# ЕКОНОМИКА

**4**

## ГЛАВНИ И ОДГОВОРНИ УРЕДНИК:
Проф. Др Зоран Симоновић

1. Часопис "Економика" покренут је јула 1954. године и под називом " Нишки привредни гласник" излазио је до јуна 1957. године, а као "Привредни гласник" до краја 1969. године. Назив "Наука и пракса" носио је закључно са бројем 1/1973. год. када добија назив "Економика" који и данас има.

2. Часопис су покренули Друштво економиста Ниша и Друштво инжињера и техничара Ниша (остало као издавач до краја 1964. године). Удружење књиговођа постаје издавач почев од броја 6-7/1958. године. Економски факултет у Нишу на основу своје одлуке броја 04-2021 од 26.12.1991. године постао је суиздавач "Економике". Такође и Економски факултет у ПриШтини постао је суиздавач од 1992. године. Почев од 1992. године суиздавач "Економике" је и Друштво за маркетинг региона Ниш. Као суиздавач "Економике" фигурирали су у току 1990-1996. године и Фонд за научни рад општине Ниш, Завод за просторно и урбанистичко планирање Ниш и Корпорација Винер Брокер Ниш.

3. Републички секретаријат за информације СР Србије својим Решењем бр. 651-126/73-02 од 27. новембра 1974. године усвојио је захтев "Економике" за упис у Регистар новина. Скупштина Друштва економиста Ниша на седници од 24. априла 1990. године статутарном одлуком потврдила је да "Економика" има статус правног лица. На седници Скупштине Друштва економиста Ниш од 11. новембра 1999. године донета је одлука да "Економика" отвори посебан жиро-рачун.

4. Према Мишљењу Републичког секретаријата за културу СР Србије бр. 413-516/73-02 од 10. јула 1973. године и Министарства за науку и технологију Републике Србије бр. 541-03-363/94-02 од 30. јуна 1994. године "Економика" има статус научног и ранг националног часописа "Економика" је почев од 1995. добила статус међународног економског часописа.

5. УРЕДНИЦИ: др Јован Петровић (1954-1958), Миодраг Филиповић (1958-1962), Благоје Матић (1962-1964), др Драгољуб Стојиљковић (1964-1967), др Миодраг Николић (1967-1973), др Драгољуб Симоновић (1973-1984), др Миодраг Јовановић (1984-3-4/1988), др Драгољуб Симоновић (1990-2019), др Зоран Симоновић (2019-до данас).

1. The journal EKONOMIKA was initiated in July 1954. It was published as "Nis Economic Messenger" till June, 1957 and as "The Economic Messenger" till the end of 1969. The title "Science and Practice" it had till the issue 1/1973 when it changed its name into EKONOMIKA as it entitled today.

2. The Journal was initiated by the Society of Economists of Nis and the Society of Engineers and Technicians of Nis (the latter remaind as the publisher till the end of 1964). The Society of Accountants became its publisher starting from the issue no. 6-7/1958. The Faculty of Economics, Nis, on the basis of its Resolution No. 04-2021 from December 26, 1991, became the co-publisher of EKONOMIKA. Likewise, the Faculty of Economics of Pristina became the co-publisher since in 1992. Starting from 1992, the co-publisher of EKONOMIKA has been the Society for Marketing of the Region of Nis. Other co-publishers of EKONOMIKA included, in the period 1990-1996, the Foundation for Scientific Work of the Municipality of Nis, the Institute for Spatial and Urban Planning of Nis and the Corporation Winner Broker, Nis.

3. The Republic Secretariat for Information of the Socialist Republic of Serbia, by its Resolution No. 651-126/73-02 from November, 27, 1974, approved of EKONOMIKA's requirement to be introduced into the Press Register. The Assembly of the Society of Economists of Nis, at its session on April 24, 1990, by its statutory resolution, confrmed the legal status of EKONOMIKA. At the session of the Assembly of the Society of Economists, Nis, on November 11, 1999, the resolution was adopted the EKONOMIKA was to open its own bank account.

4. According to the Opinion of the Republic Secretariat for Culture of the Socialist Republic of Serbia No. 413-516/73-02 from July 10, 1973 and the Ministry for Science and Technology of the Republic of Serbia No. 541-03-363/94-02 from June 30, 1994, EKONOMIKA has the status of a scientific and national journal. Starting from 1995, EKONOMIKA has been having the status of international economic journal.

5. EDITORS: dr Jovan Petrovic (1954-1958). Miodrag Filipovic (1958-1962), Blagoje Matic (1962-1964), dr Dragoljub Stojiljkovic (1964-1967), dr Miodrag Nikolic (1967-1973), dr Dragoljub Simonovic (1973-1984), dr Miodrag Jovanovic (1984-3-4/1988), dr Dragoljub Simonovic (1990-2019), dr Zoran Simonovic (2019-till the present day).

# САДРЖАЈ / CONTENT

## ОРИГИНАЛНИ НАУЧНИ РАДОВИ / ORIGINAL SCIENTIFIC ARTICLE

## ПРЕГЛЕДНИ НАУЧНИ РАДОВИ / SCIENTIFIC REVIEW ARTICLE

# ПРИКАЗ КЊИГА /
# BOOKS REVIEW

**Marko Jeločnik**[1]
**Darko Jakšić**[2]
**Mladen Petrović**[3]
**Ivan Bradić**[4]
*Institute of Agricultural Economics*

# CREATING ADDED VALUE AS A STEP TOWARDS INCREASING SUSTAINABILITY IN GRAPE PRODUCTION SECTOR[5]

**Abstract**

*Fresh grapes, or grape products are very often a part of daily meals, while grapes are economically among the most important agricultural products. Just growing grapes, or entering the wine production, choosing the right grapevine varieties according to occurred production and market conditions, usually it is not so easy to decide. In this paper, an economic analysis based on variable costs has been made, showing the possible way in value added creation at farm level in the national viticulture and winemaking. Gained research results show that grape processing into the wine is economically justified decision (there are observed wine production of Tamjanika Bela and Chardonnay grapevine varieties), as there are derived positive contribution margins. Even more practicing mentioned activity at the farm, namely the processing of grapes into wine could contribute from 5.4 to 12.4 times higher contribution margin compared to simple grape production.*

*Key words: grapevine varieties, wine production, Serbia, contribution margin, value added creation.*

**JEL:** Q01, Q12, Q13

# СТВАРАЊЕ ДОДАТЕ ВРЕДНОСТИ КАО КОРАК КА ПОВЕЋАЊУ ОДРЖИВОСТИ У СЕКТОРУ ПРОИЗВОДЊЕ ГРОЖЂА

**Сажетак**

*Свеже грожђе, односно производи од грожђа су врло често саставни део дневне исхране, док се из угла економије грожђе налази међу најважнијим пољопривредним производима. Адекватан одабир одговарајућег сортимента винове лозе у складу са датим производним и тржишним условима, при самом гајењу*

---

[1] marko_j@iep.bg.ac.rs, ORCID: 0000-0003-4875-1789

[2] darkojaksic@yahoo.com.au, ORCID: 0000-0002-3186-8932

[3] mladen_p@iep.bg.ac.rs, ORCID: 0000-0002-4390-9711

[4] i.bradic@cevvin.rs, ORCID: 0009-0000-6859-6902

грожђа, или током уласка у производњу вина, обично није ни мало лака одлука. У овом раду, урађена је економска анализа заснована на варијабилним трошковима, која приказује могуће начине стварања додате вредности на нивоу газдинстава унутар националног сектора виноградарства и винарства. Добијени резултати истраживања показују да је иницирање прераде грожђа у вино економски оправдана одлука (посматрана је производња вина од сорти Тамјаника бела и Шардоне), како су добијене позитивне марже покрића. Шта више, бављење поменутом делатношћу на фарми, односно прерадом грожђа у вино, могла би се остварити од 5,4 до 12,4 пута већа маржа покрића у односу на саму производњу грожђа.

**Кључне речи:** сортимент грожђа, производња вина, Србија, маржа покрића, стварање додате вредности.

## Introduction

Considered economically, grapes belong to the group of the most important edible crops (basically fruits) grown worldwide. In last couple decades they are grown at over 7 million ha (Cantu, Walker, 2019; OIV, 2024). In globally organized grape production, in 2022, in average there was achieved the yield of slightly over 11 t/ha, or overall production of almost 80.1 million t of fresh grapes (OIV, 2022). As the grapes could be used in human consumption as fresh or in form of processed products (Kandylis et al., 2021). Meanwhile, it has to be mentioned that in last several decades, grape yields had expressed increase, primarily towards implementation of well-suited production mechanisms involving intensification in use of pesticides and planting of higher yielding varieties (Lopez Ruiz, 2024).

Incorporating the value-added concept in agriculture would contributes the growth of farms competitiveness, profitability and sustainability, no matter to practiced line of production (Clark et al., 2021). Not so often, it is a precondition of farm survival in contemporary global business ambient (Clark, 2020).

Focused to gained raw agro-product, it usually assumes different level of agro-products processing, starting from their cleaning, cutting, calibration and packaging, while offering in ready to made state to the final consumer (Rasul, 2002; De Corato, Cancellara, 2019), or pulling the products through the more demanding processing activity, as are pressing, squeezing, milling, drying, pasteurization and sterilization, freezing, pickling, fermentation, or preparing of certain food product furtherly offered to final consumers (Ghoshal, 2018; Kumari, Singh, 2018; Knorr, Augustin, 2021).

In such a way to raw agro-products are assigned the new use value previously required from the market. Carrying out the transfer of raw into the processed product farmer creates the value added affecting its overall profitability. In grape growing sector, excluding the simple mechanical cleaning, sorting and packing of the fresh grapes, value-added is usually linked to higher level of grapes processing, and production of raisins, grape juice and jams, different wine products and spirits, grape seed oil, etc.

Nowadays, wine production is the most common way of grape processing. It is estimated that almost 75% of the global grape production is pushed to the wine sector (Beres et al., 2017). It is followed by relevant volume of organic waste (by products),

primarily grape pomace, seeds, skin and part of stalks (they include up to 30% of the initially crushed grapes), that could be valuable inputs in further processing (Muhlack et al., 2018). It is considered that entire wine production in 2022. were almost 260 million hectoliters, having slight decrease in last few years (Grazia et al., 2023). Besides, the estimated value of global wine market at the beginning of current decade has been exceeded the 300 billion USD (Wagner et al., 2023), with prediction to exercise sharp growth in next five years to overall revenues of over 500 billion USD (Dudic et al., 2024).

In line to rich and well-balanced chemical composition of the grapes' nutrients (Deng et al., 2011; Aubert, Chalot, 2018), grape as the major input in wine making sector are approving several health benefits of wine consumption, such are prevention in cardiovascular disease, arthritis and diabetes, enables strong antioxidant activity that decreases cancer and dementia risks, it sharps cognitive functions and stimulates anti-aging processes and immune system, or increases longevity, or it balances cholesterol level, and enables better digestion, etc. (Shrikhande, 2000; German, Walzem, 2000; Higgins, Llanos, 2015).

Among the grape producers, as leaders could be underlined primarily China, followed by the France, USA, SAR and Italy. Globally respectable volume of production has also Chile and Argentina, or Spain and Turkey (Khan et al., 2020). On the other side, as the leaders in wine production, there is a dominancy of European countries, while next could be underlined Italy (with almost one fifth of the global production), France, Spain, USA, Australia, Chile and Argentina (Moro, 2023).

Considering some previous research, basically within the group of the main wine exporters are usually top producing countries, such are France, Italy, Spain, and Portugal, or Australia, New Zealand, Chile and Argentina. It is interesting that Austria has the role of the main wine re-exporter, while the group of countries that imports the most of available wine quantities due to expressed domestic wine consumption is usually represented by USA, China, UK, Germany, and Netherlands (Thome et al., 2023).

What is happening at the Serbian wine market? Serbia is living the wine production boom in terms of introducing new technologies and improving the quality of wine. Currently in Serbia operates 488 registered wineries, showing the growth trend in last several years. These wine producers produced 20.1 million liters of wine in 2023. Of the total amount of wine produced in 2023, 11.7 million liters were produced from domestic grapes, while 8.4 million liters were produced from imported/supplied raw materials, mainly from the North Macedonia (MAFWM, 2024). Although the number of wineries is increasing, wineries are usually in form of small family business, economically so weak to significantly expand the production in short period towards the growing market needs (Simonović et al., 2019).

Besides the visible progress in national wine sector in last two decades, it is still underdeveloped comparing the market capacities and available natural conditions for grape production. Sector requires general tech-tech modernization, products branding and differentiation, strategic approach in production and marketing, while it needs fresh investments and stronger state financial and administrative support, or specific education and intensive joining of current wine producers, etc. (Prodanović et al., 2020). The general issues linked to viticulture and winemaking sector in Serbia derived from intensive grubbing up of vineyards in last couple decades, as well as decrease in planting

of local varieties. In line to previously mentioned, Serbia stays without significant areas under local varieties, inducing in same time huge and steady loss in available genetic grapevine potential, impacting the state of national viticulture sector (Jakšić et al., 2019). So, although there are active state measures for planting of new vineyards, Serbia still missed enough vineyards to enable self-sufficiency of national grape and wine market. Mentioned is especially visible in growing and processing of autochthonous (local) grapevine varieties (Petrović et al., 2024).

Apart from the problems of preserving local grapevine varieties and planting vineyards with those varieties, in recent time, grape growers and wine producers in Serbia are facing certain negative climate change effects, such are temperature growth, heatwaves extension and lack of rainfalls in growing season, usually affecting the framework of phenological stages at grown grape varieties in many wine-growing regions at national level. So, grape growers are slightly forced to adjust established vineyards (selection of optimal grape varieties) to changed climate conditions, in order to secure satisfied level of grape, and further wine production (Vujadinovic et al., 2016). The current climate changes pose a particular challenge for future viticulture and wine production in Serbia. In the future, grape and wine producers will have to make an appropriate choice between commercial international varieties and autochthonous (old local) varieties that have adapted to the local ecological conditions in Serbia for centuries. This is of particular importance as some studies have shown that the quality parameters of grape musts and wines of certain autochthonous (old local) grapevine varieties have improved over time due to climatic changes that have a positive effect on their quality (Bradić et al., 2024; Ivanović et al., 2023). Despite some problems related to excessive heating in some already hot wine-growing areas, this increases the wine production potential due to the possibility of successfully cultivating vines in new areas, the gradual expansion of the most vacated areas, as well as the opportunity to introduce new grapevine late ripening cultivars in our region (Jaksic et al., 2023).

Although there are a huge number of grapevine varieties worldwide, only 300 to 400 of them are commercially important for global production (Nikolić et al., 2021). It is a general globalization of world wine production, but also a challenge in the future selection of varieties for each wine country, including Serbia. Serbia has on disposal diverse *terroir* conditions, while the overall wine-growing area is consisted from 3 large wine-growing units, 22 regions and 77 subregions (districts), so they constitute Wine-growing Serbia (Jakšić et al., 2015). Over 10% of overall number of farms are involved in grape growing (Balenović et al., 2021). In all wine-growing areas of Serbia, nowadays are produced 224 grapevine varieties towards commercial production of grapes and wine. Meanwhile, only 31 grapevine varieties are considered as local (autochthonous), (Jaksic et al., 2024). For this reason, Serbian grape and wine producers should pay attention to whether they will be planting vineyards with internationally recognized varieties or with autochthonous (local) varieties specific to individual wine-growing areas of Serbia in order to achieve better recognition on the market. Grape producers must also determine whether it is economically more profitable to process grapes into wine, considering the characteristics and quality of the grapes and wine from certain grapevine varieties.

The main goal of research was to assess the value of created value-added at grape growing farm, if the farmer transfers the produced volume of grape into the wine. Specifically, research has to perceive whether the farmer could boost its profitability and

economic sustainability, if he turns grown grapevine variety (autochthonous, i.e. local wine variety Tamjanika Bela, or international wine variety Chardonnay) into the wine as the final product.

## Material and Methods

In order to evaluate the farm capacity to create value added in further food processing activities, specifically wine production, as in some previous researches there were used analytical calculations based on variable costs (calculation of contribution margin), and method for the determination of critical values of production. Contribution margin represents difference of gained incomes derived from wine selling and overall variable costs underlying wine production. On the other side, critical values of production represent the values of observed elements of production (price, yield and variable costs) that lead to equalization of contribution margin with zero (Jelocnik et al., 2013; Jeločnik et al., 2019; Jeločnik et al., 2020; Subić et al., 2022).

Research tempts to analyze the size of economic potential of selected grape grower in value added creation, if he enters the wine production with cultivated autochthonous (local) and commercial grapevine varieties (Tamjanika Bela - old local muscat variety for white wines, and Chardonnay - internationally widespread variety for white wines), instead of selling the harvested grape to the local wineries, i.e. on the local market. Derived research results should encourage the grape producers to accept the winemaking (especially based on autochthonous, i.e. local varieties), as the adequate tool for increasing business vitality and profitability. So, creating the value-added should gradually transfer their main activities (grape growing) to the level of processing (wine production).

Research implies the required data for analysis collected through the in-depth interview with grape producer (small family winery) located in the Tri Morave wine-growing region (Trstenik wine-growing subregion), the same one used in research (Jelocnik et al., 2024). Used data corresponds to production year 2023/24 (vintage 2023). All used inputs and derived results were presented tabularly in EUR. Meanwhile, observed costs and incomes are linked for the volume of wine gained form grapes produced at one hectare of vineyard (full yielding is assumed, while entire volume of produced grape will be in service of wine making). That way enables comparing the contribution margins gained in grape and wine production, or observing increase in overall gross financial result at specified farm. Research consults available scientific literature from the field of vine growing/wine production, and professional expertise.

There are few research limitations. Primarily it assumes economic analysis based on data only from one production cycle of the wine, organized at single locality. Besides, this is quite enough for perceiving the value-added creation in terms of grape processing at particular farm (mini winery). It has to be mentioned that in line to applied technological process, utilized equipment, level of implemented marketing approach and specific „final touch" brought to final product (general and quality category, as well as type of wine), derived research results could variate in regard to similar products gained by other wineries. As research limitation could be also considered general lack of similar economic analysis in national or regional scientific literature, that potentially disable comparability of derived research results.

Scientific and professional importance of performed research could be based on the fact of missing papers with specific but similar focus at national level. It could serve as certain agroeconomic (analytical) millstone for professionals, primarily grape growers and wine producers, policy makers and traders, as well as to scientific audience turned to observed field of agriculture.

## Results and Discussion

As was mentioned, mini winery is settled in Trstenik wine-growing sub-region. Available vineyard covers a little more than 4 hectares. In production structure dominate white wine varieties, primarily globally recognized Chardonnay and autochthonous (local) variety Tamjanika Bela. Although most of the produced grapes are sold to local wineries, interviewed producer owns all required facilities and equipment used in winemaking, while farm members together with employed workers are technologically well-experienced.

According to growth in demand for high quality wines made from local varieties at regional market, economic analysis considers wine production of Tamjanika Bela compared to those produced from Chardonnay (demand for wines derived from local grape varieties exceeds the production of specified type of wine, as in line to CVO (2024) data there are just slightly over 300 ha under Tamjanika Bela in Serbia). Business moto of the observed wine producer is "quality over the quantity", so wine production and maturing, bottled wine and its further storing deserves special attention. In line to predetermined marketing strategy, wine is later selling in original packaging (0.75 l bottles) to local wine stores and restaurants, as well as in the winery itself. Basically, previously assumed guaranties good income opportunity to observed winery.

Perceiving the potential profitability gained in wine production from both grapevine varieties (Tamjanika Bela and Chardonnay) corresponds to adequate matching of the occurred incomes and costs (Tables 1. and 2.). Surely, it has to be underlined that gained positive contribution margin does not necessarily reflects the profitability in wine making, while it is furtherly determined by the level of fixed costs underlying the observed production. Similarly, increase in contribution margin is favoring some of available production lines, but only if occurred fixed costs are equal for all of them.

In wine production are used stainless steel vessels (capacity of 2,000 l each). It is assumed that the wine production at both grapevine varieties is based under the same randman of acc. 65% (produced 65 liters of wine from 100 kilograms of grapes), what is in line to normative of good production practice. In other words, fresh grapes of variety Tamjanika Bela produced at one hectare (12 t) could be transferred into the 7,800 l of wine (i.e. 10,400 bottles), while at variety Chardonnay, 10 t of fresh grapes could be turned to 6,500 l of wine (i.e. 8,666 bottles), (Jelocnik et al., 2024). Incomes are based on wholesale price of wine bottle that could be achieved at local market for high quality wines without geographical indications (fairly traded price per bottle sold with a beautiful, high-quality designed label). Besides, the interviewed producer, i.e. farm, has not received any subsidies for the wine production. Income side of calculation shows slightly better results in case of Tamjanika Bela, primarily as a result of higher quantity of the produced grapes.

**Table 1.** Contribution margin in wine production (in EUR, production cycle 2023/2024., grapevine variety Tamjanika Bela)

| A – Value of production | | | | |
|---|---|---|---|---|
| **Element** | **UM** | **Quantity per UM** | **Price per UM** | **Total** |
| Wine (bottled) | 0.75 l | 10,400 | 6.00 | 62,400.00 |
| Subsidies | - | - | - | - |
| **Total incomes** | | | | **62,400.00** |
| **B – Costs of production** | | | | |
| **1. Direct costs of production** | **UM** | **Quantity per UM** | **Price per UM** | **Total** |
| Fresh grapes | Kg | 12,000 | 1.000 | 12,000.00 |
| Annual preparation of vessels and used equipment (consumables and spare parts) | L | 7,800 | 0.025 | 195.00 |
| Enological means | L | 7,800 | 0.038 | 296.40 |
| Laboratory analysis of grape must (pH, sugar and acids content) | Psc | 2 | 15.00 | 30.00 |
| Laboratory analysis of wine (analysis on WineScan FOSS apparatus) | Psc | 4 | 20.00 | 80.00 |
| Laboratory analysis of wine (in accredited laboratory) | Psc | 2 | 150.00 | 300.00 |
| Supplies in the wine production | L | 7,800 | 0.031 | 241.80 |
| Renting of the cool storage (24 h) | Kg | 12,000 | 0.012 | 144.00 |
| Energy – electric power | Bottle | 10,400 | 0.093 | 967.20 |
| Water | Bottle | 10,400 | 0.014 | 145.60 |
| Labor – wine production | L | 10,400 | 0.270 | 2,808.00 |
| Other costs | - | - | - | 516.24 |
| **Total direct costs** | | | | **17,724.24** |
| **2. Packaging costs** | **UM** | **Quantity per UM** | **Price per UM** | **Total** |
| Glass bottle | Psc | 10,450 | 0.650 | 6,792.50 |
| Wine bottle stopper | Psc | 10,450 | 0.164 | 1,713.80 |
| Bottle cap | Psc | 10,450 | 0.068 | 710.60 |
| Etiquette | Psc | 10,450 | 0.342 | 3,573.90 |
| Cardboard box (for 6 bottles) | Psc | 1,742 | 0.855 | 1,489.41 |
| Labour – packing | Psc | 10,400 | 0.050 | 520.00 |
| Other costs | - | - | - | 444.00 |
| **Total packaging costs** | | | | **15,244.21** |
| **Total costs of production (1+2)** | | | | **32,968.45** |
| **Contribution Margin (A - B)** | | | | **29,431.55** |

Source: according to authors' calculation

**Table 2.** Contribution margin in wine production (in EUR, production cycle 2023/2024.,
grapevine variety Chardonnay)

| A – Value of production | | | | |
|---|---|---|---|---|
| **Element** | **UM** | **Quantity per UM** | **Price Per UM** | **Total** |
| Wine (bottled) | 0.75 l | 8,666 | 7.00 | 60,662.00 |
| Subsidies | - | - | - | - |
| **Total incomes** | | | | **60,662.00** |
| **B – Costs of production** | | | | |
| **1. Direct production costs** | **UM** | **Quantity per UM** | **Price per UM** | **Total** |
| Fresh grapes | kg | 10,000 | 0.85 | 8,500.00 |
| Annual preparation of vessels and used equipment (consumables and spare parts) | L | 6,500 | 0.025 | 162.50 |
| Enological means | L | 6,500 | 0.038 | 247.00 |
| Laboratory analysis of grape must (pH, sugar and acids content) | psc | 2 | 15.00 | 30.00 |
| Laboratory analysis of wine (analysis on WineScan *FOSS* apparatus) | psc | 4 | 20.00 | 80.00 |
| Laboratory analysis of wine (in accredited laboratory) | psc | 2 | 150.00 | 300.00 |
| Supplies in the wine production | L | 6,500 | 0.031 | 201.50 |
| Renting of the cool storage (12 h) | kg | 10,000 | 0.006 | 60.00 |
| Energy – electric power | bottle | 8,666 | 0.093 | 805.94 |
| Water | bottle | 8,666 | 0.014 | 121.32 |
| Labour - wine production | L | 8,666 | 0.270 | 2,339.82 |
| Other costs | - | - | - | 385.44 |
| **Total direct costs** | | | | **13,233.52** |
| **2. Packaging costs** | **UM** | **Quantity per UM** | **Price per UM** | **Total** |
| Glass bottle | psc | 8,700 | 0.650 | 5,655.00 |
| Wine bottle stopper | psc | 8,700 | 0.164 | 1,426.80 |
| Bottle cap | psc | 8,700 | 0.068 | 591.60 |
| Etiquette | psc | 8,700 | 0.342 | 2,975.40 |
| Cardboard box (for 6 bottles) | psc | 1,450 | 0.855 | 1,239.75 |
| Labor – packing | psc | 8,666 | 0.047 | 407.30 |
| Other costs | - | - | - | 351.43 |
| **Total packaging costs** | | | | **12,647.28** |
| **Total costs of production (1+2)** | | | | **25,880.80** |
| **Contribution Margin (A - B)** | | | | **34,781.20** |

Source: according to authors' calculation

On the other side, production of wine Chardonnay is burdened for around 27,4% lesser overall costs of production. Overall costs of production involve group of direct costs of production and costs related to packaging and logistic under the produced wine (could be assumed that both groups of costs are mutually balanced). In both calculations (Tables 1. and 2.) costs of fresh grapes are dominated within the structure of overall costs (although the grapes are produced at the farm, as a raw material used in wine production costs of grape are evaluated per current wholesale price at the local market), with 36.4 % at Tamjanika Bela, or 32.8 % at Chardonnay. They are followed by labor costs (involve both engagement of external (technologist/enologist) and internal (farm members) labor) that could be assumed as variable costs too (Subić, Jeločnik, 2016), or costs of bottles and etiquettes, etc. Besides, it should be mentioned that other costs represent costs of small repairs, certain taxes, or reservation for the costs of unexpected events which could potentially occur, while they are estimated as 3% of the total direct costs of production. As the quality of final product (wine) is among the highest producers' priorities, in each cycle of wine production there are done several laboratory analyses of grape must and wine in different stage of production. As like in grape production, farm is purchasing all inputs at the local market.

Although there are used different grapevine varieties in white wines production (Tamjanika Bela and Chardonnay), used technological approach at the farm has not significantly differed. Despite the fact of quite unfavorable weather conditions for grape production in vegetative season 2023/24 (vintage 2023), there has been achieved expected quality of produced wine (wine production prefers quality than quantity). Related to gained contribution margin, it is for around 18.2% higher in production of Chardonnay, what is mainly consequence of lower overall costs of its production.

**Table 3.** Critical values in wine production (grapevine varieties Tamjanika Bela and Chardonnay)

| Description | Tamjanika Bela (in EUR/bottle) | Chardonnay (in EUR/bottle) |
|---|---|---|
| Expected production (EY) | 10,400 | 8,666 |
| Expected price (EP) | 6.00 | 7.00 |
| Subsidy (S) | - | - |
| Variable costs (VC) | 32,968.45 | 25,880.80 |
| Critical price: CP = (VC - S) / EY | 3.17 | 2.99 |
| Critical production: CP = (VC - S) / EP | 5,495 | 3,697 |
| Critical variable costs: CVC = (EY x EP) + S | 62,400 | 60,662 |

Source: according to authors' calculation

In previous table (Table 3.) are shown critical values derived in wine production from both grapevine varieties. They represent the values of production parameters that leads to equalization of contribution margin with zero (Jeločnik et al., 2021; Subić et al., 2022). Contrary to grape production (Jelocnik et al., 2024), wine production from the grapes of Tamjanika Bela grapevine variety is more sensitive to possible production risks.

Summing the overall contribution margin gained in grape production at one hectare, and later their processing into the wine at the farm (Table 4.), there could be seen that initial contribution margin derived in basic agricultural production is enlarging for 6.4 times (in case of Tamjanika Bela), or for even 13.4 times (in case of Chardonnay) through the value adding to the grapes and their transfer, i.e. processing into the wine.

**Table 4.** Overall contribution margin gained in grape production and grape processing (grapevine varieties Tamjanika Bela and Chardonnay, in EUR)

| Element | Tamjanika Bela (in EUR) | Chardonnay (in EUR) |
|---|---|---|
| Contribution margin gained in grape production at 1 ha* | 5,395.00 | 2,800.00 |
| Contribution margin gained in winemaking (from the grapes produced at 1 ha) | 29,431.55 | 34,781.20 |
| Overall contribution margin gained at the farm | 34,826.55 | 37,581.20 |

Source: according to authors' calculation and * Jelocnik et al., 2024.

Considering the decision which variety has to be produced, or dominated within the production structure at the farm, if all produced grapes will go into the processing, sounds as somehow tricky question. Although the overall contribution margin is for 8 % higher in production of Chardonnay wine, that does not mean its favoritism at all costs. Before all, difference in gained contribution margins is relatively small. Secondly, observed locally, Chardonnay wine as widely recognized variety could be sold on the Serbian, as well on the international market. On the other hand, Tamjanika Bela wine represents a national „rising star" (even regionally), because the demand for this wine is high, so that the wine producers can sell these wines easily and quickly. At the end, growing and especially processing the grapes into the wine for both grapevine varieties could be considered as good business solution for the certain farm, much better than selling the fresh grapes.

## Conclusions

Agri-food production is among the essential human activities, that tries to satisfy existential human need, nutrition. In this process farmers have to strive to implement as much as possible value added in food product they realize at the market. In this way they will secure increase in incomes, sustainability to farm, and certain level of prosperity to local community.

Globally grape is among the most valuable agricultural products. Its production is widely spread worldwide. Wine serves as the perfect alternative for value adding to fresh grapes at the farm level.

In paper was tried to economically assess the value of created value added in grape production sector regarding the processing of grapes into the wine. Processing of two white grapevine varieties was focused (Tamjanika Bela and Chardonnay), while wondering which variety has to be favorized by the producers, international wine variety or local (autochthonous) one. Derived results show that in both cases contribution margins are

positive, surely impacting the creation of value added at the farm level. Re-summing the contribution margins gained in grape production and further winemaking from the grapes obtained at the one hectare of vineyard, initial contribution margin achieved in grape production is increasing from over 6 to 13 times, depending on the grown, i.e. processed grapes of grapevine variety.

Deciding which grapevine variety has to be labeled as the winner is so hard, as both observed varieties at national level have the wining mentality. Chardonnay seems to be widely recognized and, in some moments, irreplaceable wine variety, while from Tamjanika Bela is expected to play the important role at national wine market so soon, ensuring quick and easy sales. So, gained contribution margins have to support the popularization of grape production and processing at the farm level, as this business solution (value added creation through wine production) will certainly improve competitiveness, while strengthen the sustainability of farms involved in viticulture, or even the sustainability of entire sector. Besides, paper has also certain scientific contribution, as at national or regional level there is no such a similar economic analysis.

Next research steps will lead to investment analysis (investment in vineyard planting, and grape and wine production), trying to discover which of observed varieties bring better economic results to farm, if it decides to enlarge current production capacities, or just to enter the sector of viticulture and winemaking for the first time. Potentially, further research steps could be also turned to decision making towards the choosing the most suitable variety for the Serbian growing circumstances, based on experts' opinion and further multi-criteria decision analysis.

## References

Aubert, C., Chalot, G. (2018). Chemical composition, bioactive compounds, and volatiles of six table grape varieties (*Vitis vinifera* L.). *Food Chemistry*, 240:524-533, https://doi.org/10.1016/j.foodchem.2017.07.152

Balenović, I., Ignjatijević, S., Stojanović, G., Vapa Tankosić, J., Lekić, N., Milutinović, O., Gajic, A., Ivanis, M., Boskovic, J., Prodanovic, R., Puvaca, N., Duđak, L. (2021). Factors influencing wine purchasing by generation y and older cohorts on the Serbian wine market. *Agriculture,* 11(11):1054, https://doi.org/10.3390/agriculture11111054

Beres, C., Costa, G., Cabezudo, I., da Silva James, N., Teles, A., Cruz, A., Mellinger Silva, C., Tonon, R., Cabral, L., Freitas, S. (2017). Towards integral utilization of grape pomace from winemaking process: A review. *Waste management,* 68:581-594, https://doi.org/10.1016/j.wasman.2017.07.017

Bradić, I., Ristić M., Mošić I., Milić R., Beader, I., Jakšić D. (2024). Uvological characteristics of local grapevine varieties: Smederevka and Zametovka. *Zbornik Matice srpske za prirodne nauke*, 146:115-128, https://doi.org/10.2298/ZMSPN2446115B

Cantu, D., Walker, M. (Eds.), (2019). *The grape genome*. Springer, Cham, Switzerland

Clark, J., Jablonski, B., Inwood, S., Irish, A., Freedgood, J. (2021). A contemporary concept of the value(s)-added food and agriculture sector and rural development. *Community Development*, 52(2):186-204, https://doi.org/10.1080/15575330.2020.1854804

Clark, S. (2020). Financial viability of an on-farm processing and retail enterprise: A case study of value-added agriculture in rural Kentucky (USA). *Sustainability*, 12(2):708, https://doi.org/10.3390/su12020708

CVO (2024). *Data related to presence of grape variety Tamjanika Bela in Serbia.* Data upon the request, Center for Viticulture and Oenology (CVO), Nis, Serbia

De Corato, U., Cancellara, F. (2019). Measures, technologies, and incentives for cleaning the minimally processed fruits and vegetables supply chain in the Italian food industry. *Journal of cleaner production*, 237:117735, https://doi.org/10.1016/j.jclepro.2019.117735

Deng, Q., Penner, M., Zhao, Y. (2011). Chemical composition of dietary fiber and polyphenols of five different varieties of wine grape pomace skins. *Food Research International*, 44(9):2712-2720, https://doi.org/10.1016/j.foodres.2011.05.026

Dudic, B., Mittelman, A., Gubiniova, K., Bartakova, G., Kader, S., Zejak, D., Spalevic, V. (2024). Wine Industry and Wine Markets: Dynamics, Challenges, and Implications of Globalization. *AGROFOR International Journal,* 9(1):27-39, doi: 10.7251/AGREN2401027D

German, J., Walzem, R. (2000). The health benefits of wine. *Annual review of nutrition,* 20(1):561-593, https://doi.org/10.1146/annurev.nutr.20.1.561

Ghoshal, G. (2018). *Emerging food processing technologies*. In: Grumezescu, A., Holban, A. (eds.) Food processing for increased quality and consumption, Academic Press, Cambridge USA, pp. 29-65, https://doi.org/10.1016/B978-0-12-811447-6.00002-3

Grazia, D., Mazzocchi, C., Ruggeri, G., Corsi, S. (2023). Grapes, wines, and changing times: A bibliometric analysis of climate change influence. *Australian Journal of Grape and Wine Research*, 2023(1):9937930, https://doi.org/10.1155/2023/9937930

Higgins, L., Llanos, E. (2015). A healthy indulgence? Wine consumers and the health benefits of wine. *Wine Economics and Policy*, 4(1):3-11, https://doi.org/10.1016/j.wep.2015.01.001

Ivanovic, J., Rankovic Vasic, Z., Jaksic, D., Sotonica D., Utvic, S., Kalajdzic, M., Nikolic, D. (2023). Production and Technological Characteristics of the Minor Grapevine variety Sremska Zelenika. *Zbornik Matice srpske za prirodne nauke*, 145:85-96, https://doi.org/10.2298/ZMSPN2345085I

Jakšić, D., Bradić, I., Beader, I., Milić, R., Ristić, M. (2019). *Autohtohtone i regionalne sorte vinove loze Srbije.* Centar za vinogradarstvo i vinarstvo, Niš, Srbija, retrieved at: https://cevvin.rs/publikacije/#dearflip-df_3901/3/, 22nd June 2024

Jakšić, D., Ivanišević. D., Đokić, V., Brbaklić Tepavac, M. (2015). *Vinski atlas, Poljoprivreda u Republici Srbiji: Popis poljoprivrede 2012*. Statistical Office of the Republic of Serbia, Belgrade, Serbia, retrieved at: https://publikacije.stat.gov.rs/G2015/Pdf/G201514011.pdf, 22nd June 2024

Jaksic, D., Maraš, V., Blesic, M., Beleski, K., Ivanišević, D., Basha, E., La Notte F., Petrovic, M., Bradic, I. (2023). The Viticulture and Wine Production Potential of the Western Balkans Region (Southeastern Europe) in Light of Climate Change. In: *44th World Congress of Vine and Wine, 21th General Assembly of the OIV - Vitiviniculture and Information Technologies,* Cádiz, Spain, 5-9th

June 2023, book of abstracts, pp. 555-556, OIV, Dijon, France, retrieved at: www.researchgate.net/publication/371538783_THE_VITICULTURE_AND_WINE_PRODUCTION_POTENTIAL_OF_THE_WESTERN_BALKANS_REGION_SOUTHEASTERN_EUROPE_IN_LIGHT_OF_CLIMATE_CHANGE#fullTextFileContent

Jakšić, D., Perović, V., Nikolić, D., Ivanišević, D., Ćirković, B., Stojanović, V., Bradić, I. (2024). Classification of Sustainability Potential of Genetic Resources of Local Grapevine Varieties in Serbia. *Zbornik Matice srpske za prirodne nauke*, 145: 91-113, https://doi.org/10.2298/ZMSPN2446091J

Jelocnik, M., Bekic, B., Subic, J. (2013). Contribution Margin in the Mobile Beekeeping on the Territory of Pancevo City. *Ekonomika*, 59(2):73-91

Jelocnik, M., Jakšić, D., Petrović, M. (2024). Economic Competitiveness of Autochthonous (Local) Grapevine Varieties for the Production of White Wines. *Ekonomika,* 70(2):13-26, doi: 10.5937/ekonomika2402013J

Jeločnik, M., Nastić, L., Subić, J. (2020). *Processing of pork meat in the function of value-added creation at the family farms*. In: Proceedings of the IX international conference Competitiveness of Agro-food and environmental economy (CAFEE 2020), ASE, FEAM, Bucharest, Romania, pp. 97-106

Jeločnik, M., Subić, J., Kovačević, V. (2019). Competitiveness of Sauerkraut Production. *Western Balkan Journal of Agricultural Economics and Rural Development*, 1(2):113-123

Jeločnik, M., Subić, J., Nastić, L. (2021). *Upravljanje troškovima na poljoprivrednim gazdinstvima [Managing the costs at the agricultural husbandries]*. Institute of agricultural economics, Belgrade, Serbia

Kandylis, P., Dimitrellou, D., Moschakis, T. (2021). Recent applications of grapes and their derivatives in dairy products. *Trends in Food Science & Technology,* 114:696-711, https://doi.org/10.1016/j.tifs.2021.05.029

Khan, N., Fahad, S., Naushad, M., Faisal, S. (2020). Grape production critical review in the world. *SSRN,* 2020:3595842, http://dx.doi.org/10.2139/ssrn.3595842

Knorr, D., Augustin, M. (2021). Food processing needs, advantages and misconceptions. *Trends in Food Science & Technology*, 108:103-110, https://doi.org/10.1016/j.tifs.2020.11.026

Kumari, A., Singh, J. (2018). Advanced techniques for preservation, processing and value addition of fruits and vegetables to generate extra income. *Food Science Research Journal*, 9(1):212-217, doi: 10.15740/HAS/FSRJ/9.1/212-217

Lopez Ruiz, F. (2024). *The grape crop*. In: Oliver, R. (edt.) Agrios' Plant Pathology, pp. 715-721, Academic Press, Cambridge, USA, https://doi.org/10.1016/B978-0-12-822429-8.00026-1

MAFWM (2024). *Report on the state of agriculture in the Republic of Serbia in 2003*. Book I - Market overview, Ministry of Agriculture, Forestry and Water Management (MAFWM), Belgrade, Serbia, retrieved at: www.minpolj.gov.rs/download/ZK-2023-II-knjiga.pdf, 21st June 2024

Moro, A. (2023). *Ranked: World's Biggest Wine Producers by Country*. Portal of the Visual-capitalist, Vancouver, Canada, retrieved at: www.visualcapitalist.com/cp/biggest-wine-producers-by-country/, 1st June 2024

Muhlack, R., Potumarthi, R., Jeffery, D. (2018). Sustainable wineries through waste valorisation: A review of grape marc utilisation for value-added products. *Waste management*, 72:99-118, https://doi.org/10.1016/j.wasman.2017.11.011

Nikolić, D., Korać, N., Todić, S., Jakšić, D., Ivanišević, D. (2021). *Grapevine genetic diversity in Serbia*. In: 1st international conference of Vranac and other Montenegrin indigenous sorts of grapevine, Montenegrin Academy of Science and Arts, Podgorica, Montenegro, 22:159-173

OIV (2022). *Annual Assessment of the World Vine and Wine Sector in 2022*. International Organization of Vine and Wine (OIV), Dijon France, retrieved at: www.oiv.int/sites/default/files/documents/OIV_Annual_Assessment-2023.pdf, 21st June 2024

OIV (2024). *State of the World Vine and Wine Sector in 2023*. International Organization of Vine and Wine (OIV), Dijon France, retrieved at: www.oiv.int/sites/default/files/2024-04/OIV_STATE_OF_THE_WORLD_VINE_AND_WINE_SECTOR_IN_2023.pdf, 20th June 2024

Petrović, M., Savić, B., Jakšić, D. (2024). Forecast of planting vineyards with local grapevine varieties in the republic of Serbia using the ARIMA models. *Zbornik Matice srpske za prirodne nauke*, 146:129-142, https://doi.org/10.2298/ZMSPN2446129P

Prodanović, R., Brkić, I., Škrbić, S., Đurić, K., Bošković, J. (2020). Strengthening the capacity of the wine sector in the service of sustainable rural development of the Republic of Serbia. *Journal of Agronomy, Technology and Engineering Management*, 3(5):489-498

Rasul, N. (2002). *Value addition due to food processing and income distribution amongst the poor*. In: Chaturvedi, P. (edt.) Food Security in South Asia, Concept Publishing Company, New Delhi, India, pp. 143-157

Shrikhande, A. (2000). Wine by-products with health benefits. *Food Research International,* 33(6):469-474, https://doi.org/10.1016/S0963-9969(00)00071-5

Simonović, Z., Petrović, D., Ćurčić, N. (2019). Production of grapes and wine in Serbia. *Ekonomika,* 65(4):11-20, doi: 10.5937/ekonomika1904011S

Subić, J., Jeločnik, M. (2016). *Economic Effects of New Technologies Application in Vegetable Production*. In: Tomić et al. (eds.) proceedings of the 152nd EAAE Seminar „Emerging Technologies and the Development of Agriculture", SAAE and IAE, Belgrade, Serbia, pp. 15-35

Subić, J., Jeločnik, M., Kovačević, V., Grujić Vučkovski, B. (2022) *Estimation of Economic Effects of Processing of Organic Products in the case of Family Farms*. In: Course for trainers: Entrepreneurial innovation in agri-food science. Alexandru Ioan Cuza University of Iasi, Romania, Institute of Agricultural Economy, Belgrade, Belgrade, pp. 175-195

Sudarević, T., & Milovanov, O. (2015). Sinergijsko delovanje osnovnih aktera u domenu održive proizvodnje i potrošnje. *Anali Ekonomskog fakulteta u Subotici*, *34*, 15-28.

Thome, K., Paiva, V., Gois, T. (2023). Wine international market structure and competitiveness. *International Journal of Wine Business Research*, 35(4):561-579, doi: 10.1108/IJWBR-06-2022-0019

Vujadinovic, M., Vukovic, A., Jaksic, D., Djurdjevic, V., Ruml, M., Rankovic Vasic, Z., Przic, Z., Sivcev, B., Markovic, N., Cvetkovic, B., La Notte, P. (2016). *Climate change projections in Serbian wine-growing regions.* In: IVES Conference Series - Climates of Wine Regions Worldwide (Terroir 2016), IVES, Villenave d'Ornon, France, pp. 65-70

Wagner, M., Stanbury, P., Dietrich, T., Döring, J., Ewert, J., Foerster, C., Freund, M., Friedel, M., Kammann, C., Koch, M., Owtram, T., Schultz, H., Fels, K., Hanf, J. (2023). Developing a Sustainability Vision for the Global Wine Industry. *Sustainability*, 15(13):10487, https://doi.org/10.3390/su151310487

**Vuk Miletić[1]**
*The College of Academic Studies "Dositej", Belgrade,*

**Nikola Ćurčić[2]**
*"Tamiš" Research and Development Institute, Pančevo,*

# ANALYSIS OF THE QUALITATIVE BUSINESS OF ORGANIZATIONS RELATIVE TO COMPARABLE COMPETITORS

## Abstract

*The analysis of the organization's qualitative performance relative to comparable competitors is based on the output, i.e. the achievement of established goals, as a result of appropriate behavior and effective use of resources, required knowledge, skills, and competencies. In an effort to achieve faster development, higher quality of business, and profit, organizations primarily actively strive to improve their productivity. In addition to a number of necessary factors, competent management is a key prerequisite for creating an organization that will ensure qualitatively better business results relative to comparable competitors. The extent to which management will contribute to the quality of the organization's operations depends on various parameters. The topic of this research focuses on the impact of the interaction between variables, specifically the level of operation and the duration of the organization's operation, relative to comparable resources. The premise is that the indicators of the duration of business and the level of the organization's operations have a great influence on the dimension of business success, taking into account the characteristics of competitors with which the organization is compared and competes in the defined market. The obtained responses of the respondents were processed using the non-parametric χ2 test.*

***Keywords:*** *organization, qualitative business, competitors, length of business, scope of functioning.*

***JEL classification:*** L15, l25, M21

# АНАЛИЗА КВАЛИТАТИВНОГ ПОСЛОВАЊА ОРГАНИЗАЦИЈА У ОДНОСУ НА УПОРЕДИВЕ КОНКУРЕНТЕ

## Апстракт

*Анализа квалитативног пословања организације у односу на упоредиве конкуренте базира на оутпуту односно постигнућу установљених циљева,*

---

[1] vukmiletic88@gmail.com ORCID ID https://orcid.org/0000-0002-6250-6803

[2] nikolavcurcic@yahoo.com ORCID ID https://orcid.org/0000-0003-3375-2690

као резултат одговарајућег понашања и ефективне употребе ресурса, за-хтеваног знања, вештина, и компетенција. У настојању да остваре бржи развој, виши квалитет пословања и добит, организације превасходно актив-но стреме ка унапређењу своје продуктивности. Поред низа низа неопход-них фактора, компетентно руководство је кључни предуслов за креирање организације која ће осигурати квалитативно боље пословне резултате у односу на упоредиве конкуренте. Колико ће руковођење доприносити квали-тету пословања организације зависи од различитих параметара. Тематика овог истраживања фокусирана је на утицају интеракције променљивих ни-воа функционисања и дужине пословања организације у односу на упоредиве ресурсе. Пошло се од претпоставке да индикатори дужина пословања и ниво привређивања организације имају велики утицај на димензију пословне ус-пешности, узимајући у обзир својства конкурената са којима се организација мери и такмичи на дефинисаном тржишту. Добијени одговори испитаника обрађени су непараметарским χ2 тестом.

*Кључне речи:* организација, квалитативно пословање*,* конкуренти, дужина пословања, обим функционисања.

## Introduction

Qualitative business operations, viewed more broadly, imply a system implemented within the organizational structure that enables the achievement of business excellence based on the effects of improving business productivity, strengthening market competition, developing innovations and technologies, enhancing the education system (Čeha, 2015), and so on. Given that qualitative business operations are a multidimensional determinant, its understanding involves analyzing various aspects – market, technical, and managerial. This means that when analyzing qualitative business operations and market competition (Schindehutte, et al., 2008), the question of understanding the organization's operational success can also be raised.

The development of a qualitative business system for an organization (Miletić, et al., 2020a) that is more successful in its orientation toward competitors (O'Dwyer, Gilmore, 2019) operating in the same or similar market represents one of the primary parameters for achieving a stable market position in operations. The continuous improvement of such a business and management system (Miletić, et al., 2017) creates conditions for increasing labor productivity as a significant factor and driver of overall operations, which enables cost reduction and enhances competitiveness both in the national and international markets.

Creating a sustainable competitive position (Miletić, et al., 2018b) essentially arises as a result of the process of specifically combining the efforts and activities of the organization, regardless of the duration and level of business in the market. As competition in the market becomes increasingly intense, the successful functioning of the organization includes the conceptual role of knowledge (Ndubisi, et al., 2020) and management based on the continuous acquisition of experience and the improvement of the quality of products and services (Miletić, Ćurčić, 2021). The competition thus moves

from the level of prices and technical innovations of products that pass the test of the international market to the area of knowledge management and innovations in the field of management and marketing (Grubor, 2011). Customer satisfaction with the product characteristics related to created or expressed needs and the overall performance of the organization (Stamatis, 2012; Ćurčić, Miletić, 2020) should be continuously monitored in order to identify opportunities for improving the competitive position. In a business environment that is ultimately profit-oriented, innovation management (Ferreira, et al., 2020), quality, and marketing enable organizations to find an appropriate response to the challenges of qualitative business operations. In this context, marketing power (Ivanova, et al., 2017), or weakness, is increasingly being linked to the overall strength of the organization in the comparable market.

Improving the organization's operations relative to comparable competitors is its primary goal, embodied through the achievement of business excellence and reaching the defined class of product and service quality. At the micro level, qualitative business operations represent the organization's ability to compete with rivals (Andrevski, Ferrier, 2019) in a way that allows it to position itself highly in the market, ensuring conditions for further growth and development. To such a business trajectory, the organization's management (Suryaningrum, et al., 2023) needs to add new knowledge in order to provide an appropriate response to the demands placed by the market (Lengler, et al., 2014).

Achieving a unique competitive position in line with global market standards is a complex process that requires management (McMullen, et al., 2009) to coordinate all business functions within the organization, regardless of the duration and level of operation, and to invest exceptional financial and marketing efforts. Efforts should primarily be directed toward management competence (Yang, 2011) and the implementation of integrated management systems (Jørgensen, et. al. 2006) that pave the way to the international market, along with the improvement of knowledge productivity as a strong foundation for such an outcome. The implementation of integrated management systems (Laudon, Laudon, 2010) and innovative technologies is the path to achieving the competitive capability of organizations (Debruyne, et al., 2010; Pešević, 2020) in a flexible corporate environment. This concept enables the reduction of the time needed to improve the scope of operations, thereby generating conditions for national organizations, by adhering to international standards (Ćurčić, Miletić, 2021), to successfully operate in foreign markets.

## Starting point and methodological approach

Numerous studies have verified the intense need for organizations to improve their qualitative business operations, taking into account the competitors with whom they are compared and compete in the market, while simultaneously striving to achieve business excellence. Various authors have proposed the concept of maturity with the intention of facilitating the gradual improvement of organizational performance quality (Harmon, 2004; Collinson, Narula, 2014; Su, et al., 2020; Smith, et al., 2005). This paper is based on the thesis that, in addition to a range of necessary factors, competent leadership is a decisive prerequisite for creating an organization that will achieve better business

results relative to comparable competitors. The research also covered the observation of selected factors believed to be significant for improving the qualitative business operations of organizations. The significance of the following elements was considered: the implementation of integrated management systems, business productivity, knowledge in the fields of management and marketing, the standardization of operational quality, and the technical-technological foundation of existence. The focus of this study is primarily directed toward a comparative analysis of organizations with varying durations of business operations in evaluating qualitative performance relative to comparable resources, as well as the impact of the interaction between the variables regarding the level of operation and duration of operation on the assessment of qualitative business performance relative to competitors with whom they identify.

The research conducted is deterministic-implicative, as it is based on theoretical frameworks and the results of previous empirical studies. The research was conducted on a sample of 82 organizations, of which 17% were micro-organizations, 34% were small organizations, 31% were medium-sized organizations, and 18% were large organizations. In designing the methodological framework of the study, alongside the exploratory method, the bibliographic-speculative method was employed, while the analysis and interpretation of results utilized the method of multiple comparisons and statistical tests. The survey responses were provided by senior-level managers within the organization. The goal of the questionnaire was to gather primary information in order to observe factors significant for improving the qualitative business operations of organizations and to conduct a comparative analysis of the impact of the interaction between the variables regarding the level of operation and duration of operation, evaluating their qualitative business performance relative to comparable resources. The responses obtained from the respondents were processed using the non-parametric $\chi 2$ test. The significance level for variation was set at 0.05. The collected data were presented graphically, in tables, and descriptively.

## Presentation of results

In the research, the senior-level managers of domestic organizations were asked to note some of the most significant factors for improving qualitative business operations, considering comparable competitors, regardless of the duration and level of their presence in the market. In this context, it was assumed that certain elements were highly significant, certain elements were seen as both significant and insignificant, and certain factors were seen as insignificant. Table 1 presents the ratings in absolute and relative indicators for each incorporated factor significant for improving the qualitative business operations of organizations, in correlation with the competitors with whom the organizations compete in the market.

*Table 1.* **Observation of specific factors significant for improving the qualitative business operations of organizations relative to comparable competitors**

Factors for improvement qualitative business

| Very significant factor | | And it is and it is not significant factor | | It's not significant factor | |
|---|---|---|---|---|---|
| Af | Rf | Af | Rf | Af | Rf |
| 120 | 88,2 | 15 — Business productivity — 11,4 | | 0 | 0 |
| 115 | 84,9 | 16 — Knowledge in the field of management and marketing — 11,4 | | 5 | 3,2 |
| 112 | 82,4 | 16 — Technical and technological basis of business — 11,4 | | 7 | 4,6 |
| 121 | 88,9 | 16 — Application of integrated system management — 11,4 | | 0 | 0 |
| 115 | 84,4 | 17 — Standardization of quality functioning — 12,5 | | 4 | 2,9 |

Note: Af – absolute frequencies; Rf – relative frequencies (percentages).

*Source: Authors*

The table shows that the following elements were rated as highly significant for the profitable operation of the organization relative to comparable competitors: successful implementation of integrated management systems, business productivity, possession of knowledge in the fields of management and marketing, standardization of operational quality, and the technical-technological foundation of operations.

In this study, qualitative business operations of the organization relative to comparable competitors were further examined through a two-factor analysis. The analysis determined that the duration of operation and the level of operation (local, national, regional, and international) of organizations influence variations in their operational characteristics. These serve as generative factors that should enable an organization to achieve qualitative success relative to its competitors. A significance level of 0.05 was applied (for all values of Sig ≤ 0.05, the difference is considered statistically significant).

The mean values of ratings for the qualitative business performance of the organization relative to comparable competitors, for each level and duration of operation, are presented in Table 2. The standard deviation (Std. Deviation) represents the deviation from the mean value of the rating, while N indicates the number of respondents in the sample.

*Table 2.* **Mean values of ratings for the qualitative business performance of the organization relative to comparable competitors**

| Business level | Length of an organization's business | Mean | Std. Deviation | N |
|---|---|---|---|---|
| Local market | From 6 to 10 | 3.00 | .000 | 4 |
| | From 11 to 20 | 5.00 | .000 | 3 |
| | From 21 to 30 | 4.75 | .463 | 7 |
| | Over 40 years | 4.00 | .000 | 2 |
| | Total | 4.29 | .849 | 16 |
| National market | Up to 5 | 5.00 | .000 | 7 |
| | From 6 to 10 | 4.00 | .000 | 2 |
| | From 11 to 20 | 3.33 | .866 | 8 |
| | From 21 to 30 | 3.80 | .919 | 10 |
| | From 31 to 40 | 5.00 | .000 | 2 |
| | Over 40 years | 3.50 | .577 | 4 |
| | Total | 3.97 | .937 | 33 |
| R e g i o n a l market | From 6 to 10 | 4.00 | .000 | 2 |
| | From 11 to 20 | 4.25 | .886 | 8 |
| | From 21 to 30 | 5.00 | .000 | 4 |
| | Over 40 years | 4.22 | .441 | **9** |
| | Total | 4.35 | .647 | 23 |
| International market | From 6 to 10 | 4.07 | .884 | 13 |
| | From 11 to 20 | 4.42 | .515 | 12 |
| | From 21 to 30 | 4.52 | .512 | 20 |
| | From 31 to 40 | 4.00 | .000 | 3 |
| | Over 40 years | 4.00 | .632 | 11 |
| | Total | 4.27 | .657 | 59 |
| Total | Up to 5 | 5.00 | .000 | 7 |
| | From 6 to 10 | 3.87 | .815 | 21 |
| | From 11 to 20 | 4.13 | .871 | 31 |
| | From 21 to 30 | 4.44 | .700 | 41 |
| | From 31 to 40 | 4.40 | .548 | 5 |
| | Over 40 years | 4.00 | .566 | 24 |
| | Total | 4.21 | .764 | 129 |

*Source: Authors*

From the given table, it can be observed that organizations operating at the regional level, particularly those with 21 to 30 years of operation, rated their qualitative business performance relative to comparable competitors the highest.

The mean values of ratings for the qualitative business performance of the organization relative to comparable competitors are also presented in Graph 1. It can be observed that the highest-rated organizations are those operating in the local market for

up to 5 years and between 11 and 20 years, in the national market for 31 to 40 years, in the national market for up to 5 years, and in the regional market for 21 to 30 years.
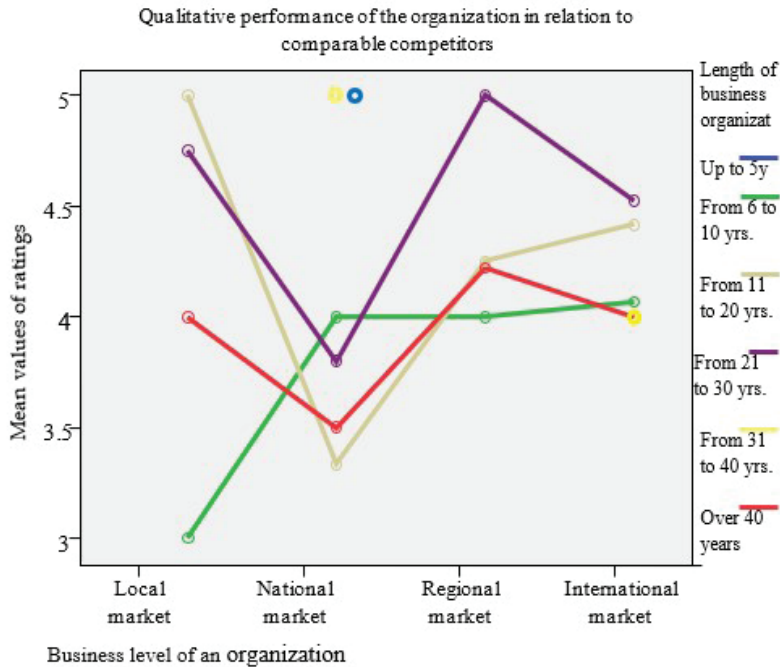


Graph 1. *Mean values of the evaluation of the organization's qualitative operations in relation to comparable resources*

*Source: Authors*

The impact of the interaction between the organization's duration of operation and level of operation on the evaluation of qualitative business performance relative to comparable competitors is presented in Table 3. In the column *Level of operation/ Duration of operation*, Sig = 0.002, which is less than 0.05. This suggests that there are noticeable variations in the evaluations of the organization's qualitative business performance relative to comparable resources. The impact of the interaction between the level of operation and the duration of operation is statistically significant.

Following the analysis of the corrective impact, attention was directed toward evaluating specific effects. In the Sig column for the level of operation, the value Sig = 0.086 > 0.05 is observed, leading to the conclusion that the level of operation of the organization does not have a significant impact on the evaluation of its qualitative business performance relative to comparable resources. In the Sig column for the duration of operation, the value 0.000 is observed, which is less than 0.05, indicating that the duration of operation significantly influences differences in evaluations. Based on the above, it can be concluded that the level of operation and duration of operation play a significant role in the disparities in the evaluation of an organization's qualitative business performance

relative to comparable resources, viewed through the combined influence of the variables. However, the individual impact is significant only for the duration of operation.

*Table 3. Impact of the interaction between the variables level of operation and duration of operation on the evaluations of the organization's qualitative business performance relative to comparable resources*

| The variables | Df | Mean Square | F | Sig. |
|---|---|---|---|---|
| The length of business operations | 3 | .890 | 2.252 | .086 |
| The level of business operations/ The length of business operations | 5 | 2.510 | 6.351 | .000 |
| The level of business operations | 10 | 1.171 | 2.962 | .002 |

*Source: Authors*

From the data presented, it can be stated that the individual impact of the duration of operation differs. One final Tukey test determined which organizations, depending on the duration of operation, differ specifically in their evaluations. Table 4 shows that the evaluations differ significantly between organizations operating for up to 5 years and those operating for 6 to 10 years, up to 5 years and those operating for 11 to 20 years, up to 5 years and those operating for over 40 years, and between organizations operating for 6 to 10 years and those operating for 21 to 30 years.

*Table 4. Comparative analysis of organizations with different durations of operation in the evaluations of the organization's qualitative business performance relative to comparable resources*

| (I) The length of doing business of the organization | (J) The length of doing business of the organization | Mean difference (I-J) | Standard deviation | Deviation significance (Sig) | 95% Confidence interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower limit | Upper limit |
| Up to 5 years | From 6 to 10 | 1.13(*) | .271 | .001 | .34 | 1.92 |
| | From 11 to 20 | .88(*) | .262 | .014 | .11 | 1.64 |
| | From 21 to 30 | .56 | .256 | .256 | -.18 | 1.30 |
| | From 31 to 40 | .60 | .368 | .581 | -.47 | 1.67 |
| | Over 40 years | 1.00(*) | | .004 | .22 | 1.78 |
| From 6 to 10 | Up to 5 years | -1.13(*) | .271 | .001 | -1.92 | -.34 |
| | From 11 to 20 | -.26 | .172 | .674 | -.75 | .24 |
| | From 21 to 30 | -.57(*) | .162 | .008 | -1.04 | -.10 |
| | From 31 to 40 | -.53 | .310 | .528 | -1.43 | .37 |
| | Over 40 years | -.13 | .180 | .979 | -.65 | .39 |

| | | | | | | |
|---|---|---|---|---|---|---|
| From 11 to 20 | Up to 5 years | -.88(*) | .262 | .014 | -1.64 | -.11 |
| | From 6 to 10 | .26 | .172 | .674 | -.24 | .75 |
| | From 21 to 30 | -.32 | .147 | .265 | -.74 | .11 |
| | From 31 to 40 | -.28 | .302 | .943 | -1.15 | .60 |
| | Over 40 years | .13 | .166 | .975 | -.36 | .61 |
| From 21 to 30 | Up to 5 years | -.56 | .256 | .256 | -1.30 | .18 |
| | From 6 to 10 | .57(*) | .162 | .008 | .10 | 1.04 |
| | From 11 to 20 | .32 | .147 | .265 | -.11 | .74 |
| | From 31 to 40 | .04 | .297 | 1.000 | -.82 | .90 |
| | Over 40 years | .44 | .156 | .060 | -.01 | .89 |
| From 31 to 40 | Up to 5 years | -.60 | .368 | .581 | -1.67 | .47 |
| | From 6 to 10 | .53 | .310 | .528 | -.37 | 1.43 |
| | From 11 to 20 | .28 | .302 | .943 | -.60 | 1.15 |
| | From 21 to 30 | -.04 | .297 | 1.000 | -.90 | .82 |
| | Over 40 years | .40 | .307 | .783 | -.49 | 1.29 |
| Over 40 years | Up to 5 years | -1.00(*) | .268 | .004 | -1.78 | -.22 |
| | From 6 to 10 | .13 | .180 | .979 | -.39 | .65 |
| | From 11 to 20 | -.13 | .166 | .975 | -.61 | .36 |
| | From 21 to 30 | -.44 | .156 | .060 | -.89 | .01 |
| | From 31 to 40 | -.40 | .307 | .783 | -1.29 | .49 |

*Source: Authors*

## Conclusion

The research results, presented through evaluations in absolute and relative indicators for each incorporated factor, show that these factors are highly significant for improving the qualitative business performance of organizations relative to comparable competitors. The highest percentage of factors deemed highly significant for the qualitative business performance of organizations, as indicated in relative indicators, ranged from 88.9% for the application of integrated management systems to 82.4% for the importance of the technical-technological foundation of business operations.

The two-factor analysis determined that the duration of operation and the level of operation (local, national, regional, and international) of organizations influence fluctuations in the characteristics of their operations as important factors that enable the organization to be more successful in the market relative to the competitors with which it identifies. Organizations operating at the regional level, particularly those with 21 to 30 years of operation, rated their qualitative business performance relative to competitors the highest.

The highest mean values for qualitative business performance, relative to comparable competitors, were given by organizations operating in the local market for up to 5 years and between 11 to 20 years, on the national market for 31 to 40 years, on the national market for up to 5 years, and on the regional market for 21 to 30 years. The results further show that the interaction between the level and duration of business operations is

statistically significant, meaning there are notable fluctuations in the evaluations of the organization's qualitative performance relative to comparable resources. For the level of business operations, the value of Sig=0.086 > 0.05 indicates that it does not have a significant impact on the evaluations of the organization's qualitative performance relative to comparable resources. For the duration of operations, the value of 0.000 < 0.05 indicates that the duration of operation significantly affects the differences in the evaluations. The Tukey test shows that there are significant differences in the evaluations between organizations that have been operating for up to 5 years and those operating for 6 to 10 years, up to 5 years and 11 to 20 years, up to 5 years and over 40 years, as well as between organizations operating for 6 to 10 years and 21 to 30 years.

In conclusion, it can be stated that, for the organization's operations to be evaluated as qualitatively dominant relative to comparable competitors, the application of appropriate management technology and the necessary resources available to the organization is essential. By improving its qualitative business operations, the organization creates a favorable environment for successful performance in the global market.

# References

Andrevski, G. i Ferrier, W., (2019). Does It Pay to Compete Aggressively? Contingent Roles of Internal and External Resources. *Journal of Managemen*t, 45(2), str. 620-644.

Collinson, S. C. i Narula, R. (2014). Asset recombination in international partnerships as a source of improved innovation capabilities in China. *Multinational Business Review*. 22(4): 394 – 415.

Debruyne, M., Frambach, R. i Moenaert, R., (2010). Using the Weapons You Have: The Role of Resources and Competitor Orientation as Enablers and Inhibitors of Competitive Reaction to New Products. *Journal of Product Innovation Management*, 27(2), str. 161-178.

Ferreira, J.; Coelho, A.; Moutinho, L. (2020). Dynamic capabilities, creativity and innovation capability and their impact on competitive advantage and firm performance: The moderating role of entrepreneurial orientation. Technovation, 92, 102061.

Čeha, M. (2015). He role knowledge improvement in enhancement of competitiveness of domestic enterprises. International Scientific Conference of IT and Business-Related Research - Contemporary business and management SYNTHESIS, p. 303-307

Ćurčić, N., Miletić, V. (2020). Factors important for achieving the competitiveness of industrial and agroindustrial products. Published in international journals, "Economics of Agriculture", Belgrade, Vol. LXIII, 67(3), pp. 831-849

Ćurčić, N. Miletić, V. (2021). Valuation of the parameters important for the appearance of Serbian enterprises in new markets. 74th International Scientific Conference on Economic and Social Development, Lisbon, Book of Proceedings, 18-19 November, Portugal, p. 1-13.

Grubor, A. (2011). Globalna marketing konkurentnost, Ekonomske teme, br. 4. str. 651-666.

Harmon P. (2004). Evaluating an Organization's Business Process Maturity. In: Business Process Trends, 2(3), p. 1-11.

Ivanova, T.Y., Kochkova, Y., Živković, S. (2017). Marketing activity performance: Valuati on problem and its resolution. Vol. 63, july-september 2017, № 3, p. 13-24

Laudon, K., & Laudon, J. (2010). Management information systems: Managing the digital firm. (11th ed.). Upper Saddle River, NJ: Pearson Prentice Hall

Lengler, J., Sousa, C. i Marques, C. (2014). Examining the Relationship between Market Orientation and Export Performance: The moderationg role of competitive intensity. International Marketing in Rapidly Changing Environments: Advances in International Marketing, 24, str. 75-102.

McMullen, J., Shepherd, D. i Patzelt, H. (2009). Managerial (in)attention to competitive threats. Journal of Mangement Studies, 46(2), str. 157-181.

Miletić, V. Ćurčić, N. (2021). Valorization of the quality of the products made by enterprises on the market where they do business. *Poslovna ekonomija*, God. XV Br. 2, str. 19-30.

Miletić, V., Jovanović, Z., Pavić, Ž. (2020a). Evaluation of management methods and techniques regarding quality improvement of Serbian organization' business. *Ekonomika,* vol. 66, no. 3 p. 55-71.

Miletić, V., Ćurčić, N., Simonović, Z. (2020b). Quality standardization - a factor of sustainable competitiveness of enterprises in Serbia. *Anali Ekonomskog fakulteta u Subotici*, Vol. 56, No. 44, p. 099-114.

Miletić, V., Jovanović, Z. Jeremić, Lj. (2017). Progresive Managament System - a Development and Organization Manager to Success. *Ekonomika*, Niš, no. 3, pp. 35-43.

Ndubisi, N., Dayan, M., Yeniaras, V. i M., Al-hawari, M. (2020). The effects of complementarity of knowledge and capabilities on joint innovation capabilities and service innovation: The role of competitive intensity and demand uncertainty. *Industrial Marketing Management*, 89, str. 196-208.

O'Dwyer, M. i Gilmore, A. (2019). Competitor orientation in successful SMEs: an exploration of the impact on innovation. Journal of Strategic Marketing, 27(1), str. 21-37.

Pešević, S. (2020). Konkurentska sposobnost preduzeća sa aspekta upravljačkog računovodstva. *Naučno-stručni časopis, SVAROG* br. 20, (168-178)

Schindehutte, M., Morris, M. i Kocak, A. (2008). Understanding market-driving behavior: The role of entrepreneurship. Journal of Small Business Management, 46(1), str. 4-26.

Smith, K., Ferrier, W. i Ndofor, H. (2005). Competitive Dynamics Research: Critique and Future Directions. U: M. Hitt, R. Freeman i J. Harrison, ur. Handbook of Strategic Management. London: Blackwell Publishers.

Stamatis, D.H. (2012).10 Esentials for High Perfomance Quality in the 21 st Century, CRC Press Taylor&Francis Group.

Su, J., Zhang, S. i Ma, H. (2020). Entrepreneurial orientation, environmental characteristics, and business model innovation: a configurational approach. Innovation, 22(4), str. 399-421.

Suryaningrum, D. H., Rahman, A., Meero, A. i Cakranegara, P. A. (2023). Mergers and acquisitions: does performance depend on managerial ability?, Journal of Innovation and Entrepreneurship, 12(1): 1-23. URL: https://doi.org/10.1186/s13731-023-00296-x,

Tine H. Jørgensen, Arne Remmen, M. Dolores Mellado (2006). Integrated management systems – three different levels of integration. Journal of Cleaner Production Volume 14, Issue 8, Pages 713-722

Yang, T. i Li, C. (2011). Competence exploration and exploitation in new product development: themode-rating effects of environmental dynamism and competitiveness. Management Decision, 49(9), str. 1444-1470.

**Vladimir Radivojević**[1]
*University of Priština in Kosovska Mitrovica,*
*Faculty of Economics*

**Miloš Krstić**[2]
*University of Niš, Faculty of Sciences and Mathematics*

**Jelena Dimovski**[3]

# ANTITRUST ENFORCEMENT IN THE DIGITAL ECONOMY: FROM GLOBAL TRENDS TO GOOGLE'S FINES

## Abstract

*The rapid expansion in the digital economy is reshaping markets around the world and attracting more regulatory attention to ensure fair competition and prevent monopolistic practices. This paper aims to provide a comprehensive analysis of antitrust actions in the digital market, focusing on global trends and specific high-profile cases. The purpose is to examine the distribution of antitrust activity by country income level, geographic region, type of infringement (mergers, abuse of dominance, restrictive agreements), and affected companies to understand broader patterns in global competition policy. Utilizing descriptive analysis and case study methods, this paper explores the significance of these trends and delves into two major actions involving Google – Google Shopping and Google Android – as this company has both the highest number of antitrust investigations and the two largest fines imposed by the European Commission. The results emphasize the critical need for adaptable and enforceable competition policies in digital markets, where dominance by a few large players often challenges market fairness. These insights may inform policy-makers and regulators in developing balanced approaches to competition policy, especially in regulating global tech giants like Google to foster a competitive and innovative digital ecosystem.*

***Key words:** antitrust, digital economy, market power, Google*

***JEL classification: L40, L86, K21***

# СПРОВОЂЕЊЕ АНТИМОНОПОЛСКЕ ПОЛИТИКЕ У ДИГИТАЛНОЈ ЕКОНОМИЈИ: ОД ГЛОБАЛНИХ ТРЕНДОВА ДО КАЖЊАВАЊА GOOGLE-A

## Апстракт

*Брза експанзија дигиталне економије преобликује тржишта широм света и привлачи све већу регулаторну пажњу у погледу обезбеђивања*

---

[1] vladimir.radivojevic@pr.ac.rs, ORCID ID 0000-0002-3928-0623

[2] milos.krstic1@pmf.edu.rs, ORCID ID 0000-0002-5256-8613

[3] jelena.s.dimovski@gmail.com, ORCID ID 0000-0002-1353-4349

*фер конкуренције и спречавања монополске праксе. Овај рад има за циљ да пружи свеобухватну анализу антимонополских активности на дигиталном тржишту, фокусирајући се на глобалне трендове и специфичне случајеве високог профила. Сврха је да се испита дисперзија антимонополских поступака према нивоу прихода земље, географском региону, врсти прекршаја (недозвољена спајања, злоупотреба доминантног положаја, рестриктивни споразуми) и конкретним компанијама како би се разумели шири обрасци у глобалној политици заштите конкуренције. Користећи дескриптивну анализу и методе студије случаја, овај рад истражује значај наведених трендова и детаљно испитује два карактеристична случаја против компаније Google – Google Shopping и Google Android – будући да ова компанија има највећи број покренутих антимонополских поступака и две највише новчане казне изречене од стране Европске комисије. Резултати наглашавају критичну потребу за прилагодљивим и применљивим политикама заштите конкуренције на дигиталним тржиштима, где доминација неколико великих играча често доводи у питање тржишну праведност. Ови увиди могу да користе креаторима политике и регулаторима у развоју уравнотежених приступа политици заштите конкуренције, посебно у регулисању глобалних технолошких гиганата, као што је Google, како би се подстакао конкурентан и иновативан дигитални екосистем.*

***Кључне речи:*** *антимонополска политика, дигитална економија, тржишна моћ, Google*

# Introduction

The rapid growth and influence of digital platforms have transformed global markets, sparking fundamental changes in how goods, services, and information are exchanged. Over the past two decades, digital platforms have reshaped the competitive landscape by enabling new business models, accelerating data-driven innovations, and creating highly interconnected market ecosystems. However, these transformative changes have also raised significant concerns around market concentration, competitive fairness, and customer welfare. As some digital companies gain dominant positions within their respective sectors, their market power can stifle competition, limit choices for customers, and reduce incentives for innovation. In response, governments and regulatory bodies worldwide have intensified efforts to examine and address potential anticompetitive behaviors within the digital economy, often resulting in landmark antitrust cases.

This paper delves into the critical role of competition policy in the platform economy by first presenting a comprehensive analysis of global antitrust statistics in digital markets. Through an examination of key data points, including the number and distribution of antitrust cases by region, sector, and specific companies, the study provides an overview of how enforcement practices vary across jurisdictions. This analysis illuminates patterns in regulatory focus, illustrating how competition policy priorities evolve as new challenges emerge in the digital domain.

Following the statistical overview, the paper offers a detailed review of two high-profile antitrust cases against dominant tech player *Google*. These cases represent pivotal moments in competition policy enforcement, each highlighting distinct aspects of regulatory and legal approaches to managing platform dominance. The case studies explore the specific antitrust allegations, the defense arguments presented by the company involved, and the eventual outcomes of these cases, with particular attention to the broader implications for the digital economy. This analysis also considers the impact of these decisions on subsequent policy development, revealing the feedback loop between enforcement actions and regulatory adaptation.

Ultimately, this paper seeks to enhance understanding of the intersection between competition policy and the platform economy, offering insights into the challenges of maintaining fair competition in a landscape increasingly shaped by digital giants. By synthesizing global data and case-specific insights, this study contributes to ongoing discussions regarding the future of competition policy in an era of rapid digitalization, where balancing market dynamism with regulatory oversight remains a critical, yet complex, task.

This paper goes beyond analyzing global trends in antitrust activity within the digital economy, striving also to offer actionable insights for policymakers and regulators. By examining the distribution of cases across income levels, regions, and infringement types, as well as the actions against key players like *Google*, the findings highlight critical areas where regulatory interventions may need to adapt to the unique challenges of the digital market. The study's results offer valuable guidance for shaping policy frameworks that balance market dynamism with fairness, particularly in addressing the dominance of global tech giants. These insights can assist policymakers in identifying priority areas for intervention, crafting region-specific strategies, and ensuring that competition policies remain effective in fostering innovation while safeguarding consumer welfare.

## The rise of digital giants: Analyzing corporate and regional concentration in the digital economy

The digital economy has transformed how businesses operate, customers engage, and markets evolve, shaping a new economic landscape that thrives on connectivity and data (Javaid et al., 2024). Driven by rapid technological advancements, it encompasses a wide range of sectors – from e-commerce and social media to online advertising and cloud computing – where digital platforms and services now play central roles (Kraus et al., 2021). Nearly every aspect of modern life has moved online, from shopping and socializing to banking and education, creating a fully interconnected digital ecosystem. According to recent statistics from Forbes (2024), a new website is created every three seconds, more than 71% of businesses now have a web presence, and even 28% of all business activities take place online. This shift has spurred remarkable growth opportunities, yet it has also introduced unique challenges, especially concerning competition and market concentration as a few major players increasingly control key areas (ICC, 2023).

The following table illustrates the current state of global website traffic, highlighting key trends in user engagement as of November 2023 (Statista, 2024b). It

clearly suggests that the digital market is dominated by a few global giants, with data showing that websites like *Google*, *YouTube*, and *Facebook* attract billions of unique monthly visitors. The figures presented highlight the enormous influence of certain platforms, facilitating unprecedented user engagement, but also raising concerns about competition and customer choice.

*Table 1: Leading websites worldwide by unique monthly visitors (in billions), November 2023*

| Site | Number of unique visitors | Company | Country |
|---|---|---|---|
| Google.com | 9.01 | Google | United States |
| YouTube.com | 5.66 | Google | United States |
| Facebook.com | 3.03 | Meta | United States |
| Instagram.com | 1.8 | Meta | United States |
| Wikipedia.com | 1.69 | Wikipedia | United States |
| Pornhub.com | 1.66 | Aylo | Canada |
| Twitter.com | 1.53 | X Corp. | United States |
| Xvideos.com | 1.27 | WGCZ Holding | France |
| Reddit.com | 1.14 | Reddit | United States |
| TikTok.com | 1.12 | ByteDance | China |
| Amazon.com | 0.92 | Amazon | United States |
| Whatsapp.com | 0.86 | Meta | United States |
| Weather.com | 0.84 | The Weather Channel | United States |
| Xnxx.com | 0.77 | WGCZ Holding | France |
| Bing.com | 0.69 | Microsoft | United States |

*Source: Statista (2024b)*

Table 1 reveals the overwhelming dominance of a few companies and underscores the concentration of market power within the digital economy, largely anchored in the United States (US). The top websites by unique monthly visitors, led by platforms such as *Google.com* (9.01 billion), *YouTube.com* (5.66 billion), and *Facebook.com* (3.03 billion), showcase the unparalleled reach of US-based technology firms. *Google* and *Meta* alone account for a significant proportion of global web traffic, reflecting these companies' extensive influence over online content, advertising, and data collection. *Google's* presence as the top platform, with both *Google.com* and *YouTube.com* leading in user engagement, exemplifies the strong network effects that make it challenging for smaller competitors to capture significant market share.

The table further highlights that of the fifteen most popular websites, eleven are headquartered in the US, reinforcing the concentration of market influence within a single country. This geographic concentration suggests that competition policy in the US holds a pivotal role in shaping global digital market dynamics. With high-profile firms like *Meta*, *Amazon*, and *Microsoft* among the leaders, the US continues to dominate both in terms of innovation and market power, raising concerns internationally about the degree of influence these companies exert over the global digital ecosystem.

In addition to the US, Table 1 also includes firms from China (*TikTok.com*) and France (*Xvideos.com* and *Xnxx.com*), demonstrating that while a few companies from other countries command substantial traffic, their presence is limited compared to US-based platforms. *TikTok*, operated by China's *ByteDance*, is one of the few non-US platforms to achieve a high ranking, attracting 1.12 billion visitors. *TikTok's* inclusion highlights the competitive impact of a Chinese firm in a market otherwise dominated by US entities. This raises unique considerations for competition policy, as regulatory approaches may differ significantly based on political and economic agendas between countries.

The substantial market concentration seen in Table 1 underscores not only the dominance of specific companies but also points to potential risks associated with limited customer choice, data privacy concerns, and barriers to entry for smaller companies. As US-based firms expand their influence across sectors – from social media to e-commerce, search engines, and cloud services – the challenge of ensuring fair competition intensifies. This concentration of digital market power has spurred significant regulatory attention, with antitrust cases and policy discussions focusing on curbing practices that could harm competitors or reduce innovation.

By capturing both the corporate and geographic concentration in the digital marketplace, the presented table serves as a foundation for assessing the implications of such concentrated market power. These insights are essential for understanding how dominant platforms can impact customer access and for guiding the development of robust competition policies that promote a balanced and competitive digital environment.

## Mapping antitrust trends: Income, region, and infringement types in digital markets

A high concentration of market share among a few firms does not automatically signal anti-competitive actions. Many leading companies gain their strong market positions through innovation, cost efficiencies, or customer trust (Handoyo et al., 2022; Krstić, Stanišić, & Radivojević, 2016; Spulber, 2023). However, concentrated markets can increase the possibility of dominant players exerting their market power in ways that may restrict competition (Krstić, Radivojević, & Stanišić, 2016a; Krstić, Radivojević, & Stanišić, 2016b). In these situations, companies might engage in practices that hinder new entrants, raise prices, or reduce customer choice. Consequently, regulatory bodies pay close attention to such markets, as high concentration levels may create conditions favorable to practices that could impact competition and customer options negatively.

Moving to the broader picture of digital antitrust enforcement, Figure 1 demonstrates the distribution of antitrust cases by country income level based on World Bank (2024) statistics, showing a significant concentration of cases in high-income nations. This trend suggests that economically advanced countries are more proactive in addressing antitrust concerns in digital markets, likely due to their established regulatory infrastructures and more mature digital economies. This disparity indicates that competition issues in the digital realm may be less visible or less enforceable in low-income regions, where resources and regulatory frameworks might limit antitrust oversight.

*Figure 1: Distribution of cases by income level*
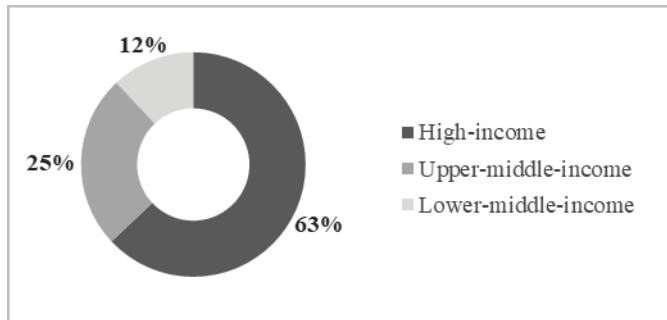


*Source: World Bank (2024)*

As shown in Figure 1, high-income countries lead significantly, accounting for 63% of all cases. This concentration indicates that wealthier nations tend to prioritize and have greater resources to address anticompetitive behavior, particularly within the digital market, where legislation and institutional capacity are crucial for effective enforcement. Upper-middle-income countries follow, constituting 25% of cases, while lower-middle-income countries represent only 12%.

The disparity in antitrust activity suggests that high-income nations are often the primary enforcers of digital market competition policies. This gap may stem from limited resources and regulatory infrastructure in low- and middle-income countries, which could hinder their ability to monitor and challenge anticompetitive behavior effectively. As digital platforms operate globally, this concentration in high-income regions can lead to gaps in regulatory oversight in lower-income countries, where customer rights and fair market access may remain unprotected. This highlights the need for international collaboration and support to help lower-income countries develop the capability to address antitrust concerns in the digital market.

The following Figure 2 further delves into the regional aspects of this trend, showing that Europe and East Asia and Pacific are at the forefront of antitrust enforcement in digital markets. The figure suggests a general correlation between regions with a high presence of dominant digital platforms and increased regulatory scrutiny. However, this relationship is not consistent in all cases; for instance, while the US hosts the largest number of tech company headquarters, it has comparatively fewer antitrust cases than regions like Europe, which has adopted a more proactive regulatory stance. It confirms the need for more globally coordinated efforts to address the influence of these platforms, as market behaviors in one region can impact competitive conditions worldwide.

*Figure 2: Distribution of cases by region*
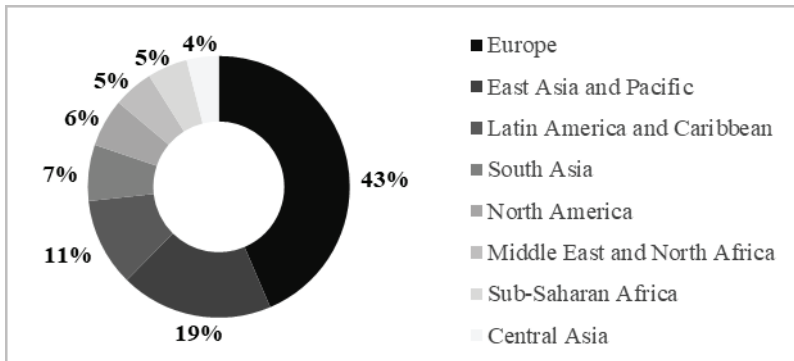


*Source: World Bank (2024)*

Figure 2 shows that Europe leads with 43% of antitrust cases in the digital market, reflecting its proactive regulatory approach and well-established competition policy. This high percentage likely stems from the EU's strong commitment to regulating digital giants, evident in legislation like the *Digital Markets Act*, which targets large platforms to prevent monopolistic behavior (Andriychuk, 2024; Nicoli & Iosifidis, 2023). Europe's emphasis on protecting customer rights and fostering a competitive market for local businesses also drives extensive regulatory activity.

East Asia and Pacific, with 19% of cases, follows as the second-most active region, largely due to countries like China and Japan, which have increasingly prioritized digital market regulation. China, for instance, has introduced guidelines for the platform economy, focusing on issues like data privacy and abuse of dominance, particularly in response to the rapid growth of companies like *Alibaba* and *ByteDance* (Colino, 2022). Japan has similarly issued guidance on applying competition laws to digital platforms, reflecting the region's heightened focus on addressing the competitive challenges presented by dominant local players (Harada, Nedachi, & Shimada, 2023).

Latin America and Caribbean, accounting for 11%, shows moderate regulatory activity, influenced by growing digital economies in countries like Brazil and Mexico. The region's involvement in antitrust cases reflects an effort to align with global trends and address potential monopolistic behaviors, especially as US and Chinese platforms expand their influence in these markets.

South Asia has a 7% share of antitrust cases, reflecting India's increasing focus on competition within its digital market, driven by the presence of global and regional players. India's regulatory actions aim to create a level playing field for local firms while addressing potential anticompetitive practices by foreign giants.

North America surprisingly only represents 6% of antitrust cases, despite housing major digital firms like *Google*, *Meta*, and *Amazon*. This comparatively low percentage might be due to historically relaxed regulatory approaches toward large technology firms and ongoing legislative discussions about how to adapt antitrust laws for the digital era. However, recent trends show increased scrutiny, and future cases may bring North America's share closer to other regions.

Middle East and North Africa (5%), Sub-Saharan Africa (5%), and Central Asia (4%) collectively account for a minor share of cases, reflecting the limited regulatory infrastructure and digital market development in these regions. As digital platforms extend their reach into emerging markets, these areas may need to bolster regulatory frameworks to address competitive challenges. For now, limited resources and economic priorities may lead to less focus on antitrust cases, especially when compared to more economically developed regions.

The distribution of antitrust cases highlights a global disparity in digital market regulation, with Europe and East Asia leading the way, while other regions show varied levels of engagement based on local market dynamics, regulatory capabilities, and economic priorities.

Figure 3 builds on this analysis by presenting the types of antitrust cases in the digital sector, offering a closer look at the specific regulatory issues – such as mergers, abuse of dominance, and restrictive practices – that capture the most attention from competition authorities. Understanding this breakdown offers insight into the specific competitive behaviors that most concern regulators in the context of digital market dynamics.

*Figure 3: Distribution of cases by type*
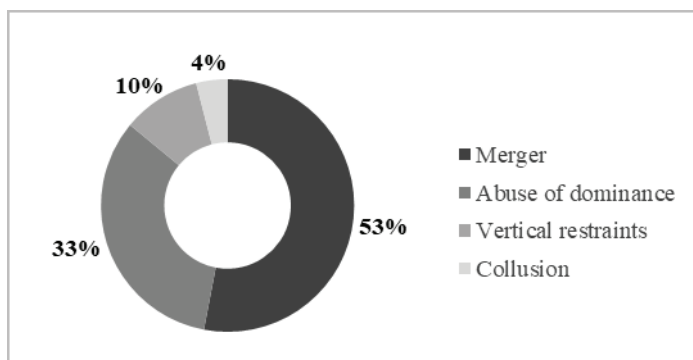


*Source: World Bank (2024)*

The data shown in Figure 3 illustrate that merger cases dominate antitrust actions in the digital market, comprising 53% of cases. This high percentage reflects significant regulatory attention to mergers and acquisitions within the digital sector, where large firms frequently acquire smaller competitors or innovative startups to expand their reach, consolidate their position, and acquire new technologies. Such mergers raise concerns about market concentration, as they can reduce competition by eliminating potential rivals and integrating valuable data and technological assets into already powerful platforms. Given the risk of market monopolization and the potential to stifle innovation, competition authorities often scrutinize mergers closely to protect market dynamism and customer choice.

Abuse of dominance cases account for 33% of antitrust actions, underscoring concerns over how dominant digital platforms may leverage their substantial market power. Dominant firms in the digital space, such as major search engines, social media platforms, and e-commerce sites, can use their position to disadvantage smaller competitors or forcefully enter new markets (Ong & Toh, 2023). Common issues involve

exclusionary tactics, such as restricting access to key infrastructure or prioritizing their own products, which limit opportunities for other players. This focus aligns with previous figures showing high concentration in particular companies and regions, as regulators aim to address behaviors that prevent fair competition.

Vertical restraints make up 10% of cases, highlighting concerns over restrictive agreements imposed by dominant digital firms on suppliers or partners, which can impact competition at different levels of the supply chain. In the digital market, vertical restraints may include exclusive contracts or restrictions on pricing policies, limiting the ability of smaller firms to compete on equal footing. This case type reflects how dominant platforms often exert control over various aspects of the market structure, using their influence to secure more favorable terms that reinforce their market position.

Finally, collusion accounts for only 4% of antitrust cases, indicating relatively lower regulatory focus on explicit agreements between digital firms to fix prices or divide markets. While collusion remains a core concern in traditional antitrust enforcement, the digital market's competitive dynamics and transparency in online transactions may reduce opportunities for such overtly collaborative practices. However, the emergence of data-sharing agreements and potential algorithmic collusion may prompt future regulatory action in this area.

This figure reveals a strong regulatory emphasis on mergers and abuse of dominance cases, reflecting the challenges of maintaining competition in highly concentrated digital markets. The data suggests that regulators prioritize actions that address market consolidation and power abuses, given their potential to limit competition and innovation within the rapidly evolving digital economy.

Figure 4 shifts the focus to specific companies most frequently targeted by antitrust actions, such as *Google*, *Uber*, and *Booking*. This figure highlights how these firms' dominant positions and distinctive business models draw considerable regulatory attention due to their influence on competition and customer choice.

*Figure 4: Distribution of cases by firm*
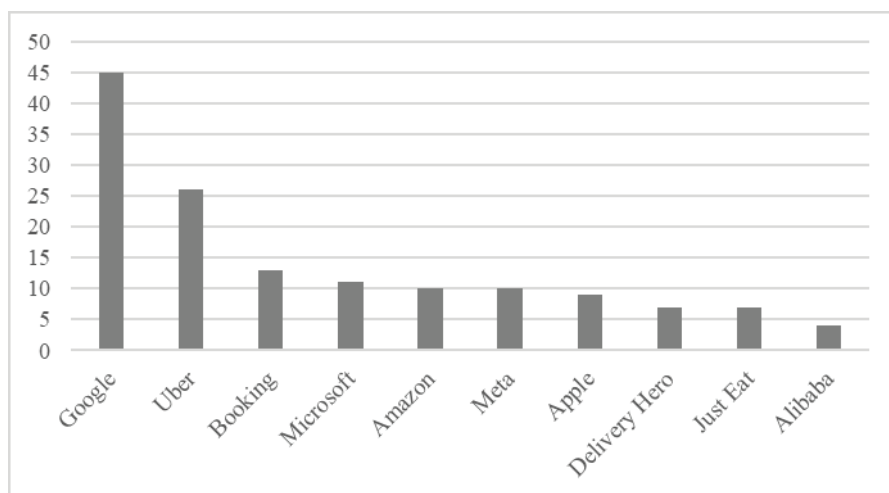


*Source: World Bank (2024)*

The data shown in Figure 4 display the distribution of antitrust cases across major digital firms, with *Google* leading at 45 cases. This high figure reflects *Google's* extensive presence across search, advertising, and other digital services, where its dominant market position and data control have led to frequent scrutiny. *Google's* wide range of services and acquisitions may raise concerns about monopolistic practices, exclusionary tactics, and data privacy issues, driving regulators to examine its impact on competition and customer choice.

*Uber* follows with 26 cases, a notable number for a platform focusing on ride-hailing and delivery services. *Uber's* unique business model, reliance on gig workers, and rapid global expansion often raise questions around market fairness, labor practices, and local competition laws. Regulatory challenges commonly involve *Uber's* potential to disrupt traditional transport markets, alongside concerns about pricing policies and driver treatment.

*Booking.com* has 13 cases, primarily linked to its dominance in online travel booking. Given *Booking's* large share of the travel market, cases typically focus on restrictive contract terms with hotels and other accommodations, such as price parity clauses that limit competition. Such practices raise regulatory concerns around market barriers and customer access to competitive pricing, prompting action by competition authorities.

*Microsoft* and *Amazon* follow with 11 and 10 cases, respectively, highlighting scrutiny related to their dominant positions in software, cloud services, and e-commerce. *Microsoft's* cases may involve legacy antitrust issues tied to its software market control, while *Amazon* faces questions about its influence in online retail, marketplace competition, and data usage to advantage its products over third-party sellers.

*Meta* (10 cases) and *Apple* (9 cases) are also under significant scrutiny, reflecting concerns over their influence in social media, mobile platforms, and app marketplaces. *Meta's* antitrust cases often center on its acquisitions and potential dominance in social media and digital advertising, while *Apple's* cases frequently involve its *App Store* policies, which may disadvantage app developers and limit customer choice.

The presence of *Delivery Hero* and *Just Eat* with 7 cases each, as well as *Alibaba* with 4 cases, suggests increasing regulatory attention on food delivery and e-commerce platforms. *Delivery Hero* and *Just Eat*, both major players in food delivery, face scrutiny over market concentration, pricing practices, and treatment of gig workers, similar to *Uber*. *Alibaba's* cases may involve issues related to market power in e-commerce and concerns over data usage within the Chinese and international markets.

The data underscores the concentration of antitrust cases around a few dominant firms, particularly those that wield significant market power and operate across multiple sectors. This pattern reflects competition authorities' focus on preventing potential monopolistic behavior, protecting customer choice, and ensuring fair competition within highly concentrated digital markets (Stojanović, Radivojević, & Stanišić, 2012).

Summarizing the data from the table and figures underscore the prominent role of high-income regions and a few major digital platforms in shaping the current competition policy landscape. These insights reinforce the global debate on the adequacy of existing regulatory approaches, especially considering the unique nature of digital platforms and the transnational impact of their business practices.

The EU, in particular, has taken a strong stance on curbing monopolistic behaviors within the digital market, imposing some of the highest fines in antitrust history. The following section delves into two landmark cases involving *Google*, each highlighting specific exclusive practices that have raised concerns over competition and fairness in the digital economy. Through these cases, we gain insight into the EU's approach to regulating digital giants and the broader implications for market competition.

## Google: Examining exclusive practices…

*Google* was once a widely admired company, but in recent years it has been under constant government scrutiny and the subject of more than 100 antitrust investigations worldwide (Bergqvist, 2024). Publicly available information suggests that the investigations were conducted in more than 20 jurisdictions, which in addition to the countries of the EU, United Kingdom, and the US, include South Korea, Russia, Japan, India, South Africa, Brazil, Australia, and Turkey. An extensive empirical analysis of antimonopoly cases conducted against this company showed that all violations of competition rules were realized in several categories of services provided by *Google*. For example, Bergqvist (2024) highlights five typical areas, three of which are particularly characteristic of antitrust cases conducted in the EU:

(1) *The Google Search (Shopping)* cases focus on *Google's* practice of favoring its own services in search results, especially in the comparison shopping sector. Through its search engine, *Google* prominently features its own shopping service, *Google Shopping*, at the top of search results, while competing services are often ranked lower or pushed to later pages. This self-preferencing allows *Google Shopping* to capture a substantial share of user clicks, as users tend to click on the top results far more than those that appear lower on the page.

(2) *The Google Android* cases focus on *Google's* strategy of preinstalling its apps, like *Chrome* and *Search*, on *Android* devices, which it licenses for free to smartphone manufacturers. To secure these preinstallations, *Google* allegedly offers financial incentives, such as revenue-sharing from ad profits, ensuring that its apps appear as default options on most *Android* devices. This approach is considered exclusionary because it limits opportunities for competing apps to gain visibility on *Android*, effectively reinforcing *Google's* dominance in search and web browsing.

(3) *The Google AdWords/AdSense* cases center on *Google's* control over online advertising and its influence on publishers to rely on its ad services exclusively. Through contracts and requirements, *Google* allegedly restricts publishers' ability to display ads from competing ad services, thereby limiting the reach and diversity of *non-Google* ad platforms. This conduct, known as "tying", effectively binds publishers to *Google's* advertising tools, potentially reducing competition and making it difficult for other ad providers to compete.

As expected, many of the *Google* investigations that were conducted in the previous period (100+) did not end with the imposition of a competition protection measure. Some investigations did not result in the initiation of antitrust disputes, some were not confirmed in court cases, while some are still in one of the stages of evidentiary proceedings.

### … in the web search (Google Shopping)

One of the antitrust cases recently upheld by the European Court of Justice (2024) is the case in which the European Commission imposed a significant fine of €2.42 billion on *Google* in 2017, accusing it of abusing its dominant position as a search engine to give its own comparison shopping service, *Google Shopping*, an unfair advantage. It is the second-highest fine ever levied for breaking EU antitrust regulations (Statista, 2024a). This landmark decision was rooted in *Google's* overwhelming market power in all 31 countries of the European Economic Area (EEA), where it held over 90% of the search engine market share since 2008 (European Commission, 2017). The Commission's investigation, launched following multiple complaints from rival services, found that *Google's* practices significantly hindered competition by prioritizing its own shopping service in search results, thereby disadvantaging competing comparison shopping platforms.

The Commission's findings highlighted that *Google* strategically placed its comparison shopping results at the top or in a prominent reserved space on the right-hand side of the search page. This placement ensured that *Google Shopping* was visible to users searching for product information, while results for rival shopping services were subjected to *Google's* standard search algorithms. As a result, competing services were often demoted to lower ranks, such as the fourth page or beyond, where they were unlikely to be seen by users. Studies cited by the European Commission (2017) showed that search results on the first page receive approximately 95% of clicks, while results on the second page drop to a mere 1%. Thus, this tactic led to a sharp decrease in visibility and traffic for rivals, making it extremely difficult for these services to compete with *Google Shopping* on an equal footing.

The European Commission (2017) stated that the impact of *Google's* actions was notable. Traffic to *Google Shopping* surged significantly across EEA countries, with the service growing 45-fold in the United Kingdom, 35-fold in Germany, and 29-fold in the Netherlands, among other regions. In contrast, traffic to competing comparison shopping websites plummeted. Some rival sites saw sudden and sustained declines in traffic by as much as 85% in the United Kingdom, 92% in Germany, and 80% in France after *Google* adjusted its algorithms. These drops were attributed directly to *Google's* demotion policies, which prioritized its own service and placed competitors at a disadvantage. Although some competitors managed to regain partial traffic over time, they could never fully recover to pre-demotion levels, highlighting the lasting impact of *Google's* practices on market dynamics.

The Commission argued that *Google's* actions limited customer choice and stifled innovation by reducing the viability of competitive comparison shopping platforms. While *Google* claimed its service offered a better user experience, the Commission noted that such practices harmed competitors in a way that did not constitute competition on the merits. *Google's* market power as a search engine gave it a unique responsibility not to distort competition unfairly, yet it leveraged this dominance to bolster *Google Shopping's* success, which ultimately led to the antitrust ruling.

The decision required *Google* to end its preferential treatment of *Google Shopping* within 90 days and to ensure that it applied the same ranking processes to all comparison shopping services, including rivals. The Commission warned that non-compliance would

result in additional fines, set at a daily rate of up to 5% of *Alphabet's* global daily turnover. This directive marked a significant step in the EU's approach to enforcing competition in digital markets, setting a precedent for how authorities might handle similar cases of market dominance and self-preferencing in the future.

## … in the mobile operating system (Google Android)

An equally important and widely known antitrust case against *Google* in Europe was conducted for abusing its dominance in the mobile operating system market through its practices related to *Android*. The European Commission (2018) imposed a record-breaking €4.34 billion fine, which was slightly reduced to €4.125 billion by the judgment of the Court of Justice (2022). It is the largest fine ever imposed for a violation of antitrust rules in the EU (Statista, 2024a). The antitrust decision (European Commission, 2018) and judgment (Court of Justice, 2022) identified three key practices as unfair and harmful to competition. Firstly, *Google* required smartphone manufacturers to preinstall both *Google Search* and *Chrome* on *Android* devices as a condition for accessing the *Google Play Store*. This requirement ensured that users would primarily interact with *Google's* search engine and web browser, effectively preserving *Google's* dominant position in search, as most users would naturally use the preinstalled options. By positioning itself as the default search tool, *Google* retained a large share of search-based advertising revenue, limiting customer choice and blocking rivals from reaching a substantial portion of the mobile market.

Secondly, *Google* implemented revenue-sharing agreements with manufacturers and mobile network operators. These agreements rewarded manufacturers for exclusively preinstalling *Google's* services, specifically its search engine, on their devices. In practice, this strategy meant that manufacturers would lose significant financial incentives if they included competing search engines or browsers on their devices. This exclusivity further entrenched *Google's* search monopoly, as it created a strong financial barrier for manufacturers to offer alternative services. Consequently, rivals found it challenging to expand their presence in the mobile search market, as *Google's* financial incentives provided a clear advantage for manufacturers to stick with *Google* products.

Finally, *Google* enforced strict "anti-fragmentation agreements" on manufacturers, preventing them from developing or distributing alternative, modified versions of the *Android* operating system, often called "forked" versions. These anti-fragmentation policies ensured that *Android* remained uniform and prevented fragmentation, but they also stifled innovation and competition by restricting manufacturers' ability to create customized operating systems that could support *non-Google* services. This effectively meant that *Android*, while open-source in theory, operated under constraints that locked out potential competitors. By forbidding manufacturers from developing *Android* alternatives, *Google* limited the ecosystem to a version of *Android* that relied heavily on *Google* services, solidifying its market control and reducing the diversity of mobile operating systems available to customers.

The Commission (2017) argued that these practices collectively harmed competition, not only in the mobile operating system space but also in search and browsing. By leveraging its *Android* platform, *Google* could secure its search engine

and browser's default status across millions of mobile devices in Europe, blocking alternative providers from reaching users. According to the Commission, this conduct was not simply an effort to improve the *Android* experience but a calculated strategy to protect and expand *Google's* search and advertising dominance.

To address these concerns, the Commission (2017) mandated that *Google* cease these anti-competitive practices, requiring it to separate the licensing of *Google Search* and *Chrome* from the *Google Play Store*. This decision was aimed at creating more competitive conditions, allowing other search engines and browsers a fair opportunity to reach mobile users. The Commission also ordered *Google* to revise its revenue-sharing agreements and remove restrictions on *Android* modifications, thereby opening the door for manufacturers to develop more diverse and innovative versions of the *Android* operating system.

This landmark ruling against *Google* set a significant precedent for competition policy in the digital market, especially regarding how regulators view the role of default settings and preinstalled services in the mobile ecosystem. By addressing *Google's* practices with *Android*, the European Commission sent a strong message about the importance of customer choice and fair competition in the rapidly expanding mobile internet market. This decision is expected to have long-lasting impacts, not only for *Google* but for other tech giants with similarly structured ecosystems, as regulators increasingly scrutinize the influence of preinstallation requirements and financial incentives on competitive dynamics in the digital economy.

## Conclusion

This study highlights the pressing need for strong antitrust frameworks in the digital economy, where market dominance by a few major players poses intricate regulatory challenges. Through an analysis of global antitrust cases, we observe a marked concentration of enforcement efforts in high-income regions, particularly within the EU and the East Asia and Pacific. Cases related to mergers and abuse of dominance are predominant, reflecting regulatory efforts to prevent monopolistic behavior and to foster competitive diversity within digital marketplaces.

Managing antitrust issues in digital markets requires specialized expertise among antimonopoly bodies, the judiciary, and investigative teams. Cases in this field often involve complex technical concepts, such as algorithms and data handling processes, which demand an advanced understanding beyond conventional legal standards. This specialized knowledge is essential for regulatory bodies, as well as for judges, who must accurately interpret the nuances of high-tech markets in their rulings. Effective oversight requires coordination with technology experts who can identify and evaluate the sophisticated forms of market abuse that may occur within digital platforms, ensuring that outcomes are well-grounded, precise, and actionable.

In developing countries, such as Serbia and others in the region, the challenges are even more significant due to limited resources and expertise. These nations often face budget constraints that make it difficult to respond quickly to the rapidly evolving digital economy and to implement effective antitrust enforcement. Consequently, developing economies may struggle to establish comprehensive and enforceable competition

policies, risking that monopolistic practices could go unaddressed.

The cases of *Google Shopping* and *Google Android* illustrate the broad impact that major tech firms can have on customer choices, market entry, and innovation. These cases reveal how dominant companies may use their market power across various sectors, which could inhibit competition if not closely monitored. The EU's substantial fines and corrective actions against *Google* reflect a growing international consensus on the need for flexible, enforceable antitrust policies that respond to the specific challenges posed by digital platforms.

This study suggests that policymakers and regulators should continue advancing antitrust approaches, especially in developing regions, to ensure that digital markets remain open, competitive, and beneficial to consumers. Supporting a balanced digital environment will require a long-term commitment to specialized training, international collaboration, and resource investment, enabling even smaller economies to safeguard their markets and encourage competition in the increasingly digital global economy.

# References

Andriychuk, O. (2024). The new EU and UK regimes for regulating competition in digital markets: we finally see what's on the plate – but do we know how to eat it? Journal of Antitrust Enforcement, 12, 195-200. https://doi.org/10.1093/jaenfo/jnae028

Bergqvist, C. (2024). Taking stock of Google's antitrust troubles as the world turns against it. Promarket. https://www.promarket.org/2024/02/19/taking-stock-of-googles-antitrust-troubles-as-the-world-turns-against-it/

Colino, S.M. (2022). The case against Alibaba in China and its wider policy repercussions. Journal of Antitrust Enforcement, 10(1), 217-229. https://doi.org/10.1093/jaenfo/jnab022

European Commission (2017). Antitrust: Commission fines Google €2.42 billion for abusing dominance as search engine by giving illegal advantage to own comparison shopping service – Factsheet. https://ec.europa.eu/commission/presscorner/api/files/document/print/es/memo_17_1785/MEMO_17_1785_EN.pdf

European Commission (2018). CASE AT.40099 Google Android. https://ec.europa.eu/competition/antitrust/cases/dec_docs/40099/40099_9993_3.pdf

European Court of Justice (2022). Press Release No 147/22: Judgment of the General Court in Case T-604/18 | Google and Alphabet v Commission (Google Android). https://curia.europa.eu/jcms/upload/docs/application/pdf/2022-09/cp220147en.pdf

European Court of Justice (2024). Case: Google and Alphabet v Commission (Google Shopping) Case C-48/22 P. https://curia.europa.eu/juris/liste.jsf?language=en&td=ALL&num=C-48/22%20P

Forbes (2024). Top Website Statistics For 2024. https://www.forbes.com/advisor/business/software/website-statistics/

Grubor, A., Milićević, N., & Đokić, N. (2018). Product availability in the context of retail service quality. *Anali Ekonomskog fakulteta u Subotici*, *39*, 75-88. https://doi.org/10.5937/AnEkSub1839075G

Handoyo, S., Suharman, H., Ghani, E.K., & Soedarsono, S. (2023). A business strategy, operational efficiency, ownership structure, and manufacturing performance: The moderating role of market uncertainty and competition intensity and its implication on open innovation. Journal of Open Innovation: Technology, Market, and Complexity, 9(2), 100039. https://doi.org/10.1016/j.joitmc.2023.100039

Harada, M., Nedachi, T., & Shimada, M. (2023). Competition in digital markets. Law Business Research. https://www.nishimura.com/sites/default/files/articles/file/94369.pdf

ICC (2023). Global report on antitrust enforcement in the digital economy.

https://iccwbo.org/news-publications/policies-reports/global-report-on-antitrust-enforcement-inthe-digital-economy/

Javaid, M., Haleem, A., Singh, R.P., & Sinha, A.K. (2024). Digital economy to improve the culture of industry 4.0: A study on features, implementation and challenges. Green Technologies and Sustainability, 2(2), 100083. https://doi.org/10.1016/j.grets.2024.100083.

Kraus, S., Jones, P., Kailer, N., Weinmann, A., Chaparro-Banegas, N., & Roig-Tierno, N. (2021). Digital Transformation: An Overview of the Current State of the Art of Research. Sage Open, 11(3). https://doi.org/10.1177/21582440211047576

Krstić, B., Radivojević, V., & Stanišić, T. (2016a). Measuring and analysis of competition intensity in the sugar market in Serbia. Ekonomika poljoprivrede, 63(2), 389-406. https://doi.org/10.5937/ekoPolj1602389K

Krstić, B., Radivojević, V., & Stanišić, T. (2016b). Measuring market concentration in mobile telecommunications market in Serbia. Facta Universitatis - Series: Economics and Organization, 13(3), 247-260. https://casopisi.junis.ni.ac.rs/index.php/FUEconOrg/article/view/1916/1372

Krstić, B., Stanišić, T., & Radivojević, V. (2016). The impact of innovativeness' factors on the EU countries competitiveness. Industrija, 44(2), 101-116. doi: 10.5937/industrija44-10674

Nicoli, N., & Iosifidis, P. (2023). EU digital economy competition policy: From ex-post to ex-ante. The case of Alphabet, Amazon, Apple, and Meta. Global Media and China, 8(1), 24-38. https://doi.org/10.1177/20594364231152673

Ong, B., & Toh, D.J. (2023). Digital Dominance and Social Media Platforms: Are Competition Authorities Up to the Task?. International Review of Intellectual Property and Competition Law, 54, 527-572. https://doi.org/10.1007/s40319-023-01302-1

Spulber, D. (2023). Antitrust and Innovation Competition. Journal of Antitrust Enforcement, 11(1), 5-50. https://doi.org/10.1093/jaenfo/jnac013

Statista (2024a). Largest fines given to companies for breaking antitrust rules by the EU's Directorate-General for Competition from 2001 to 2018. https://www.statista.com/statistics/1338745/competition-policy-eu-antitrust-fines/

Statista (2024b). Most popular websites worldwide as of November 2023, by unique visitors (in billions). https://www.statista.com/statistics/1201889/most-visited-websites-worldwide-unique-visits/

Stojanović, B., Radivojević, V., & Stanišić, T. (2012). Institutional assumptions of competition policy efficiency (in Serbian). Ekonomski horizonti, 14(2), 121-131. https://doi.org/10.5937/ekonhor1202121S

World Bank (2024). The Global Markets Competition and Technology Digital Antitrust Database. https://dataviz.worldbank.org/views/Global-Digital-Antitrust-Database/Overview?%3Aembed=y&%3AisGuestRedirectFromVizportal=y

**Udeme Henrietta Ukpe**[1]
**Ruth Bazo Ilu**[2]
*Department of Agricultural Economics and Extension,*
*Faculty of Agriculture and Life Sciences,*
*Federal University Wukari, Taraba State, Nigeria*

# ASSESSING THE ROLE OF RICE PRODUCTION IN ALLEVIATING POVERTY IN KARIM LAMIDO LOCAL GOVERNMENT AREA OF TARABA STATE, NIGERIA

## Abstract

*The link between rice production and poverty reduction presents a critical challenge, characterized by disparities in access to resources, technology, and markets, which hinder the realization of its full poverty-alleviating potential. This problem necessitates an in-depth examination of the factors that mediate the impact of rice production on poverty reduction, with a focus on equity, sustainability, and rural development. This study assessed the role of rice production in alleviating poverty for sustainable agribusiness in Karim Lamido Local Government Area of Taraba state, Nigeria. The study found that rice production is profitable in the study area. Annual income and the level of education significantly affect poverty. Further, capital, herbicides, labour and farming experience are the factors that affect rice productivity. Pest and diseases attack, high cost of fertilizer, and high cost of transportation, climate change and bad road were the major impediment to the rice farming. It is recommended to promote integrated pest management practices that involve using biological controls, resistant crop varieties, and reduced pesticide use, encourage the use of organic and locally available fertilizers to reduce dependency on expensive chemical fertilizer, improve rural road infrastructure to reduce transportation costs, encourage climate-resilient farming practices and drought tolerant rice varieties.*

***Keywords:*** *Rice, Poverty, Farmers, Productivity, Profitability, Constraints*

***JEl Classification: Q1, Q12***

# ПРОЦЕНА УЛОГЕ ПРОИЗВОДЊЕ ПИРИНЧА У УБЛАЖАВАЊУ СИРОМАШТВА У ПОДРУЧЈУ ЛОКАЛНЕ САМОУПРАВЕ КАРИМ ЛАМИДО ДРЖАВЕ ТАРАБА, НИГЕРИЈА

## Апстракт

*Веза између производње пиринча и смањења сиромаштва представља критичан изазов, који карактеришу диспаритети у приступу ресурсима,*

---

[1] ukpe@fuwukari.edu.ng, ORCID ID 0000-0001-7633-5112

[2] ORCID ID 0009-0000-7348-5123

*технологији и тржиштима, који ометају реализацију његовог пуног потенцијала за смањење сиромаштва. Овај проблем захтева дубинско испитивање фактора који посредују у утицају производње пиринча на смањење сиромаштва, са фокусом на правичност, одрживост и рурални развој. Ова студија је проценила улогу производње пиринча у ублажавању сиромаштва за одрживи агробизнис у области локалне управе Карим Ламидо у држави Тараба, Нигерија. Студија је показала да је производња пиринча профитабилна у области истраживања. Годишњи приходи и ниво образовања значајно утичу на сиромаштво. Даље, капитал, хербициди, радна снага и пољопривредно искуство су фактори који утичу на продуктивност пиринча. Напад штеточина и болести, висока цена ђубрива и висока цена транспорта, климатске промене и лош пут били су главна препрека узгоју пиринча. Препоручује се промовисање интегрисаних пракси управљања штеточинама које укључују коришћење биолошких контрола, отпорних сорти усева и смањену употребу пестицида, подстицање употребе органских и локално доступних ђубрива да би се смањила зависност од скупих хемијских ђубрива, побољшање инфраструктуре сеоских путева како би се смањили трошкови транспорта, подстичу пољопривредне праксе отпорне на климу и сорте пиринча отпорне на сушу.*

***Кључне речи:*** *пиринач, сиромаштво, фармери, продуктивност, профитабилност, ограничења*

# Introduction

The link between rice production and poverty reduction in Nigeria presents a complex challenge, marked by disparities in access to resources, technology, and markets, hindering the realization of rice production's full potential as a poverty alleviation tool. These difficulties necessitate a comprehensive investigation into the factors that influence the effectiveness of rice production in reducing poverty, accounting for socioeconomic disparities. Considering how rice impacts poverty is vital, given its economic importance. This study can provide insights that inform agricultural and poverty reduction policies in Nigeria. It can help government officials make informed decisions to support rice production as a means of poverty alleviation. Eventually, understanding how rice production affects poverty can lead to interventions and programs that directly improve the livelihoods of vulnerable populations in Nigeria. A noticeable knowledge gap in the relationship between rice production and poverty alleviation is the limited focus on the nuanced impact of sustainable agricultural practices on income levels of smallholder farmers in the context of developing countries, including Nigeria. While various studies have explored the general link between agriculture and poverty reduction (Diao et al., 2017), and some have touched on the role of specific crops in this process, such as rice (Zhang & Zhang, 2021), there is a scarcity of comprehensive research that delves into the effectiveness of sustainable rice production practices as a means to alleviate poverty at the household level in Nigeria. Given the country's substantial rice production and the global emphasis on sustainable agriculture as a tool for poverty reduction, further investigation in this area is warranted.

Poverty alleviation is a pressing issue in a country like Nigeria endowed with immense potential and rich resources that paradoxically, harbors a significant portion of its population living below the poverty line. With an estimated population of over two hundred million people, Nigeria is not only the most populated African country but is also marked by persistent and deep-rooted poverty, despite its vast oil wealth and potential for agricultural development (World Bank, 2021). Rice production plays a pivotal role in global agriculture, serving as a staple food for a significant portion of the world's population. Beyond its nutritional importance, rice cultivation has far-reaching socio-economic implications, particularly in the context of poverty alleviation. As the primary food source for over half of the world's population, rice holds a unique position in the battle against poverty, as it directly impacts the livelihoods of millions of smallholder farmers and low-income households (Food and Agriculture organization (FAO), 2021).

In Nigeria, rice production has emerged as a critical driver in the fight against poverty. As the most populous country in Africa, with a rapidly growing population, the significance of rice as a staple food cannot be overstated. Its role extends beyond mere sustenance; rice cultivation holds immense potential to uplift the socio-economic conditions of the rural poor (Ukwuru, 2018). The Nigerian's government prioritized rice production in the past 7 years given its importance as a staple food in Nigeria. According to FAO (2021) significant progress has been recorded so far. For instance, rice production in Nigeria reached a peak of 3.7 million tons in 2017, and was estimated to amount to five million metric tons in 2021. Between 2010 and 2021, rice crop increased overall. In terms of local production, rice is now one of the main cereals produced by Nigerian farmers, and it covers both the upland and the lowland swamps, depending on the variety.

Understanding the multifaceted role of rice production in poverty reduction is essential for aiming to promote sustainable agricultural development and poverty alleviation. This study sets the stage for an exploration of how rice production in Nigeria is serving as a powerful catalyst for poverty alleviation, presenting an opportunity to improve the lives of millions. Specifically, this study assessed the profitable of rice production; ascertains the determinants of poverty, analyse the factors influencing rice production, and identify the constraints faced by rice farmers.

## Methodology

### The Study Area

This study was carried out in Karim Lamido Local Government Area of Taraba State which is located in North-eastern Nigeria. It is a town bounded to the south by the Benue River and flows through Eastern side of Lau River, it shares boundary with Gombe State to the North, Plateau to the West and Ardo kola Local Government Area to the East. It covers a land mass of approximately 6,620km$^2$ with a population of 195,844 and lie between latitude $8°$ 33'-10°21'N and longitude 10°21'-11°24'E. It has two distinct seasons namely; rainy which extends from May to October and dry which extends from November to April with an average temperature and precipitation of 28°C and 1058mm respectively.

*Figure 1: Map of Karim Lamido Local Government Area*
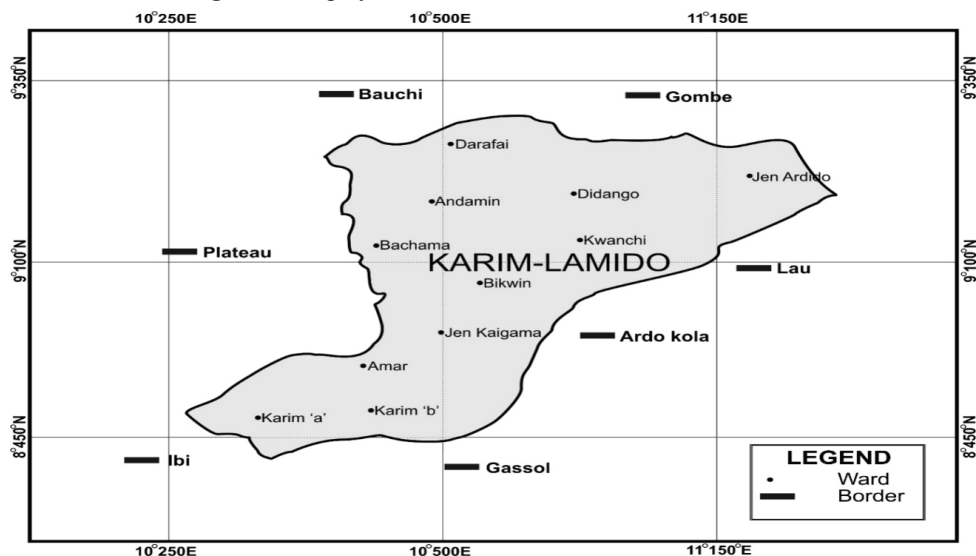


*Source: Karim Lamido Local Government Area Secretariat*

## Sampling Procedure

A multi-stage sampling technique was used to select the rice farmers. Firstly, purposive selection of five wards which are Jen, kwanchi, Didango, Karim 'a' karim 'b' and Didango noted for high production of rice out of the 11 wards, the second stage involved a random selection of four villages were selected from each ward making a total of 20 villages. Thirdly, a random selection of 2% rice farmers was selected from each of the village to make a total of one hundred and twenty (80) rice farmers as the sample size.

## Data Collection

Primary data was collected randomly with a well-structured questionnaire. The data collected were the socioeconomic characteristics of rice farmers, cost and return of rice production, determinants of poverty, the factors influencing rice production and the constraints faced by rice farmers in the study area.

## Analytical Techniques

Descriptive statistics and inferential statistics were used to analyze the data collected. Descriptive statistics was used to analyze the socioeconomic characteristics and constraints faced by rice farmers. Gross margin was used to analyze assess the profitability of rice production. Logit regression analysis was used to ascertains the determinants of poverty, and ordinary least square was used to assess the factors influencing rice production.

# Model specification

## Gross Margin Analysis

Gross margin (GM) = TR – TVC ----------------------------------------------------------- ------------------------------------- (1)

TR = Total Revenue

TVC = Total Variable Cost

TR=Q *Py -------------------------------------------------------------------------------------- ------------------------------------- (2)

Qy = quantity sold

Py = unit price

## Binary Logit Model

Logit (P) =a+ $b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8$ ------------------- ----------------------------------- (3)

Y= poverty status (poor =0 non poor =1)

b =constant

$X_1$= annual income (₦)

$X_2$= quantity of rice (kg)

$X_3$=number of feeding per day

$X_4$=quality of house lived in (plastered and roofed= 1, not plastered and roofed = 0)

$X_5$ = access to clothing (bought clothing in a year=1, not bought in a year = 0)

$X_6$ = level of education (years)

$X_7$= dependency ratio (%)

$X_8$ =access to medical service (access to medical service=1, no access=0)

e= error term

$$\text{Poverty status} = \frac{Average\ annual\ income\ from\ rice\ production}{number\ of\ days\ in\ a\ year\ (365)}$$ ----------------------------- -----------------------

$$\text{Dependency ratio} = \frac{Total\ number\ of\ peopl\ aged\ between\ 0-4\ and\ above\ 65}{total\ number\ of\ people\ aged\ between\ 15-64} \times 100$$ --------- ---------------------------------- (5)

If poverty status is < \$1.90 which is ₦826.84 at the rate of ₦435.18 (Dollar to Naira exchange rate), the farmer is poor and if the poverty status is ≥ \$1.90 then the famer is non poor.

## Head Count Index

Poverty was determined by the most widely-used measure which is the headcount index, which simply measures the proportion of the population that is counted as poor, often denoted by $P_0$. Formally,

$$P_o = \frac{N_p}{N}$$ --------------------------------------------------------------------------------------------------------------------------- (6)

Where;

$N_p$ = number of poor

N = total population

## Multiple Régression Model

$Y=f(X_1,X_2,X_3,X_4,X_5,X_6,X_7,X_8,X_9)$ ----------------------------------------------------------------------------------------------- (7)

Where $Y=b_0+ b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 +\mu$

Where Y=Output (in Kg)

$b_o$=constant

$X_1$=fertilizer(kg)

$X_2$=education(years)

$X_3$=capital (₦)

$X_4$=farm size(hectares)

$X_5$=herbicides(kg)

$X_6$=seed(L)

$X_7$=labour(man/day)

$X_8$=experience(years)

$X_9$=age(years)

µ=Disturbance term assumed to be normally distributed with zero mean and constant variance.

The explicit representation of the model was analysed using four functional forms: the linear, exponential, semi log and double log functions.

a. linear form: $y= a+ b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8+u$

b. Exponential form : $Y = b0 +b1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 +b_7X_7 + b_8X_8+ et$

c. Semi-log form : $Y= a + b_1logX_1 + b_2logX_2 + b_3logX_3 + b_4logX_4 + b_5logX_5 + b_6logX_6 +b_7logX_7 + b_8logX_8$

d. double log form : $log Y= = a + b_1logX_1 + b_2logX_2 + b_3logX_3 + b_4logX_4 + b_5logX_5 + b_6logX_6 +b_7logX_7 + b_8logX_8$

## Results and Discussion

### Probability of paddy rice production

The profitability of paddy rice farmers in the study area is presented on Table 12. The result shows that total variable cost per hectare was ₦189098.75 and total revenue was ₦687962.5 per hectare. The gross margin obtained was ₦498663.75 per hectare. The return on investment was ₦2.64. This implies that for every ₦1 invested by a farmer in rice production, the farmer is expected to earn ₦2.64 returns. It can be concluded therefore that that paddy rice production in karim lamido Local Government Area in Nigeria was profitable. This result is similar to the findings of Djomo et al. (2020).

*Table 12: Gross Margin Per Hectare of Paddy Rice Producers*

| Item | Cost | Percentage(%) |
|---|---|---|
| **Variable Cost** | | |
| Labour cost | 68246.25 | 43.96 |
| Fertilizer Cost | 49475 | 24.18 |
| Seed Cost | 24781.25 | 16.48 |
| Herbicide Cost | 37106.25 | 8.79 |
| Bag pack Cost | 9490 | 6.59 |
| **Total Variable Cost** | 189098.75 | |
| **Revenue** | | |
| **Total Revenue** | 687962.5 | |
| **Gross Margin(GM)** | 498663.75 | |
| **Return on investment** | $\dfrac{GM}{TVC}$ | 2.64 |

*Source: Authors' computation, 2023*

## Determinants of poverty

The determinants of poverty are shown in Table 13. The regression in the equation explains 75.93% of the total variation in the household. Annual income and level of education are the two significant variables at 1% and 5% respectively. For a given household, the odds of a farmer being poor decreases with an increase in annual income. This implies that as income increases, farmers may experience improved social standing and participation in decision making processes within their communities, potentially reducing social disparities and exclusion. Also, with a higher income, farmers may find it easier to access credit or loans, which can be used to expand their farming operations or start new income generating activities. This finding agrees with Haanpaa et al. (2019). The odds of a farmer being poor also decreases with an increase in access to education. Education can provide farmers with knowledge and skills to adopt modern and sustainable farming practices, leading to increased crop yields and better farm management, which can help lift them out of poverty. This finding agrees with Hegedus (2018).

*Table 13. Logistic Regression of Determinants of Poverty*

| Poverty status | Odds ratio | Standard error | z ratio |
|---|---|---|---|
| Constant | 0.000043 | 0002566 | -1.63 |
| Annual income | -0.000028*** | 0.00000882 | -3.20 |
| Rice quantity | 1.003995 | 0.0082161 | 0.49 |
| Feeding | 0.6773376 | 1.367364 | -0.19 |
| House quality | 1.346364 | 2.292283 | -0.17 |

| | | | |
|---|---|---|---|
| Clothing | 0.8949599 | 1.262417 | -0.08 |
| Level of education | -0.078656** | 0.08783335 | -2.28 |
| Access to medical service | 0.5597052 | 1.194565 | -0.27 |
| Dependency ratio | 1.043486 | 0.0370805 | 1.20 |
| Pseudo R$^2$ | 0.7768 | | |
| Chi $^2$ | 75.93(0.0000) | | |

*Source: Data analysis result, 2023*

## Factors Influencing Rice Production

The result of factors influencing rice production in the study area is presented on Table 14. Out of the three functional models, semi-log model was the best as it was observed from the t values as well as appropriateness of their signs with relation to a priori expectation and the coefficient of determination $R^2$. The findings show that the coefficient of determination ($R^2$) is 0.679 indicating that 67.9% of the variation in the output of rice is explained by the explanatory variables. Also, this finding shows that capital, herbicides, labour and farming experience significantly affect rice output. Specifically, the coefficient of capital is positive and significant at 10%. This implies that a unit increase in the capital invested will increase rice output by 1311.27kg. This is similar to the findings of Omaore and Oyediran, (2020) revealed that inadequate finance is a significant factor influencing rice productivity. Similarly, the coefficients of herbicides and farming experience are significant at 5%. This implies that a unit increase in the quantity of herbicides and number of years of experience will increase rice output by1663.14kg and 1254kg respectively. The positive relationship between herbicides and rice output is due to the its proper application and the role that its played in control weed infestations, reducing competition for resources and allowing crops to thrive. This is in tandem with Cordelia and Edwin (2022) who revealed that herbicides significantly influence rice productivity. Finally, the coefficient of labour labour is positive and significant at 1%. Increased labour availability especially during peak seasons, can lead to improve crop planting, weeding, and harvesting resulting in higher productivity. This study is in line with the findings of Musaba and Mukwalikulu, (2019). However, the coefficients of seed, fertilizer and farm size were not significant. Therefore, they have no significant effect on rice productivity.

*Table 14: Regression result of factors affecting the production of rice in the study area*

| Variables | Coefficient | Standard error | t-statistics |
|---|---|---|---|
| Constant | -21780.87223 | 4820.864 | -4.518 |
| Fertilizer | 477.177 | 556.923 | 0.858 |
| Capital | 1311.273* | 725.221 | 1.808 |

| | | | |
|---|---|---|---|
| Farm size | -2.475 | 996.707 | 0.002 |
| Herbicides | 1663.142** | 726.050 | 2.291 |
| Seed bags | -51.491 | 1370.785 | 0.038 |
| Labour | 3298.752*** | 748.564 | 4.407 |
| Farming experience | 1253.995** | 512.052 | 2.449 |
| Prob > F | 0.000 | | |
| $R^2$ | 0.679 | | |
| Adjusted $R^2$ | 0.648 | | |

***, **, * significance at 1%, 5% and 10 % respectively
*Source: Data analysis result, 2023*

## Constraints faced by paddy rice farmers

The constraints faced by paddy rice farmers is presented on table 15 in order of their ranking. The result identifies that pest and diseases attacks (88.75%), high cost of fertilizer (72.5%), and high cost of transportation (68.75%) were the major impediment to the rice farming ranking 1st, 2nd and 3rd respectively. This study agrees with the findings of Omoare and Oyediran, (2022) who revealed that pest and disease and corruption ridden fertilizer distribution system affects rice production in Nigeria and it is due to high relative humidity in the rain forest region. This result is also in consonance with the finding of (Ayodele, 2016) who reported that high cost of transportation is a marketing constraint affecting rice production. Poor yield (46.25%) has been attributed to unfavourable climate condition and poor soil quality. This agrees with Abibou et al. (2017). Inadequate financing (41.24%) and nonavailability of quality seeds were other constraints to rice farming. This study is in line with the findings of Akimbeli et al. (2018) who revealed that inadequate funds was one of the constraints to rice production. The least constraints faced by rice farmers in the study area were lack of quality seeds (35%), poor milling equipment (30%), and low market price (18.75%). Similar study was conducted by Yenyinou et al. (2022) who revealed that the lack of a sales market, poor milling equipment, were constraints found only in the north and south of Benin. Low market price caused by poor farm gate price and fluctuation during off season tends to reduce farmer's share and level of profit accruing to them.

*Table 15: Distribution of the constraints faced by rice farmers*

| Constraints | Frequency | Percentages | Rank |
|---|---|---|---|
| Pest and diseases | 71 | 88.75 | 1st |
| High cost of fertilizer | 58 | 72.50 | 2nd |
| High transportation cost | 55 | 68.75 | 3rd |
| Climate change | 46 | 57.50 | 4th |
| Bad road network | 46 | 57.50 | 4th |

| Inadequate extension services support | 44 | 55.00 | 6th |
|---|---|---|---|
| Lack of storage facilities | 40 | 50.00 | 7th |
| Poor yield | 37 | 46.25 | 8th |
| Inadequate finance | 33 | 41.25 | 9th |
| Non availability of quality seed | 28 | 35.00 | 10th |
| Poor milling equipments | 24 | 30.00 | 11th |
| Low market price | 15 | 18.75 | 12th |

*Source: Authors' computation, 2023*
**Note:** Multiple responses recorded

## Conclusion

This study assessed the role of rice production in alleviating poverty for sustainable agribusiness in Karim Lamido Local Government Area of Taraba state, Nigeria. The study found that rice production is profitable in the study area. Annual income and the level of education significantly affect poverty. Further, capital, herbicides, labour and farming experience are the factors that affect rice productivity. Pest and diseases attack, high cost of fertilizer, and high cost of transportation, climate change and bad road were the major impediment to the rice farming. It is recommended to:

i. Promote integrated pest management practices that involve using biological controls, resistant crop varieties, and reduced pesticide use.

ii. Promote the use of organic and locally available fertilizers to reduce dependency on expensive chemical fertilizer.

iii. Improve rural road infrastructure to reduce transportation costs.

iv. Promote climate-resilient farming practices and drought tolerant rice varieties.

v. Advocate for road maintenance and construction projects in rural areas.

vi. Strengthen agricultural extension services to provide farmers with knowledge and guidance.

vii. Establish community based and centralized storage facilities to reduce post-harvest losses.

## References

Abibou, N., Mathias, B., Frank, E., Ibnou, D., Thomas, G., Atsuko, T., Kalimuthu, S., Jonne, R., Jean- Marshal, J., Cyriaque, A., Zackarie, S., Henri, G., Famara, J., Ralph, k., Wilson, D., Sekou, K., Nianankoro, K., Illiassou, M., Oadele, S.B., Madiama, C., & Kazuki, S. (2017). Variability and Determinants of Yields in Rice Production system of West Africa. *Field Crop Research.*207, 1-12. https://doi.org/10.1016/j.fcr.2017.02.014

Akimbeli, A. I., Aminu, O.O. & Sokeye, I.G. (2018). Constraints Encountered on Rice Production by Rice Farmers in Ogun State, Nigeria. *Nigerian Journal of Rural Sociology*, 8(1), 85-92.

Ayodele, O. J. (2016). Economic Analysis of Irrigated Rice Production in Kura Local Government Area of Kano State, Nigeria. A dissertation submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria, in partial fulfillment of the requirements for the award of Master of Science degree in Agricultural Economics department of agricultural economics and rural sociology faculty of agriculture ahmadu bello university zaria, kaduna state nigeria.

Cordela, N. O., and Edwin, O. (2020). Analysis of the Factors Influencing Productivity of Rice Farms in Ebonyi State, Nigeria. *International Journal Of Agricultural science.*2(2):316-325

Diao, X., Aduayom, D., & Ulimwengu, J. (2017). Assessing the potential impact of growth in agricultural productivity and infrastructure in Africa: A CGE analysis. IFPRI Discussion Paper 01634. [http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/131771] (http://ebrary.ifpri.org/cdm/ref/collection/p 15738coll2/id/131771). Accessed on October 22nd 2023

Djomo Choumbou Raoul Fani, Ukpe Udeme Henrietta, Oben Njock Emmanuel,& Gbadebo Odularu. (2020)**.** Productivity Analysis Among Smallholder Rice Farmers: Policy Implications for Nutrition Security in the West Region of Cameroon. In G. Odularu (Ed.), Nutrition, Sustainable Agriculture and Climate Change in Africa, Issues and Innovative Strategies(117-132), Springer Nature: Switzerland AG, Gewerbestrassehttps://doi.org/10.1007/978-3-030-47875-9_9

Food and Agriculture Organization of the United Nations (FAO). (2021). "Rice Market Monitor" [https://www.fao.org/3/cb2586en/cb2586en.pdf](https://www.fao.org/3/cb2586en/cb2586en.pdf). Accessed on October 22nd 2023

Haanpaa, L., Kuula, M., & Hakovirta, M. (2019). Social relationships, child poverty, and children's life

satisfaction. *Social sciences*, 8(2), 35. https://doi.org/10.3390/socsci8020035

Hegedus, E. (2018). Evaluating the relationships between poverty and school performance. https://www.nwea.org. Accessed on October 22nd 2023

Musaba, E. C., & Mukwalikuli, M. (2019). Socioeconomic Factors Affecting Rice Production among Small Holder Farmers in Lukulu District, Western Zambia. *International Journal of Research in Agricultural Sciences*.5, 35-40. http://dx.doi.org/10.20431/2454-6224.0511005

Omaore, A. M, & Oyediran, W. O. (2022). Factors Affecting Rice Farming Practices among Farmers in Ogun and Niger State, Nigeria. *Journal of Agricultural Extension,*. 24(2), 92-103. https://dx.doi.org/10.4314/jae.v24i2.10

Ukwuru, M. (2018). "Rice Production and Food Security in Sub-Saharan Africa: A Case Study of Nigeria." In Food Security and Climate Change in Sub-Saharan Africa (pp. 43-65). Springer.

Work Bank. (2021). Nigeria Overview. https://www.worldbank.org/en/country/nigeria/overview. Accessed on October 22nd 2023

Yêyinou, L. E., Charlemagne, D. S. J., Gbemavo, Gustave, D., Ebenezer, E., Azize, O., Joelle,. T., Cyrille, T., Paulin, S., and François, S. (2022). Characterization of Rice Farming Systems, Production Constraints and Determinants of Adoption of Improved Varieties by Smallholder Farmers of the Republic of Benin. *Scientific Reports, 12.3959.* https://doi.org/10.1038/s41598-022-07946-2.

Zhang, C., & Zhang, L. (2021). Rice Production and Rural Poverty Alleviation in China: A Nonparametric Approach. *Sustainability*, 13(1), 66. [https://www.mdpi.com/2071-1050/13/1/66] (https://www.mdpi.com/2071- 1050/13/1/66)

**Stefan Ugrinov**[1]
**Dragan Ćoćkalo**[2]
**Mihajl Bakator**[3]
*Tehnical Faculty "Mihajlo Pupin" Zrenjanin*

# OPTIMIZATION AND SUSTAINABILITY OF SUPPLY CHAINS IN THE FOOD AND BEVERAGE INDUSTRY

## Abstract

*This paper presents the strategies to improve and enhance the sustainability of food and beverage supply chain. It is a systematic literature review to address the increasing needs of efficiency and greenness in supply chain in food and beverage industry. The main emphasis is placed on the key strategies to enhance the inventory management and operational efficiency of the food and beverage supply chain with the implementation of the Internet of things (IoT) technology, blockchain and big data analytics. Other focus is on the sustainable strategies to reduce the waste, and use the renewable energy sources, waste reduction programs and the principles of circular economy to enhance the sustainability of the supply chain in food and beverage industry.*

*One of the main conclusions of this paper is that integration and optimization in supply chains can significantly improve all performance metrics (efficiency, cost reductions, brand, etc), and can generate a competitive advantage in the highly competitive food and beverage industry. Despite the trend of big businesses having their own supply chains, the study points out the importance of collaboration among all supply chain partners, e.g. suppliers, manufacturers, distributors and retailers, if the product maintains its quality and is produced in an efficient way.The paper presents practical implications on how implementing these strategies can indeed result in higher customer satisfaction, reduced waste, and a stronger competitive position in the food and beverage industry*

***Key words:*** *Optimization, Sustainability, IoT, Big Data, Supply chain, Circular economy*

***JEL classification:*** *L6*

# ОПТИМИЗАЦИЈА И ОДРЖИВОСТ ЛАНАЦА СНАБДЕВАЊА У ИНДУСТРИЈИ ХРАНЕ И ПИЋА

## Апстракт

*Овај рад представља стратегије за побољшање и унапређење одрживости ланца снабдевања у индустрији хране и пића. Овај рад представља систематски*

---

1 stefan.ugrinov@tfzr.rs ORCID ID https://orcid.org/0009-0000-7206-655X

2 dragan.cockalo@tfzr.rs ORCID ID https://orcid.org/0000-0003-2085-5420

3 mihalj.bakator@tfzr.rs ORCID ID https://orcid.org/0000-0001-8540-2460

*преглед литературе који адресира све веће потребе за ефикасношћу и еколошком прихватљивошћу у ланцима снабдевања индустрије хране и пића. Главни акценат је стављен на кључне стратегије за унапређење управљања залихама и оперативне ефикасности ланца снабдевања хране и пића путем имплементације технологије Интернета ствари (ИоТ), блокцхаина и аналитике великих података. Други фокус је на одрживим стратегијама за смањење отпада и коришћење обновљивих извора енергије, програма за смањење отпада и принципа циркуларне економије како би се побољшала одрживост ланца снабдевања хране и пића.*

*Један од главних закључака овог рада је да интеграција и оптимизација у ланцима снабдевања могу значајно побољшати све перформансе (ефикасност, смањење трошкова, бренд, итд.) и генерисати конкурентску предност у високо конкурентној индустрији хране и пића. Упркос тренду да велике компаније имају сопствене ланце снабдевања, студија указује на важност сарадње између свих партнера у ланцу снабдевања, нпр. добављача, произвођача, дистрибутера и малопродаја, како би производ задржао свој квалитет и био произведен на ефикасан начин. Рад представља практичне импликације како примена ових стратегија може резултирати већим задовољством купаца, смањењем отпада и јачом конкурентском позицијом у индустрији хране и пића.*

***Кључне речи:*** *Оптимизација, Одрживост, ИоТ, Биг Дата, Ланци Снабдевања, Циркуларна економија*

## Introduction

Food and beverage supply chains help to provide consumers with products on time and in the correct manner. It consists of a large number of complex processes and activities, ranging from raw material production to processing and distribution to the end consumer. These supply chains are very essential for the processing, packaging, and distributing of food and beverage products.

More and more important is the need to find sustainable and efficient methods for supply chain optimization, especially in the face of the rising demand for fresh and high-quality food products and the growing competition in the food market (Seuring and Müller 2008).Thanks to the development of new technologies like the Internet of Things (IoT) and blockchain, as well as the utilisation of big data analytics, companies gain more control over their stocks, can predict the demand much better and reduce the waste (Wong et al., 2024). Additionally, these technologies support food quality and safety by empowering the stakeholders to control the complete supply chain and monitor their products at every step (Brandenburg et al. 2014).

Along with this optimization, sustainability has emerged also as an important objective of the food and beverage supply chain (Ageron et al. 2012). Sustainability refers to the implementation of practices aimed at minimizing the consequences of the food production process on the environment and on society (Guang Shi et al. 2012); these include waste reduction, the use of renewable energy sources and environmentally-friendly production, the reduction of greenhouse gas emissions, animal welfare, fair working conditions and

responsible consumption (Ferreira et al. 2023). Over the years, many companies have started viewing sustainable practices as a crucial mission not only in response to regulatory requirements of consumer pressure, but also in order to reap long-term benefits in terms of reduction of costs and strengthening of the brand.

Combining optimization and sustainability processes for supply chains is a difficult challenge, but also an opportunity to improve the operation re-engineering process to improve the business in the food industry (Kamble et al. 2020). The objective of this paper is to delve into how we can combine optimization and sustainability to improve the performance and gain competitive advantage of food and beverage supply chains.

Supply chains can be quite complex, and as a result, numerous factors impact the effectiveness and productivity of the system. These include fluctuating prices of raw material, seasonal variations in production volume, and logistical imperatives such as storage and delivery of produce to the consumer (Bešić et al., 2021). Traditional supply chain management methods are often insufficient to address some of these challenges and so there is an increasing focus on the use of innovative tools to make better decisions and to do it more quickly (Quintana & León, 2021). Some of these advanced analytical tools can improve demand forecasts, optimise delivery routes and inventories, and all of this can be done in a way that reduces costs and improves service (Ahi and Searcy 2013).

Besides technological change, social and environmental factors are also important. Due to the growing awareness of environmental problems and protection, issues of sustainability in supply chains are gaining in importance (Bešić et al., 2022). Companies that implement ecological approaches such as reducing carbon emissions, recycling, and using sustainable materials are not only saving the environment but also benefit from an improved brand image due to consumers who increasingly prefer these products (Shin & Cho, 2022).

Implementing optimization alongside sustainability goals will pay off in the long run. More specific example: Using renewable energies will not only reduce the ecological footprint, but also lower electricity costs in the long run. A more efficient inventory management generates less losses, which will result in a reduction of waste, and as a result more profit, and also in less negative environmental impact(Cvetkovic et al., 2017). This paper will discuss the main approaches and strategies to implement these goals and analyze some concrete examples from practice.

The paper is organized as follows: after this introduction, the methodology chapter explains the search criteria and processes employed for selecting and coding the relevant literature, while the review results chapter undertakes a thematic analysis of the findings, putting forward key strategies, impacts and knowledge gaps. The discussion summarizes those findings while drawing implications for theory, practice and policy. The conclusion contextualises the main themes and reflects on the research implications for the debate on sustainable development of the food and beverage industry.

As guidelines for research, this paper addresses four main research questions:

1. Considering the food and beverage industry, what are the main strategies that can be adopted to optimise supply chains? What are their effects on business efficiency and cost?
2. How can food and beverage supply chains best engage with environmental and social sustainability, and what methods are the most effective for doing so?
3. What are the main challenges in implementing strategies for optimization and sustainability in food and beverage supply chains, and how do successful

companies overcome them?

4. What is the role of optimization alongside sustainability in food and beverage supply chains and how does it contribute to the long-term competitive position and profitability of firms?

Four main sections excluding the introduction and conclusion are included in this paper. First, more detailed explanations of the research methodology are provided. Then, the results of the literature review process will be presented.

## Methodology

### Literature Review and Selection Process

For conducting an adequate literature review, the research was conducted using two search engines: KoBSON and Google Scholar. The field of academic research that focuses on circular supply chain management model, the practices of supply chain, circular economy, sustainable innovation in the field of food and beverage supply chain were initially searched, and the articles were downloaded to conduct the review. Then, the articles with duplication were deleted. A strict selection process was carried out for publishing academic articles which mention relevant topics and information for the systematic literature review, so any other literature sources which are unwanted will be disregarded.

### Eligibility Criteria for Literature

The interval for the search was between the year 2014 and 2024. All of the articles are written in scientific and peer-reviewed journals. The major topics discussed in the article are:

- Supply chain management in the food and beverage industry
- Management in circular supply chains
- Circular economy
- Food and beverage industry
- Sustainability and innovation

Articles not taken into consideration during the review were those published in predatory journals. Most scientific journals publish literature on supply chains, textile industry, innovation and circular economy, and sustainability.Source for the specific literature used can be found in the 'References' section.

## Results and discussion

### Literature Review and Categorization of Results

The results and discussion section delves into the critical findings from our review, focusing on the optimization and sustainability of supply chains in the food and beverage industry. This section is organized into key thematic areas, including collaboration among supply chain partners, technological innovations, and strategies for waste reduction, as well as addressing challenges and presenting actionable solutions. By exploring these aspects, we highlight the interconnection between supply chain efficiency, environmental sustainability, and long-term business competitiveness. Each subsection provides insights into specific

strategies, technologies, and practices that drive improvement, offering a comprehensive understanding of how companies can balance operational demands with sustainability goals.

1. Cooperation among supply chain partners, including suppliers, manufacturers, distributors and retailers, is essential for the success of SCM (Huang et al., 2020). The sharing of information freely enables improved planning and coordination, ultimately resulting in increased efficiency and lowered risks of supply chain disruptions.. For instance, in the food and drinks industry, cooperation among partners ensures product availability at the point of sale in the best possible condition and uncompromised quality and freshness (Gichuru et al., 2015). COLLABORATION IN SUPPLY CHAINS

2. Supply chain optimization (SCM) refers to a range of strategies and methods that help companies manage their resources efficiently, reduce costs, minimize waste, improve the quality of services and products (Govindan et al., 2015). The basic concepts of SCM optimization are the management of stocks, efficient logistics, collaboration among supply chain members, and tracking and analyzing technologies. Food and beverage companies in particular heavily rely on efficient supply chains, due to the fact that products are perishable and have specific storage and transportation conditions. SCM plays a crucial role in making sure that products reach consumers fresh and safe to be consumed (Rahbari et al., 2023). SUPPLY CHAIN OPTIMIZATION

3. In the food and beverage industry, sustainable supply chains encompass a natural resource utilization concept that aligns with economic, environmental, and social goals. The goal of sustainable supply chains is to minimise environmental damage and maximise economic and social responsibility. One of these is waste reduction due to more efficient inventory management, usage of recycled raw materials, and many others.In order to implement sustainable supply chains, the circular economy principles should be taken into considerations. Such an approach to the economy assumes reusing and recycling of resources instead of disposing them as garbage. As a result, new raw materials will not be produced and waste will not be generated (Haseli et al., 2024). SUSTAINABLE SUPPLY CHAINS.

4. Incorporating sustainable energy sources at various points in the supply chain can improve the overall sustainability of the supply chain. Food storage and transport utilise a lot of energy, so shifting from energy production of fossil fuels to renewable energy resources, such as solar or wind energy, can to reduce the quantity of carbon dioxide emissions.(Palazzo & Vollero, 2022). Furthermore, shortening the distance of transporting food and using environmentally friendly vehicles can reduce the emission of various pollutant gases, and optimize the efficiency of supply chain transport, which is beneficial to improving the ecological sustainability of the supply chain (Adams et al., 2023). SUSTAINABLE SUPPLY CHAIN.

5. Technological innovations such as IoT and blockchain can transform supply chains in the food, beverages and related industries (Sarkis et al., 2011). Real-time monitoring and information sharing among supply chain members are possible through the use of Internet of Things (IoT) and information and communication technologies (ICT), enabled by sensors, internal systems, computers, and mobile devices.(Rejeb et al., 2019). The Internet of Things (IoT) that relies on sensors,

along with these technologies, can track the whereabouts of perishable items throughout the entire supply chain, beginning from the point of production. (Ansari & Kant, 2017). Sensors, for instance, identify the temperature and humidity levels in warehouses and during transport, which is of vital importance for the quality and freshness of food. The data are collected automatically and can be quickly analyze d and acted upon, preventing, for instance, perishable commodities' deterioration caused by inappropriate storage conditions or delays in delivery (Jagtap et al., 2021). TECHNOLOGICAL INNOVATIONS

6. Blockchain reduces risk in the food and beverage supply chain by making processes more transparent and secure. Each transaction in the food supply chain can be recorded and verified through blockchain, making it easy to trace products, check certificates, and examine the authenticity of information The consumer can scan a QR code on a particular product and trace the product's entire journey from farm to table, reassuring himself that it is safe and good. The traceability through blockchain helps curtail fraudulent activities in the food industry which can be detrimental to our health. Blockchain helps curb the issue of counterfeit products in the food supply chain as well (Subramanian et al., 2020). SUPER TECHNOLOGY INNOVATIONS

7. The application of big data analytics to improve supply. Using the information extracted from big data analytics, supply chains can optimise the supply and demand and minimize the number of required inventories.For instance, with the help of analytical tools, companies can establish patterns such as the seasonal trends of a certain product. By combining these patterns with sales data in previous years, the current situation of the market can be anticipated. By doing so, issues like insufficient inventory and the accumulation of excess materials can be prevented, thus improving production and storage efficiency (Irfan & Wang, 2019). BIG DATA ANALYTICS

8. An organisation can perform deep analysis of supply chain performance using Big Data analytics to help identify the bottlenecks and to reduce the cost and to improve the overall performance (Talwar et al., 2021). The company can make decisions regarding the delivery of their goods through transport data so that can optimise delivery routes thus reducing the time and cost of delivery (Kholaif et al.,2023). Big data analytics will help to find the best suppliers, to increase the efficiency of relationships with customers, and to the marketing strategy that can be designed according to the deep insights of consumer behaviour. BIG DATA ANALYTICS

9. Advancement of technology and digitalisation not only fails to increase efficiency and transparency of the supply chains, but also contributes to an overall agility and quicker response to market changes, as IoT, blockchain and the use of big data analytics can further reduce the costs for companies of the food sector, improve the quality of service and the products, and boost the global satisfaction of end consumers (Alkhatib, 2023). BIG DATA ANALYTICS

10. Since the manufacturing of food, beverage and their packagings require various resources, supply chain optimization (SCM) could help food and beverages companies to be more effective in using these resources. The application of Just-In-Time (JIT) methods reduces storage costs and the risk of product spoilage

by decreasing inventories and stocks. The food sector greatly benefits from this reduction, particularly because shelf lives are frequently restricted. (Stritto & Schiraldi, 2013). SUPPLY CHAIN OPTIMIZATION

11. Applying an optimised supply chains can directly decrease carbon footprint of a company. Reducing energy usage and gas emission are the result of more efficient production and distribution process (Stanković et al., 2022). Optimising delivery flows though transportation management software (TMS) will lead to a lower total distance of travel by vehicles which reducing fuel consumption and carbon dioxide discharge. Using vehicles with environmentally friendly fuel, like electric or hybrid vehicles, can also help to decrease the environmental impact (Thakur , 2021). SUSTAINABLE SUPPLY CHAINS

12. Renewable energy sources are also part of sustainable supply chains – for example, warehouses or production facilities can be powered by solar energy or other renewable sources. Energy efficiency is another important pillar for sustainability, for instance, LED lighting or energy-saving heating, ventilation and air conditioning (HVAC) systems can improve the ecological performance of a company (Schulman et al, 2021). SUSTAINABLE SUPPLY CHAINS

13. When applied to supply chains, circular economy principles can reduce the ecological footprint even more. Reducing the extraction of new raw materials and the amount of waste sent to landfills can be achieved by recycling and reusing products. For example, a company that offers programmes for the return of packaging and the recycling of used materials can extend the life cycle of the product and reduce waste (Read et al., 2020). RESOURCE AND WASTE MANAGEMENT

14. Moreover, next to enhancing the ecological performance of the company, implementing more sustainable supply chains can also improve the competitiveness of the company, because of the importance that consumers attribute to environmental issues, and the importance that both actors in B2B and B2C encounters attach to products produced sustainably (Beske et al., 2014) Implementing more sustainable supply chains can assist a company in enhancing its reputation, cultivating customer loyalty, and accessing new markets. (Frederick & Elting, 2013). SUSTAINABLE SUPPLY CHAINS

15. Optimizing the supply chain (SCM) in the food and beverages industry poses numerous challenges and hurdles that can impede the attainment of maximum efficiency. The first obvious barrier is high costs. Implementing new technologies requires huge initial investments, such as the expenditures of purchasing the equipment and needed software, as well as costs of training employees. For small and medium-sized enterprises that usually don't have enough resources, these investments can be a burden. The company's budget can come under significant pressure due to the high expenses associated with maintaining and updating these technologies. Some other challenges and obstacles in SCM implementation are the initial training costs, the distribution of proper equipment in every warehouse and plant, as well as the difficult task of replacing and updating the data. (Espinosa et al., 2021). CHALLENGES AND OBSTACLES IN SCM IMPLEMENTATION

16. Technical limitations are probably the next great barrier to the implementation of SCM. Introducing new technologies into current systems can be challenging,

primarily because the operation of the current processes must be adjusted to accommodate the new technologies. (Bayir et al., 2022). As an example, the introduction of IoT sensors for internal use within the enterprise (e.g. to track inventory and transport), requires the implementation of a network infrastructure that needs to be reliable. However, this in turn requires a language base that is not easily available in many rural and developing areas of our planet. Secondly, the lack of tech-savvy employees within the company means that the integration and utilisation of new technologies is more difficult (Ha et al., 2013). CHALLENGES AND OBSTACLES IN SCM IMPLEMENTATION

17. Regulations and standards can be a challenge too. Food and beverages are heavily regulated areas. For example, they have laws concerning food safety, packaging, and transport, which might require more resources and adaption of processes that are already established. Moreover, regulations and standards can vary across different markets, making the global coordination and compliance a more complex and costly task (Sindhu & Kumar, 2022). CHALLENGES AND OBSTACLES TO THE IMPLEMENTATION OF SCM

18. There are many different strategies companies can adopt to overcome the challenges and obstacles that exist to implementing SCM. One of the most important strategies is phased technology implementation, which is to say that firms can begin implementing new technological changes by focusing on the most critical areas first, such as warehouses, before expanding to transport operations, which allows the costs to be distributed over a longer period of time (Zain et al., 2023). STRATEGIES FOR OVERCOMING OBSTACLES

19. Companies can also promote sustainability by utilizing financial tools and offering incentives.. Governments, for instance, provide subsidies or tax incentives to the companies that implement sustainable, technology-oriented solutions. Availability of low cost debt and equity lends support to such funds procurement (Minj et al., 2020). STRATEGIES FOR OVERCOMING OBSTACLES

20. Education and training of employees is one of the most important factors for success of SCM. In this regard, companies must invest in employee training to develop internal technical competence and to ensure that workers can use new technologies and processes in a productive manner (Gupta et al., 2020). Training and skills development that occurs regularly can decrease alleged friction to change and enhance operational effectiveness (Sovacool et al., 2021). STRATEGIES FOR WORKING AROUND BARRIERS

21. The efficiency, costs, and reduced environmental impact are definitely influenced by waste within the food and beverage supply chain, particularly during transportation and mobility. In order reduce waste during transport, some specific waste reduction strategies for logistics and mobility exist (Haessner et al., 2024). Better load planning/consolidation. Improving the load planning and consolidation results in more pallets and packages being filled with goods. This helps to expand the truck's load range and increase the number of pallets per truck. Consequently, the transportation trips are reduced, therefore fuel consumption and emission are decreased. Moreover, the partial load is also likely to be spoiled during transportation. Combining multiple shipments into a single delivery route can increase vehicle utilisation and improve the overall efficiency

of the transportation process.(Parfitt et al., 2010). RESOURCE AND WASTE MANAGEMENT

22. Packaging solutions can also be improved to help reduce waste. Packaging with strong and eco-friendly materials can lower the chances of product damage or deterioration. Using packaging materials that can withstand extreme temperatures, or packaging that offers cushioning to sensitive or delicate items, can help to protect the quality of products throughout the supply chain (De Boni et al., 2022). More sustainable packaging materials that can be recycled or are biodegradable can increase the sustainability of processes through minimising environmental waste (Verghese et al., 2015). RESOURCE AND WASTE MANAGEMENT

23. A further smart zero-waste approach is collaborative logistics: companies can share and pool transport resources (trucks, warehouses, etc) to maximise load optimization, reducing the number of vehicles and prospective mileage to be run, thereby resulting in fewer kilometres driven and therefore lower fuel consumption and emissions. Shared logistics networks can also enhance the velocity and efficiency of the chain, reducing the time perishable goods are in transit and decreasing the risk of waste (Fiorello et al., 2021). COLLABORATION IN SUPPLY CHAINS

24. Reducing waste while transporting products requires maintaining and optimising transport vehicles. Vehicles that are properly maintained operate in optimal performance, thereby consuming less fuel and suffering mechanical failures such as overheating, which can lead to delaying the delivery and increasing the risk of the product spoiling.(Chintapalli & Vakharia, 2023) Telematics and predictive maintenance technologies for vehicles help companies to ensure that their vehicles are in good condition, thus reducing unplanned downtime and increasing the reliability of the dispatch (Samuel et al., 2019). RESOURCE AND WASTE MANAGEMENT

## Literature Overview

The figure below presents a detailed mind map focused on supply chain management in the food and beverage industry. At the center is the core concept, which branches into eight key themes, each representing a crucial aspect of supply chain management:

1. **Collaboration in Supply Chains** - This branch highlights the importance of partnership and logistics strategies, with references to authors like Gichuru et al. and Fiorello et al., emphasizing efficiency and compliance.

2. **Supply Chain Optimization** - Focused on improving inventory management, demand forecasting, and resource utilization, supported by studies from Stritto & Schiraldi and Rahbari et al.

3. **Sustainable Supply Chains** - Emphasizes practices like the circular economy and carbon reduction, referencing Haseli et al. and Adams et al. to illustrate sustainability efforts.

4. **Technological Innovations** - Covers the integration of IoT and blockchain technology for real-time monitoring and transparency, with insights from Jagtap et al. and Subramanian et al.

5. **Big Data Analytics** - Discusses the role of predictive analytics and decision-making in optimizing supply chains, as highlighted by Irfan & Wang and Kholaif et al.

6. **Resource and Waste Management** - Concentrates on recycling and waste reduction strategies, with contributions from Read et al. and Parfitt et al.

7. **Challenges and Barriers in SCM** - Identifies regulatory and cost challenges, featuring authors like Ha et al. and Espinosa et al., focusing on overcoming these obstacles.

8. **Strategies for Overcoming Barriers** - Explores phased adoption, incentives, and training programs as solutions, with insights from Zain et al. and Sovacool et al.

Overall, the mind map provides a comprehensive overview of how various elements and innovations contribute to optimizing supply chains in the food and beverage sector, supported by academic literature.

**Figure 1 Literature overview**
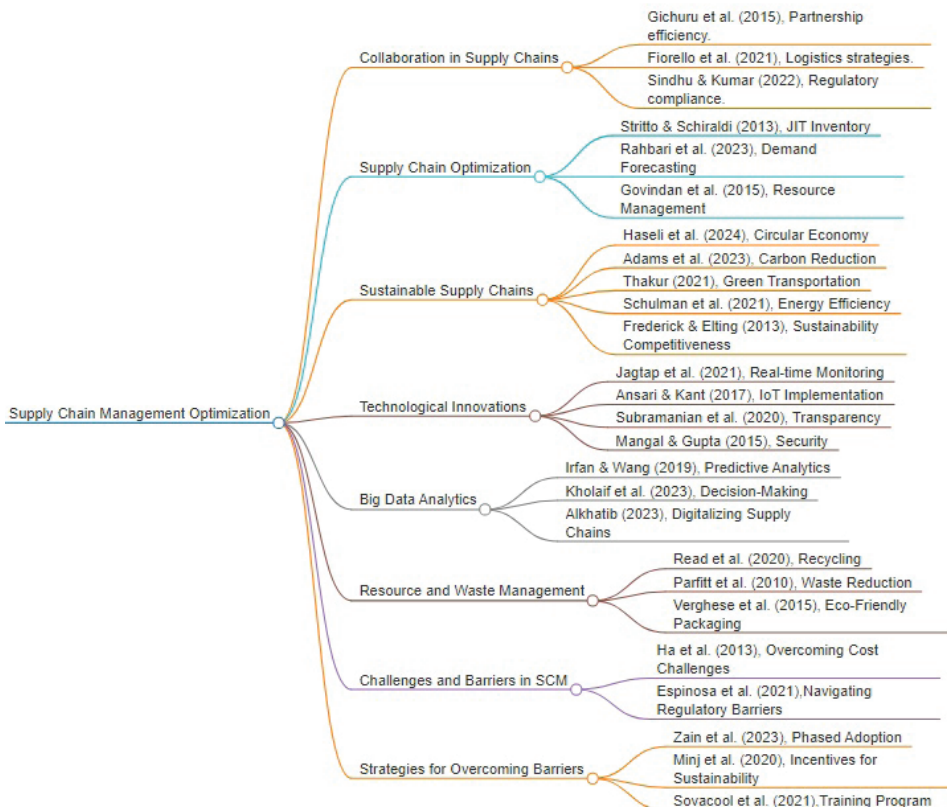
**Theoretical Model for Optimizing Supply Chain in Food and Beverage Industry**

The optimized and sustainable supply chain model for a food and beverage industry can be understood as a framework for achieving goals of sustainability and effectiveness through the inter-relationship between its sub-elements and their main elements. The inventory management is a crucial sub-element which allows the production planning team to know the actual sales data and inventory information. As a result, it helps effectively reduce waste and minimise excessive usage of resources and time, especially food.

**Figure 2 Developed model**



On the other hand, demand forecasting can be considered as another important sub-element because it supports production planning and helps in achieving the goal of reducing food waste without losing market. Through data analysis and forecasting of customer demands, this allows more accurate allocation of existing resources for production, sales and logistics distribution. Three remaining sub-elements named process automation, logistics optimization and inventory management also enable production and distribution managers to maintain and enhance the effectiveness of food shopping distribution among the entire distribution network.

Firstly, process automation supports product circulation, manufacturing, packaging, and transportation through the Internet-of-Things (IoT)" systems. For instance, algorithms can inform the working speed and guide human actions to allow the full usage of resources. This will significantly enhance the efficiency of ingredient transportation to the processing plant, which accelerates the order delivery process and reduces lead times for distribution. In addition, real-time adjustment based on big data plays a vital role in decision-making, especially in right time delivery.

Second, logistics optimization helps to decrease transportation costs and reduce carbon footprints of the production system This optimization has the potential to impact operational choices, including the determination of the appropriate number of vehicles to deploy, the optimal locations for hubs, and the most efficient way to maximize vehicle capacity. Hence, it results in decreased $CO_2$ emissions by using fewer vehicles, traveling shorter distances, and accessing more distribution hubs in the supply chain. This type of policy is frequently put into action by numerous companies, offering a hopeful strategy for enhancing the sustainability of local supply chains on a large scale.

Sustainable supply chain practices intrinsically weave together these pillars into a single coordinated approach to sustainability Tightly managing inventory and forecasting demand is beneficial for waste-reduction programs as it helps avoid over-ordering. Additionally, the lean characteristics of these programs also contribute to reducing food waste, which is a crucial area of focus for sustainability in the food sector. The integration of renewable energy lowers operational carbon emissions, especially in processes like cold chain management. Sustainable sourcing not only facilitates inventory management and automation efforts but also ensures materials are sourced responsibly. The circular economy complements programmes that minimise waste by focusing on used materials in a manner that keeps the supply chain resource-efficient.

Technology innovation drives the means to realise the twin goals of optimization and sustainability. Blockchain upgrades supply-chain transparency by increasing traceability of products, making them safer and satisfying consumer demands for information. Integration with IoT enables real-time monitoring and automation, optimising inventory, logistics and cold chain management. Big data analytics optimises demand forecasting and hence forward integration, better alignment with market trends

Reduction of food waste in the value chain is closely associated with accurate forecasts and lean inventory management enabled by waste reduction and policies of the circular economy, energy-efficient cold chain enables product quality and reduces the environmental footprint guided by renewable energy and IoT, Sustainable packaging ensures a lower carbon footprints and aligned with consumer demands, Overall, market responsiveness informed by accurate forecasts and sustainable sourcing can enhance the competitiveness of the food and beverages industry, and its ability to meet market demand and sustainability targets.

Actions and Strategies Derived from the Model :

1. Conduct a comprehensive audit of the supply chain to identify areas for sustainability improvements. Source raw materials from suppliers who practice sustainable methods.
2. Utilize IoT and AI for real-time monitoring and optimization of the supply chain. Revise transportation routes to lower carbon emissions and minimize fuel usage.
3. Establish long-term partnerships with sustainable suppliers. Invest in sustainable packaging solutions to minimize waste.
4. Develop and implement a sustainability strategy aligned with business goals.
5. Integrate sustainability metrics into performance evaluations for continuous improvement.
6. Enterprises in the food and beverage industry can optimize their supply chains for sustainability, leading to cost savings, increased efficiency, a reduced ecological footprint, a stronger brand, and higher customer satisfaction by following these

actions and strategies. The theoretical model serves as a comprehensive guide for achieving these outcomes through strategic supply chain integration.

## Discussion

**Table 1 Key performance indicators (KPIs) for supply chain optimization**

| KPI | Definition | Importance in Food & Beverage Industry |
|---|---|---|
| Inventory Turnover | The rate at which inventory is used | Ensures freshness and reduces waste |
| Order Fulfillment | The percentage of orders delivered on time | Critical for customer satisfaction |
| Delivery Lead Time | Time taken from order to delivery | Impacts freshness and quality of products |
| Forecast Accuracy | Accuracy of demand forecasts | Reduces overstocking and stockouts |
| Cost per Order | Total cost of processing an order | Affects overall profitability |
| Carbon Footprint | Total greenhouse gas emissions | Measures environmental impact |

Table above showcases us 6 most important KPIs , based on our research, regarding optimization and sustainability in food and beverages supply chain. One of the factors that greatly affect the freshness of a product delivered to the consumer is the Inventory Turnover ratio. This indicator measures how often inventory is replenished, which means that a higher inventory turnover ratio indicates more frequent and timely delivery of products to the end consumer. Another important aspect is Order Fulfillment, which evaluates the number of orders that are delivered on time, and thus, ensures the effectiveness of the process The time taken by the business to complete an order and deliver it to the customer is referred to as the Delivery Lead Time. A shorter lead time means that a process is faster and more efficient, which in turn increases customer satisfaction. Forecast Accuracy is a measure of predicting demand and providing the correct estimates of future commodity prices, while Cost per Order assesses whether the total cost of processing an order is reasonable or not. If the total cost is higher than the expected, it might indicate the presence of some ineffective processes. The final indicator is the Carbon Footprint, which assesses the business's environmental impact by measuring greenhouse gas emissions and assists in minimizing them.

**Table 2 Technological innovations in supply chain**

| Technology | Application in Supply Chain | Benefits | Example in Food & Beverage Industry |
|---|---|---|---|
| IoT | Real-time monitoring and tracking | Improved transparency and traceability | Temperature monitoring in cold chains |

| Blockchain | Secure and transparent transactions | Enhanced security and trust | Tracking product origins |
| Big Data Analytics | Data-driven decision-making | Optimized inventory and demand forecasting | Predicting seasonal demand fluctuations |
| AI and Machine Learning | Automated processes and predictive analytics | Increased efficiency and accuracy | Optimizing delivery routes |

**Table 3 Sustainable practices in supply chain**

| Practice | Description | Environmental Impact | Example in Food & Beverage Industry |
| --- | --- | --- | --- |
| Renewable Energy Usage | Using solar, wind, or other renewable sources | Reduces carbon footprint | Solar-powered warehouses |
| Waste Reduction Programs | Minimizing waste through various strategies | Decreases landfill use and pollution | Recycling packaging materials |
| Efficient Transportation | Using eco-friendly vehicles and optimized routes | Lowers greenhouse gas emissions | Electric delivery trucks |
| Circular Economy Principles | Reusing and recycling resources | Promotes resource efficiency | Recyclable packaging |

After providing these tables which summarized all the extensive literature review we are now going to answer 4 research questions we set earlier in this paper.

Research Question 1: What are the main strategies that can be adopted to optimize supply chains in the food and beverage industry, and what are their effects on business efficiency and cost? The principal ways of improving supply chain efficiency in the food and beverage industry are deploying the IoT and big data analytics, utilising Just-In-Time (JIT) inventory systems, and collaborating with supply chain partners.The use of IoT allows to predict consumer buying behaviour and to optimise inventory by ordering just enough food and beverage products. JIT inventory reduces ordering costs as it allows to order materials immediately before the need. Collaboration with supply chain partners increases the likelihood of better coordination among them, which in turn increases efficiency and reduces operational costs. Overall, these three strategies help food and beverage companies to achieve better business efficiency and reduced costs by reducing waste, optimising inventory management, and increasing flexibility in meeting consumer demand.

Research Question 2: How can food and beverage supply chains best engage with environmental and social sustainability, and what methods are the most effective for doing so? Sustainability in food and beverage supply chains can be achieved by adopting renewable energy sources in warehouses and production facilities, adopting waste reduction programmes, as well as following the principles of the circular economy. The use of renewable energies such as solar and wind in production facilities and warehouses helps to reduce carbon footprint and lower the use of non-renewable energies that are harmful to the environment. Waste reduction programmes such as the reuse of packaging materials and lowering the level of landfills

support sustainability efforts. Maximizing resource utilization and minimizing the use of new raw materials can contribute to sustainability through the adoption of circular economy principles. By following circular economy principles, unnecessary waste can be minimised and reused or recycled into new products, creating a more efficient use of resources and lowering waste levels. Overall, those efforts are a good way to support sustainability, improve the brand image, and increase the chances of success in a market that is becoming more concerned about sustainability while also leading to cost savings and a potential competitive advantage.

Research Question 3: What are the main challenges in implementing strategies for optimization and sustainability in food and beverage supply chains, and how do successful companies overcome them? Major challenges related to implementing strategies on optimization and sustainability in the food and beverage supply chain are the high initial costs, technical weaknesses and compliance to regulation. Implementing new technologies like IoT sensors and blockchain can be difficult for small and medium-sized enterprises due to the substantial investment required. The food industry is subject to strict regulations that come with various technical constraints. In many cases, there have been difficulties in integrating new systems with existing infrastructure, for example, the difficulty in getting building permission. Furthermore, the food sector must comply with different regulations in various markets, resulting in increased costs and complexity for companies.Companies that are thriving in these areas have found solutions by using a phased approach to technology implementation, starting with strategic areas and taking advantage of government incentives, such as subsidies and tax breaks to lower the costs of investment.Furthermore, investment in staff training and upskilling employees is a great way to ensure they have the necessary skills to use new technologies and processes, help with the transition and increase operational efficiency in the long run.

Research Question 4: What is the role of optimization alongside sustainability in food and beverage supply chains, and how does it contribute to the long-term competitive position and profitability of firms? optimization for sustainability is a key factor in improving firms' long-term competitive positioning and profitability. Firms in the food and beverage supply chain can become more efficient in production, distribution and sales when they effectively integrate advanced technologies (e.g., AI, machine learning and robotics) and sustainable practices. The reduction of carbon footprints, waste generation and water use during activities enables higher operational efficiency and lower costs, which can improve firms' profitability. When firms adopt corporate social responsibility practices such as reducing carbon footprints and waste generation, they may also improve their brand reputation and customer loyalty. For example, Starbucks pledged to reduce greenhouse gas emissions as a part of its strategic goals for the next decade. This commitment to sustainable practices contributed to Starbucks' enhanced competitive advantage in a challenging operating environment. Improving product quality and delivery speed can also be achieved by optimizing supply chains, resulting in increased customer satisfaction. The combination of optimization with the integration of emerging technologies and sustainable practices creates enhanced firm-level competitiveness. For instance, firms can take advantage of this competitiveness to differentiate their products or services from other firms and market to environmentally conscious customer segments. By doing all these things, firms can enhance their long-term competitive positioning and profitability.

## Conclusion

The paper concludes that there is need for optimised supply chains in the food and beverage sector for improved operational efficiency, lesser costs and sustainability. Employing the use of technology in the food supply chain can benefit food and beverage companies. For instance, integrating the use of IoT and blockchain technologies, as well as big data analytics, can help improve real-time monitoring, forecasting, and inventory management. All these will help reduce food wastage and optimise the utilisation of available resources. On the sustainability front, green energy integration, waste programmes, and the adoption of the circular economy are equally important. Companies will gain a significant competitive advantage in an increasingly green marketplace by contributing to environmental good, as well as benefiting from positive brand reputation and consumer loyalty..

Overcoming barriers to the implementation of these strategies – such as high initial costs and technical hurdles – can be achieved through phased adoption of technology, government incentives and staff training. When these optimization efforts are integrated with sustainability goals, firms can achieve higher-quality products that are delivered faster, thereby improving customer satisfaction and long-term profitability. Integrating optimization and sustainability efforts into the supply chain serves to place firms in optimal position to satisfy the demands of consumers and other stakeholders. It is also a step toward achieving the public policy goals of sustainable development in the food and beverage industry.

## References

Adams, D., Donovan, J., & Topple, C. (2023). Sustainability in large food and beverage companies and their supply chains: An investigation into key drivers and barriers affecting sustainability strategies. Business Strategy and the Environment, 32(4), 1451–1463. https://doi.org/10.1002/bse.3198

Ageron, B., Gunasekaran, A., & Spalanzani, A. (2012). Sustainable supply management: An empirical study. International Journal of Production Economics, 140(1), 168–182. https://doi.org/10.1016/j.ijpe.2011.04.007

Ahi, P., & Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. Journal of Cleaner Production, 52, 329–341. https://doi.org/10.1016/j.jclepro.2013.02.018

Alkhatib, A. W. (2023). Fostering green innovation: The roles of big data analytics capabilities and green supply chain integration. European Journal of Innovation Management. https://doi.org/10.1108/EJIM-09-2022-0491

Ansari, Z. N., & Kant, R. (2017). Exploring the Framework Development Status for Sustainability in Supply Chain Management: A Systematic Literature Synthesis and Future Research Directions. Business Strategy and the Environment, 26(7), 873–892. https://doi.org/10.1002/bse.1945

Bayir, B., Charles, A., Sekhari, A., & Ouzrout, Y. (2022). Issues and Challenges in Short Food Supply Chains: A Systematic Literature Review. *Sustainability*, *14*(5), 3029. https://doi.org/10.3390/su14053029

Beske, P., Land, A., & Seuring, S. (2014). Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature. International Journal of Production Economics, 152, 131–143. https://doi.org/10.1016/j.ijpe.2013.12.026

Bešić, C., Bakator, M., Đorđević, D., & Ćoćkalo, D. (2021). Agriculture 4.0 and improving competitiveness of the domestic agro-food sector. *Ekonomika Poljoprivrede*, *68*(2), 531–545. https://doi.org/10.5937/ekoPolj2102531B

Bešić, C., Bakator, M., Đorđević, D., Ćoćkalo, D., & Stanisavljev, S. (2022). Modern agribusiness within the framework of society 5.0. *Ekonomika Poljoprivrede*, *69*(2), 365–383. https://doi.org/10.5937/ekoPolj2202365B

Brandenburg, M., Govindan, K., Sarkis, J., & Seuring, S. (2014). Quantitative models for sustainable supply chain management: Developments and directions. European Journal of Operational Research, 233(2), 299–312. https://doi.org/10.1016/j.ejor.2013.09.032

Cvetkovic, M., Randjelovic, M., & Milicevic, R. (2017). Apparent contradictions effective and efficient supply chain: Time pressure and eliminating the stock. *Ekonomika*, *63*(3), 97–116. https://doi.org/10.5937/ekonomika17030

Chintapalli, P., & Vakharia, A. J. (2023). The waste management supply chain: A decision framework. *Decision Sciences*, deci.12595. https://doi.org/10.1111/deci.12595

De Boni, A., Ottomano Palmisano, G., De Angelis, M., & Minervini, F. (2022). Challenges for a Sustainable Food Supply Chain: A Review on Food Losses and Waste. *Sustainability*, *14*(24), 16764. https://doi.org/10.3390/su142416764

Espinosa, R. V., Soto, M., Garcia, M. V., & Naranjo, J. E. (2021). Challenges of Implementing Cleaner Production Strategies in the Food and Beverage Industry: Literature Review. In M. V. García, F. Fernández-Peña, & C. Gordón-Gallegos (Eds.), Advances and Applications in Computer Science, Electronics and Industrial Engineering (Vol. 1307, pp. 121–133). Springer Singapore. https://doi.org/10.1007/978-981-33-4565-2_8

Ferreira, I. A., Oliveira, J. P., Antonissen, J., & Carvalho, H. (2023). Assessing the impact of fusion-based additive manufacturing technologies on green supply chain management performance. Journal of Manufacturing Technology Management, 34(1), 187–211. https://doi.org/10.1108/JMTM-06-2022-0235

Fiorello, M., Bruccoleri, M., Corti, D., & Pedrazzoli, P. (2021). Supply Chain Collaboration in Craft Production: Empirical evidences from the food and beverage industry. 2021 3rd International Conference on Management Science and Industrial Engineering, 88–94. https://doi.org/10.1145/3460824.3460839

Frederick, H., & Elting, J. (2013). Determinants of green supply chain implementation in the food and beverage sector. International Journal of Business Innovation and Research, 7(2), 164. https://doi.org/10.1504/IJBIR.2013.052577

Gichuru, M., Iravo, M., & Arani, W. (2015). Collaborative Supply Chain Practices on Performance of Food and Beverages Companies: A Case Study of Del Monte Kenya Ltd. International Journal of Academic Research in Business and Social Sciences, 5(11), Pages 17-31. https://doi.org/10.6007/IJARBSS/v5-i11/1890

Govindan, K., Soleimani, H., & Kannan, D. (2015). Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future. European Journal of Operational Research, 240(3), 603–626. https://doi.org/10.1016/j.ejor.2014.07.012

Guang Shi, V., Lenny Koh, S. C., Baldwin, J., & Cucchiella, F. (2012). Natural resource based green supply chain management. Supply Chain Management: An International Journal, 17(1), 54–67. https://doi.org/10.1108/13598541211212203

Gupta, H., Kusi-Sarpong, S., & Rezaei, J. (2020). Barriers and overcoming strategies to supply chain sustainability innovation. *Resources, Conservation and Recycling*, *161*, 104819. https://doi.org/10.1016/j.resconrec.2020.104819

Haseli, G., Nazarian-Jashnabadi, J., Shirazi, B., Hajiaghaei-Keshteli, M., & Moslem, S. (2024). Sustainable strategies based on the social responsibility of the beverage industry companies for the circular supply chain. Engineering Applications of Artificial Intelligence, 133, 108253. https://doi.org/10.1016/j.engappai.2024.108253

Haessner, P., Haessner, J., & McMurtrey, M. (2024). Trends & Challenges in the Food Supply Chain. *Journal of Strategic Innovation and Sustainability*, *19*(1). https://doi.org/10.33423/jsis.v19i1.6868

Huang, Y., Han, W., & Macbeth, D. K. (2020). The complexity of collaboration in supply chain networks. *Supply Chain Management: An International Journal*, *25*(3), 393–410. https://doi.org/10.1108/SCM-11-2018-0382

Irfan, M., & Wang, M. (2019). Data-driven capabilities, supply chain integration and competitive performance: Evidence from the food and beverages industry in Pakistan. British Food Journal, 121(11), 2708–2729. https://doi.org/10.1108/BFJ-02-2019-0131

Jagtap, S., Duong, L., Trollman, H., Bader, F., Garcia-Garcia, G., Skouteris, G., Li, J., Pathare, P., Martindale, W., Swainson, M., & Rahimifard, S. (2021). IoT technologies in the food supply chain. In Food Technology Disruptions (pp. 175–211). Elsevier. https://doi.org/10.1016/B978-0-12-821470-1.00009-4

Kholaif, M. M. N. H. K., Sarwar, B., Xiao, M., Poliak, M., & Giovando, G. (2023). Post-pandemic opportunities for F&B green supply chains and supply chain viability: The moderate effect of blockchains and big data analytics. European Journal of Innovation Management. https://doi.org/10.1108/EJIM-10-2022-0581

Mangal, D., & Gupta, T. K. (2015). Management of demand uncertainty in supply chain cost planning. International Journal of Logistics Systems and Management, 22(4), 399. https://doi.org/10.1504/IJLSM.2015.072746

Minj, J., Sudhakaran V, A., & Kumari, A. (2020). Correction to: Dairy Processing: Advanced Research to Applications. In J. Minj, A. Sudhakaran V, & A. Kumari (Eds.), Dairy Processing: Advanced Research to Applications (pp. C1–C1). Springer Singapore. https://doi.org/10.1007/978-981-15-2608-4_17

Parfitt, J., Barthel, M., & Macnaughton, S. (2010). Food waste within food supply chains: Quantification and potential for change to 2050. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1554), 3065–3081. https://doi.org/10.1098/rstb.2010.0126

Palazzo, M., & Vollero, A. (2022). A systematic literature review of food sustainable supply chain management (FSSCM): Building blocks and research trends. *The TQM Journal*, *34*(7), 54–72. https://doi.org/10.1108/TQM-10-2021-0300

Quintana, B. M., & León, M. B. Q. (2021). DIFFERENCES BETWEEN A TRADITIONAL SUPPLY CHAIN AND AN INTEGRATED SUPPLY CHAIN. In E. M. Senhoras, *Administração: Estudos organizacionais e sociedade 3* (1st ed., pp. 35–43). Atena Editora. https://doi.org/10.22533/at.ed.6422117113

Rahbari, M., Arshadi Khamseh, A., & Mohammadi, M. (2023). Robust optimization and strategic analysis for agri-food supply chain under pandemic crisis: Case study from an emerging economy. Expert Systems with Applications, 225, 120081. https://doi.org/10.1016/j.eswa.2023.120081

Rejeb, A., Keogh, J. G., & Treiblmaier, H. (2019). Leveraging the Internet of Things and Blockchain Technology in Supply Chain Management. *Future Internet*, *11*(7), 161. https://doi.org/10.3390/fi11070161

Read, Q. D., Brown, S., Cuéllar, A. D., Finn, S. M., Gephart, J. A., Marston, L. T., Meyer, E., Weitz, K. A., & Muth, M. K. (2020). Assessing the environmental impacts of halving food loss and waste along the food supply chain. Science of The Total Environment, 712, 136255. https://doi.org/10.1016/j.scitotenv.2019.136255

Stanković, T., Milovanović, G., & Anđelković, A. (2022). Performances of key processes in green supply chains. *Economics of Sustainable Development*, *6*(1), 35–43. https://doi.org/10.5937/ESD2201035S

Samuel, A. U., Oyawale, F., & Fayomi, O. S. I. (2019). Effects of Waste Management in Beverage Industries: A Perspective. Journal of Physics: Conference Series, 1378(2), 022048. https://doi.org/10.1088/1742-6596/1378/2/022048

Sarkis, J., Zhu, Q., & Lai, K. (2011). An organizational theoretic review of green supply chain management literature. International Journal of Production Economics, 130(1), 1–15. https://doi.org/10.1016/j.ijpe.2010.11.010

Schulman, D. J., Bateman, A. H., & Greene, S. (2021). Supply chains (Scope 3) toward sustainable food systems: An analysis of food & beverage processing corporate greenhouse gas emissions disclosure. Cleaner Production Letters, 1, 100002. https://doi.org/10.1016/j.clpl.2021.100002

Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. Journal of Cleaner Production, 16(15), 1699–1710. https://doi.org/10.1016/j.jclepro.2008.04.020

Sindhu, S., & Kumar, R. (2022). Modeling the Challenges for Agri-Food Supply Chain 4.0: TISM Approach. In R. S. Mor, D. Kumar, & A. Singh (Eds.), Advanced Series in Management (pp. 31–51). Emerald Publishing Limited. https://doi.org/10.1108/S1877-636120220000027003

Sovacool, B. K., Bazilian, M., Griffiths, S., Kim, J., Foley, A., & Rooney, D. (2021). Decarbonizing the food and beverages industry: A critical and systematic review of developments, sociotechnical systems and policy options. Renewable and Sustainable Energy Reviews, 143, 110856. https://doi.org/10.1016/j.rser.2021.110856

Stritto, G. D., & Schiraldi, M. M. (2013). A Strategy Oriented Framework for Food and Beverage E-Supply Chain Management. International Journal of Engineering Business Management, 5, 50. https://doi.org/10.5772/57167

Subramanian, N., Chaudhuri, A., & Kayikci, Y. (2020). Blockchain Applications in Food Supply Chain. In N. Subramanian, A. Chaudhuri, & Y. Kayıkcı, Blockchain and Supply Chain Logistics (pp. 21–29). Springer International Publishing. https://doi.org/10.1007/978-3-030-47531-4_3

Shin, S., & Cho, M. (2022). Green Supply Chain Management Implemented by Suppliers as Drivers for SMEs Environmental Growth with a Focus on the Restaurant Industry. *Sustainability*, *14*(6), 3515. https://doi.org/10.3390/su14063515

Talwar, S., Kaur, P., Fosso Wamba, S., & Dhir, A. (2021). Big Data in operations and supply chain management: A systematic literature review and future research agenda. *International Journal of Production Research*, *59*(11), 3509–3534. https://doi.org/10.1080/00207543.2020.1868599

Tica, T. (2022). Analysis of the impact of ownership characteristics on the capital structure and business success of companies in the Balkan beverage industry. *Anali Ekonomskog fakulteta u Subotici*, *47*, 79-96. https://doi.org/10.5937/AnEkSub2247079T

Thakur, A. (2021). Supply Chain Sustainability in Food and Beverage Industry: In A. Amini, S. Bushell, & A. Mahmood (Eds.), Advances in Computational Intelligence and Robotics (pp. 173–189). IGI Global. https://doi.org/10.4018/978-1-7998-5879-9.ch008

Verghese, K., Lewis, H., Lockrey, S., & Williams, H. (2015). Packaging's Role in Minimizing Food Loss and Waste Across the Supply Chain: PACKAGING'S ROLE IN MINIMIZING FOOD WASTE ACROSS THE SUPPLY CHAIN. Packaging Technology and Science, 28(7), 603–620. https://doi.org/10.1002/pts.2127

Wang, H., Long, Z., Chen, J., Guo, Y., & Wang, A. (2023). Collaborative decision-making in supply chain management: A review and bibliometric analysis. *Cogent Engineering*, *10*(1), 2196823. https://doi.org/10.1080/23311916.2023.2196823

Wong, E. K. S., Ting, H. Y., & Atanda, A. F. (2024). Enhancing Supply Chain Traceability through Blockchain and IoT Integration: A Comprehensive Review. *Green Intelligent Systems and Applications*, *4*(1), 11–28. https://doi.org/10.53623/gisa.v4i1.355

Zain, R. M., Ramli, A., Zain, M. Z. M., Rahim, M. N. A., & Musa, A. (2023). Evaluation and prioritisation of GSCM barriers in food and beverage SMEs using the AHP. 030057. https://doi.org/10.1063/5.0164583

ЕКОНОМИКА

BOOK REVIEW

Zoran D. Simonović and Nikola V. Ćurčić

# DEVELOPMENT OF RESOURCES OF MODERN VITICULTURE AND WINE PRODUCTION IN THE AGE OF SMART TECHNOLOGIES

(Monograph)

Зоран Д. Симоновић и Никола В. Ђурчић

# РАЗВОЈ РЕСУРСА САВРЕМЕНОГ ВИНОГРАДАРСТВА И ПРОИЗВОДЊА ВИНА У ВРЕМЕ ПАМЕТНИХ ТЕХНОЛОГИЈА

(Монографија)

The scientific monograph deals with the basic characteristics of viticulture and wine production in the Republic of Serbia, but also in the world. The research covered production for a very long period, from the very beginning of grape cultivation in pre-Roman times to the present day. Modern viticulture has taken on significantly different determinants, bearing in mind the gradual development of the economy, adaptation to climate change, but also the current application of innovative technologies as part of the so-called smart agriculture. The monograph has been reviewed by as many as five distinguished professors/scientists in the field of business management and agricultural economics, while the publishers are two renowned organizations engaged in scientific research.

The monograph has eight sections. The first section confronts the issues of grape and wine production throughout the history of social development. A long tradition in the production and processing of grapes in the Republic of Serbia is a justification for the presentation of this activity through the centuries.

The second section shows the changes in the structure of viticulture and wine production over time, up to the adoption of the concept of organic production. Organic production will be significant due to changes in the habits of consumers who want healthy, eco-friendly, and high-quality food products, including wines as drinks. That is why it is necessary to diversify production in favour of higher quality wines and grape varieties that are grown. In this section, the basic types of wine are also shown.

The third section aims to point out the organizational challenges and problems of grape and wine producers and propose solutions for improving the position of producers engaged in this branch. The authors emphasize that there are exceptional potentials in the Republic of Serbia for further development of processing capacities, change in the way cooperative's function, renewal of old and abandoned plantations and development of small businesses in these branches of agriculture.

The role of the state in the agri-food sector is necessary because of its importance from the point of view of food safety, as well as the impact on the environment, but also because of the financial problems faced by entrepreneurs. Therefore, the fourth section deals with the development programs and incentive measures of agrarian policy makers in the field of grape and wine production.

Next, the fifth section writes down the characteristics of the wine market in the Republic of Serbia. The authors show that the supply of domestic wines is mostly of low quality, and that there is a large assortment of imported wines to meet the domestic demand, which has been growing in recent years.

The sixth section offers an insight into the possibilities of applying marketing in the field of winemaking. The role of promotion is important, bearing in mind that reputation and brand are the main (non-price) factors of competitiveness in the domestic and international markets. The authors argue that strong marketing is necessary to achieve confidence in the quality of wine, consumer satisfaction and increase demand for wine in the end. Also, this section describes the situation about the export and import of wine on the global level.

Rural and wine tourism is the basis of the seventh section. This section includes diverse topics such as the relationship between rural development and viticulture and winemaking, the gastronomic aspect of rural areas, the role of digital technology in wine tourism, as well as the latest impacts considering the COVID-19 pandemic.

Finally, within the eighth section, the authors provided an overview of the possibilities of applying modern technology in the production of grapes and wine. Smart agriculture is rapidly developing in the world, so it is used in almost all branches of agriculture. The application of modern technologies within precision agriculture will drastically change the way agricultural activity is conducted in the Republic of Serbia, so producers must get acquainted with the application of various sensors and other digital solutions. In the light of sustainable development, studying the effects of climate change is essential. That is why the authors also look at the impact of climatic factors on the future production of grapes, which will be beneficial for existing, but also for new producers who decide to direct their resources towards the production of grapes and wine.

The monograph "*Development of Resources of Modern Viticulture and Wine Production in the Age of Smart Technologies*" possesses originality and practical applicability. It is based on extensive and relevant literature that includes journals, monographs, sources from the Internet, as well as the authors' own primary data, and is a valuable contribution to contemporary theory and practice. The demand for wine is constant and is present in almost all segments of the population. Therefore, the monograph highlights the problems, position, and opportunities of grape and wine producers, as well as changes in the preferences of consumers who want a higher quality of all products, including wine. The conclusions offered by this monograph

ЕКОНОМИКА

may be of interest to agricultural producers, economic policy makers in the field of agriculture, but also to the general academic public that includes researchers, students, and the professional community.

Milan Marković, Ph.D.
Senior Research Associate
Innovation Centre of the University of Niš
https://orcid.org/0000-0002-9617-6697
markovicmilan89@gmail.com

**ШАБЛОН / ТЕМПЛАТЕ ЗА ПИСАЊЕ РАДОВА**

Име аутора (Font size 10 Normal) Times New Roman (SR-Cyrilic)
*Факултет или институција и Град (Font size 10 Italic)*

## НАСЛОВ СРПСКИ (Font size 11 Bold)

**Апстракт**

*Текст апстракта на српском ...*

***Кључне речи***:

## NASLOV ENGLESKI ili neki drugi jezik (Font size 11 Bold)

**Abstract**

*Tekst  apstrakta na engleskom ili na nekom drugom jeziku...*

***Key words:***

## НАСЛОВ (Font size 11 Bold)

Текст (Font size 10)……...

## Литература

1. Списиак литературе

Veličina strane 170mm x 240mm
Margine: Top 30mm     Bottom 20mm
           Left 22mm     Right 22mm