 |
| 2022 | 122.17 | 50.39 | 0.45 | 121.29 | 123.06 | 0.00 | 255.54 | 9.11 |

**SD: standard deviation, **Std. Error: standard error*

Calculated input costs were compared to national averages based on the Farm Accountancy Data Network maintained by the Institute of Agricultural Economics [35]. The percentage difference in seed, fertilizer and pesticide costs for VRA farms is shown in Figure 6. It can be seen that for winter wheat, seed costs were lower in three years and higher in two years on VRA farms, and in none of the years was the difference as significant as for fertilizer and pesticide. Fertilizer costs were 36-55% higher, while pesticide costs were 31-49% higher on VRA farms.

**Figure 6. Additional input costs of winter wheat production of 48 Hungarian farms using variable rate applications compared to the country average [35**




## Input costs

Total costs less land rent for VRA farms (Table 7) were calculated and annual data was compared with national averages based on the Farm Accountancy Data Network maintained by the Institute of Agricultural Economics [35]. The additional costs for VRA farms are shown in Figure 7.

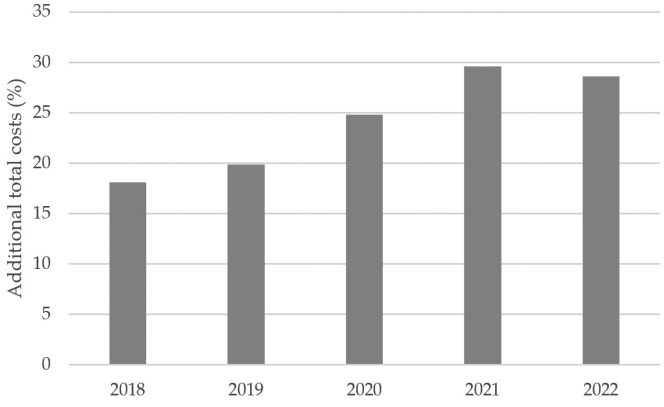
It can be seen that the total production costs of winter wheat are 18.1-29.6% higher than the national average. The ratio of the production costs of VRA farms to the national average increased dynamically until 2021 and then declined slightly.

**Table 7. Area-weighted winter wheat total costs (EUR/ha) of 48 Hungarian farms using variable rate applications from 2018 to 2022.**

| Year | Area (ha) | Mean yield (t/ha) | SD* | Std. Error** | 95% Confidence Interval for Mean Yield (t/ha) | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| 2018 | 725.80 | 220.99 | 2.04 | 721.80 | 729.80 | 401.42 | 1274.72 | 9.00 |
| 2019 | 764.56 | 232.31 | 2.08 | 760.49 | 768.63 | 424.16 | 1892.03 | 8.50 |
| 2020 | 788.26 | 231.60 | 2.07 | 784.20 | 792.32 | 423.05 | 1331.26 | 9.55 |
| 2021 | 888.66 | 263.25 | 2.42 | 883.91 | 893.41 | 439.48 | 1515.82 | 9.00 |
| 2022 | 1056.00 | 279.58 | 2.50 | 1051.10 | 1060.89 | 611.48 | 1916.04 | 9.11 |

**SD: standard deviation, **Std. Error: standard error*

**Figure 7. Additional total costs of winter wheat production of 48 Hungarian farms using variable rate applications compared to the country average.**




## Evaluation of profitability

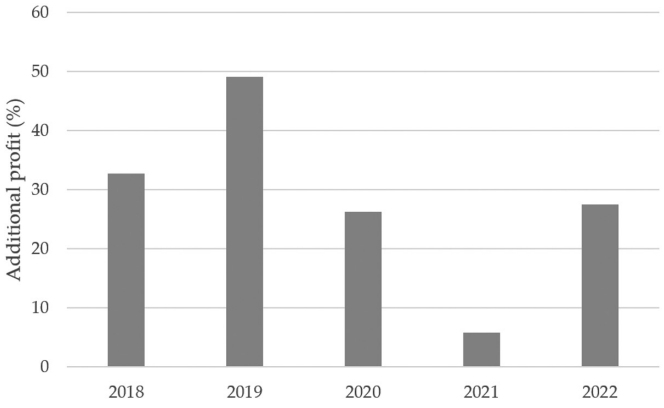
Based on the production value and total costs, the area-weighted annual specific income of VRA farms was calculated (Table 8) and compared with the national average (Figure 8). The obtained results show that the average income of farms using variable rate application in winter wheat exceeded the national average by 28.3% during the examined period. The smallest difference was in 2021 (5.8%), while the additional income rate was particularly high in 2019 (49.1%).

**Table 8. Area-weighted winter wheat annual specific income (EUR/ha) of 48 Hungarian farms using variable rate applications from 2018 to 2022.**

| Year | Area (ha) | Mean yield (t/ha) | SD* | Std. Error** | 95% Confidence Interval for Mean Yield (t/ha) | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| 2018 | 195.36 | 222.58 | 2.05 | 191.33 | 199.39 | -327.30 | 732.18 | 9.00 |
| 2019 | 208.03 | 216.67 | 1.94 | 204.24 | 211.83 | -874.73 | 636.53 | 8.50 |
| 2020 | 247.15 | 258.24 | 2.31 | 242.62 | 251.68 | -225.19 | 723.25 | 9.55 |
| 2021 | 539.04 | 251.56 | 2.32 | 534.50 | 543.58 | -267.72 | 1025.93 | 9.00 |
| 2022 | 783.60 | 473.15 | 4.23 | 775.31 | 791.88 | -215.03 | 2080.30 | 9.11 |

**SD: standard deviation, **Std. Error: standard error*

**Figure 8. Additional profit of winter wheat production of 47 Hungarian farms using variable rate applications compared to the country average**




## DISCUSSION

The average winter wheat yields of MyJohnDeere farms, which primarily benefit from navigation, exceeded the national average by 7.9-14% over the five examined years, while the yields of VRA farms were 19.5-28.1% higher. In both cases, the yield surplus exceeds the values reported in the literature [6-8], which is presumably explained by the fact that farmers open to the introduction of precision technologies are not only more technologically advanced in the field of GIS technology, but also in other areas of crop technology. This is supported by the ratio of input costs of VRA farms compared to the national average, which was 36-55% for fertilizer and 31-49% for pesticide, despite the fact that losses are reduced due to non-overlapping and variable rate application [9]. No similar difference was found for seed costs, because the variable rate application of seed is not widespread in winter wheat and more intensive technology is not clearly associated with higher number of plants.

The total cost of VRA farms also exceeded the national average by 18.1-29.6%. The additional cost rose steadily between 2018 and 2021, before declining slightly in 2022, presumably as farmers cut back slightly on costs due to the dry year and low maize yields in 2021.

Therefore, the farms included in these studies with variable rate application produce more intensively at higher cost levels, i.e. the aim of the authors was to determine whether the additional production value exceeds the additional input. The obtained results show that the specific income from winter wheat production was higher than the national average in all examined years and 28.3% higher than the national average over five years on VRA farms. The results of these studies suggest that the examined VRA farms realized additional income from winter wheat production compared to the national average and are therefore presumably more resilient to changes in the economic environment than conventional farms.

The authors feel it is necessary to extend the studies carried out for winter wheat to other major arable crops in the future to obtain a more complete picture of the economic sustainability of production on VRA farms.

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