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NIKOLA TATAR

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MILAN D. RANDJELOVIĆ

Address:
"EKONOMIKA", Society of Economists
18000 Nis, Maksima Gorkog 5/36

Phone: +381 (0)18 4245 763; 211 443
e-mail: zoki@medianis.net; ekonomika@sbb.rs
WEB: http://www.ekonomika.org.rs

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Marija Jovanović [1]
Innovation Center, University of Nish

Bojan Krstić[2]
Milica Jovanović Vujatović [3]
Faculty of Economics, University of Nish

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ORIGINAL SCIENTIFIC PAPER
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COMPARATIVE ANALYSIS OF INDUSTRY, INNOVATION AND INFRASTRUCTURE OF SERBIA AND NEIGHBOURING COUNTRIES AS DETERMINANTS OF SUSTAINABILITY

Abstract

The quality of the innovation system and resilient and sustainable (educational, transport, information and communication) infrastructure are the most important determinants of sustainable development at the national level. The development that includes the transition to a knowledge-based economy implies sustainable development of the nations with the improvement of well-being. The aim of this paper is to point out the importance of specific indicators of industry, innovation and infrastructure as possible limiting factors of sustainability. The analysis is based on indicators of the 9 Goal of sustainable development for Serbia and five neighbouring countries for the period from 2017 to 2022. It will be concluded about the key advantages and disadvantages of analysed countries in relation to this goal of sustainable development.

Keywords: *innovation, sustainability, Serbia, neighbouring countries, comparative analysis*

JEL classification: *O32, O57, Q56*

КОМПАРАТИВНА АНАЛИЗА ПРИВРЕДЕ, ИНОВАЦИЈА И ИНФРАСТРУКТУРЕ СРБИЈЕ И ЗЕМАЉА У ОКРУЖЕЊУ КАО ДЕТЕРМИНАНТЕ ОДРЖИВОСТИ

Апстракт

Квалитет иновационог система и отпорна и одржива (образовна, транспортна, информациона и комуникациона) инфраструктура су најважније детерминанте одрживог развоја на националном нивоу. Развој који укључује прелазак на економију засновану на знању подразумева одрживи развој нација уз побољшање благостања. Циљ овог рада је да укаже на значај специфичних индикатора привреде, иновација и инфраструктуре као могућих ограничавајућих фактора одрживости. Анализа је заснована на индикаторима „Деветог циља одрживог развоја“ за Србију и пет земаља у окружењу

[1] marijamptrakic@gmail.com, ORCID ID 0000-0001-5997-0501

[2] bojan.krstic@eknfak.ni.ac.rs, ORCID ID 0000-0003-4597-6819

[3] milica.jovanovic@eknfak.ni.ac.rs, ORCID ID 0000-0002-6410-0938

за период од 2017. до 2022. године. Указаће се и на кључне предности и недостатке анализираних земаља у односу на овај циљ одрживог развоја.

Кључне речи: *иновација, одрживост, Србија, земље у окружењу, компаративна анализа*

Introduction

One of the important goals of sustainable development refers to the improvement of research activity, innovation systems of countries, the adoption of new technologies and the development of industrial enterprises with a qualified workforce. It is about the 9th goal of sustainable development, which is based on resilient (educational, innovation, information, communication, transport) infrastructure and encouraging inclusive industrialization. Inclusive and resilient industrialization implies the transition from the agriculture sector to the manufacturing sector, in order to meet the 2030 target and encourage investment in scientific research and innovation. This goal requires calculation on the basis of 7 indicators based on certain data from different official databases. In order to achieve the goals related to the determined indicators, specific targets were defined which should be achieved by a certain period of time. These targets indicate practical goals that are expected to be realized, especially in developing and least-developed countries.

The paper will present a comparative analysis of indicators of industry, infrastructure and innovation in Serbia and neighbouring countries (Serbia, Bulgaria, Croatia, North Macedonia, Bosnia and Herzegovina, Albania) in order to see the key limitations in achieving Goal 9 of sustainable development, especially through a comparative analysis. This analysis will enable an overview of the indicators in which certain countries of the region are the worst, and which represent their advantages in relation to other countries in the surrounding area.

1. Literature review

Goal 9 - *Industry, Innovation and Infrastructure within Sustainable Development Goals* (SDG9) is founded on resilient and sustainable innovation, as well as other infrastructure that allows for affordable and equitable access for all as well as inclusive and sustainable industrialization. It seeks to include small businesses in value chains as a crucial source of national innovation (Cvetanović, & Sredojević, 2012; Gupta & Vegelin, 2016). Industrialization entails structural change for developing economies from traditional sectors to a contemporary manufacturing industry based on innovation and technology that supports new technologies and generates employment (Sredojević, et al., 2016; Kynčlová et al., 2020).

It is focused on increasing the "connectivity and productivity of developing countries' industries and building resilient infrastructure systems to bolster economic growth" (CSIS, 2020). This goal is focused on the modernization of the economy, the construction of a quality innovation system and information and communication

technology (ICT) at the national level, especially the application of technological achievements, the development of an educated and qualified workforce that will contribute to the transition to the knowledge economy and the growth of labour productivity. In addition, it is based on the development of the academic community. All these indicators will ultimately contribute to the growth of the living standard of the population. Sustainable industrialization at the global level requires doubling the share of industry in the job market and the product in the least developed countries, as well as the modernization of the infrastructure based on a sustainable economy, efficient usage of material resources and clean and environmentally friendly technology and processes (Szopik-Depczyńska et al., 2018).

Within Goal 9, a distinction is made between developing countries and least developed countries, which are specifically targeted by this goal. Through the development of innovative capabilities, acceptance of new technologies, efficient use of available resources, enhancing international trade, and especially investments in science and research, the goal is to increase quality employment and income in these countries (UN, 2022). In addition, nuclear science and nuclear technology play a very important role in finding cost-effective and innovative ways of "building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation". Nuclear technology is useful in order to improve the safety and quality of products and also to increase industrial productivity. It can also make "processes more efficient, environmentally friendly and cost-effective" (IAEA, 2022).

In terms of technology and innovation, high-tech industries are more environmentally friendly while they pollute less than others, especially the recycling industry which can be labelled as a green industry. The procurement of green technologies and the development of green innovations improve employment and directly contribute to the achievement of Goal 9 and other sustainable development goals, but also contribute to the reduction of energy intensity (Chakraborty & Mazzanti, 2020).

Considering ICT "more than half of the world's population is now online and almost the entire world population lives in an area covered by a mobile network. It is estimated that in 2019, 96.5 per cent were covered by at least a 2G network". These trends are particularly accelerated by the effects of the COVID-19 pandemic (digitalization of services, including access to healthcare, education and other essential services). However, on the other hand, there is a global problem associated with investments in research and development, which, although growing significantly since 2000, in developing countries are below 1% of GDP (UN, 2022) which slows down the creation of quality jobs in these countries and innovative activity.

2. Research methodology

Goal 9 consists of the following 7 indicators: 1) Population using the internet (%) – I1, 2) Mobile broadband subscriptions (per 100 population) – I2, 3) Quality of overall infrastructure (1= extremely underdeveloped; 7= extensive and efficient by international standards – I3, 4) Logistics Performance Index: Quality of trade and transport-related infrastructure (worst 1–5 best) – I4, 5) The Times Higher Education Universities Ranking: Average score of top 3 universities (worst 0–100 best) – I5, 6) Scientific and

technical journal articles (per 1,000 population) – I6, 7) Expenditure on research and development (% of GDP) – I7 (Sachs et al., 2020). Namely, it is one of 17 Sustainable Development Goals - 1) No poverty, 2) Zero hunger, 3) Good health and well-being, 4) Quality education, 5) Gender equality, 6) Clean water and sanitation, 7) Affordable and clean energy, 8) Decent work and economic growth, 9) Industry, innovation and infrastructure, 10) Reduced inequalities, 11) Sustainable cities and communities, 12) Responsible consumption and production, 13) Climate action, 14) Life below water, 15) Life on land, 16) Peace, justice and strong institutions, 17) Partnerships for the goals (Sachs et al., 2020).

The calculation of this goal of sustainable development (Goal 9 - Industry, Innovation and Infrastructure) is based on the following data: the number of people who have access to the Internet, the degree of development of the industry (the presence of certain sectors), access to critical infrastructure (education, transport, healthcare, innovation capacities, information and communication systems), access to mobile connectivity, electricity and sanitation (CSIS, 2020).

In order to realize this goal, certain targets are foreseen, which are shown in Table 1.

Table 1: Goal 9 targets and related indicators (with data source)

Target No	Explanation of target	Related indicators (with data sources for each indicator)
9.1	In order to promote economic development and human well-being, build dependable and resilient infrastructure (including regional and trans-border infrastructure), with an emphasis on equal access	1. Proportion of the rural population who live within 2 km of an all-season road (World Bank II) 2. Passenger and freight volumes, by mode of transport (ICAO, ITF-OECD)
9.2	Encourage inclusive and sustainable industrialization by boosting the sector's contribution to GDP and employment by a large amount by 2030 (doubling it in the least developed nations)	1. Manufacturing value added as a proportion of GDP and per capita (UNIDO I) 2. Manufacturing employment as a proportion of total employment (UNIDO)
9.3	Expanding small business and other company access to financial services, especially in developing nations	1. Percentage share of small-scale industries in total industry value added (UNIDO II) 2. Percentage of small-scale industries with a loan or line of credit (UNIDO, World Bank)
9.4	Improve infrastructure to make it more sustainable (by increasing resource efficiency and expanding the use of green, eco-friendly products and methods)	1.CO_2 emission per unit of value added (UNIDO, IEA)

9.5	Enhance the technological and scientific capabilities of industrial sectors by 2030 (especially in developing nations), including fostering innovation, significantly increasing the number of workers engaged in research and development per million people, and increasing both public and private research and development spending	1. Research and development expenditure as a percentage of GDP (UNESCO-UIS I) 2. Researchers (in full-time equivalent) per million inhabitants
9.A	"Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States 18"	1. Total official international support (official development assistance plus other official flows) to infrastructure (OECD)
9.B	Supporting environmental policy as well as promoting industrial diversity and adding value to commodities can help technology development, research, and innovation systems in developing countries	1. Percentage of medium and high-tech manufacturing value added in total value added (UNIDO)
9.C	By 2020, the least developed countries will have increased access to information and communications technology (ICT) and will have affordable, universal Internet access	1. Percentage of the population covered by a mobile network, by technology (ITU)

Source: Adapted to UN (2022); Kynčlová et al. (2020)

Based on the comparative analysis of indicators within the 9th goal of sustainable development, critical factors of industry, innovation and infrastructure will be found in the following countries included in the analysis: Serbia (SER), North Macedonia (MAC), Albania (ALB), Bosnia and Herzegovina (B&H), Bulgaria (BUL) and Croatia (CRO).

3. Research results and discussion

The analysis of industry, innovation and infrastructure as determinants of sustainable development of Serbia and neighbouring countries is based on data about a score of the 9th goal of sustainable development including 7 indicators for a 6-years period. With the aim of analyzing the limiting factors and advantages of Serbia and neighbouring countries in terms of Goal 9, the average scores of all 7 indicators for each country, as well as the average scores of all 7 indicators per year for all countries, are presented in Table 2.

Table 2: SDG9 indicators – Serbia and neighbouring countries (2017-2022)

	Year	SER	MAC	ALB	B&H	BUL	CRO	Average per year for all countries
I_1	**2022**	**78.4**	**81.4**	*72.2*	*73.2*	*70.2*	**78.3**	75.62
	2021	**77.4**	**79.2**	*69.6*	*69.9*	*67.9*	**79.1**	73.85
	2020	**73.4**	**79.2**	*71.8*	*70.1*	*64.8*	**75.3**	72.43
	2019	**70.3**	**76.3**	**71.8**	*69.5*	*63.4*	*67.1*	69.73
	2018	**67.1**	**72.2**	**66.4**	*54.7*	*59.8*	**72.7**	65.48
	2017	**65.3**	**70.4**	*63.3*	65.1	*56.7*	**69.8**	65.10
Average per indicator (2017-22)		**71.98**	**76.45**	*69.18*	*67.08*	*63.80*	**73.72**	70.37
I_2	**2022**	**90.3**	*64.9*	*62.1*	*47.3*	**105.6**	**82.1**	75.38
	2021	*71.3*	*64.9*	*62.1*	*47.3*	**105.6**	**82.1**	72.22
	2020	*66.0*	*64.7*	*62.8*	*55.4*	**101.0**	**79.5**	71.57
	2019	**77.0**	*60.8*	*69.3*	*43.4*	**91.6**	**79.7**	70.30
	2018	**72.8**	*57.1*	*57.6*	*40.5*	**87.4**	**77.2**	65.43
	2017	**71.8**	*56.2*	*40.6*	*33.5*	**81.3**	**75.4**	59.80
Average per indicator (2017-22)		**74.87**	*61.43*	*59.08*	*44.57*	**95.42**	**79.33**	69.12
I_3	**2022**	-	-	-	-	-	-	-
	2021	-	-	-	-	-	-	-
	2020	-	-	-	-	-	-	-
	2019	-	-	-	-	-	-	-
	2018	*3.5*	**4.1**	**4.3**	*3.4*	*3.9*	**4.7**	3.98
	2017	*3.2*	**4.1**	**4.1**	*3.2*	**3.9**	**4.4**	3.82
Average per indicator **(2017-22)**		*3.35*	**4.1**	**4.2**	*3.3*	3.9	**4.55**	3.9
I_4	**2022**	2.6	*2.5*	*2.3*	*2.4*	**2.8**	**3.0**	2.60
	2021	2.6	*2.5*	*2.3*	*2.4*	**2.8**	**3.0**	2.60
	2020	2.6	*2.5*	*2.3*	*2.4*	**2.8**	**3.0**	2.60
	2019	2.6	*2.5*	*2.3*	*2.4*	**2.8**	**3.0**	2.60
	2018	*2.5*	**2.6**	*2.0*	**2.6**	*2.4*	**3.0**	2.52
	2017	2.6	2.6	*2.2*	2.6	2.6	**3.0**	2.60
Average per indicator (2017-22)		*2.58*	*2.53*	*2.23*	*2.47*	**2.70**	**3.00**	2.59

I_5	**2022**	**29.5**	*0.0*	*0.0*	*7.0*	**16.5**	**22.0**	12.50
	2021	**25.5**	*0.0*	*0.0*	*7.0*	**17.7**	**22.6**	12.13
	2020	**22.5**	*0.0*	*0.0*	*7.0*	**16.4**	**24.1**	11.67
	2019	**22.5**	*0.0*	*0.0*	*0.0*	**14.4**	**26.1**	10.50
	2018	*4.3*	*0.0*	*0.0*	*0.0*	**12.4**	**25.7**	7.07
	2017	**4.3**	*0.0*	*0.0*	*0.0*	**6.7**	*0.0*	1.83
Average per indicator (2017-22)		**18.10**	*0.00*	*0.00*	*3.50*	**14.02**	**20.08**	9.28
I_6	**2022**	**0.9**	*0.5*	*0.2*	*0.5*	**0.9**	**1.9**	0.82
	2021	**0.5**	*0.2*	*0.1*	*0.2*	**0.5**	**1.0**	0.42
	2020	**0.5**	*0.2*	*0.1*	*0.2*	**0.5**	**1.0**	0.42
	2019	**0.6**	*0.2*	*0.1*	*0.1*	0.4	**1.0**	0.40
	2018	**0.6**	0.3	0.1	0.1	0.4	1.0	0.42
	2017	*0.7*	*0.2*	**4.8**	*0.1*	*0.4*	*0.8*	1.05
Average per indicator (2017-22)		**0.63**	*0.27*	**0.78**	*0.20*	*0.52*	**1.12**	0.59
I_7	**2022**	**0.9**	*0.4*	*0.2*	*0.2*	**0.8**	**1.0**	0.58
	2021	**0.9**	*0.4*	*0.2*	*0.2*	**0.8**	**1.0**	0.58
	2020	**0.9**	*0.4*	*0.2*	*0.2*	**0.8**	**0.9**	0.57
	2019	**0.9**	*0.4*	*0.2*	*0.2*	**0.8**	**0.9**	0.57
	2018	**0.9**	*0.4*	*0.2*	*0.2*	**1.0**	**0.9**	0.60
	2017	**0.8**	*0.4*	*0.15*	*0.3*	**0.8**	**0.5**	0.49
Average per indicator (2017-22)		**0.88**	*0.40*	*0.19*	*0.22*	**0.83**	**0.87**	0.57

Source: Sachs et al. (2017, 2018, 2019, 2020, 2021, 2022)
**Note: Bold marked above average, italics below average for each year*

Table 2 indicates that regarding indicator 1 - Population using the internet (%), North Macedonia records the best result of all 6 analysed countries, while Bulgaria is the country with the lowest percentage of the population that uses the Internet, in the analysed six-year period. Considering indicator 2 - Mobile broadband subscriptions, the highest score is achieved by Bulgaria, while the worst is achieved by Bosnia and Herzegovina. Analysing the third indicator - Quality of overall infrastructure, we conclude that Croatia achieves the best results, and Bosnia and Herzegovina the worst, but Serbia is very close. Including the fourth indicator - Logistics Performance Index, Croatia is in the first place, followed by Bulgaria, while Albania is in last place, but Bosnia and Herzegovina is also close. Bearing in mind the fifth indicator - The Times Higher Education Universities Ranking, the best score is achieved by Croatia, followed by Serbia and Bulgaria, while the biggest problem and weakness, when it comes to indicators within the 9 goals for North Macedonia and Albania, is precisely this indicator. Taking into account the sixth indicator - Scientific and technical journal articles, Croatia achieves the best results, followed by Albania and Serbia, while Bosnia and Herzegovina achieves the worst. Analysing the last indicator - Expenditure on research and development (% of GDP), it

can be concluded that this is Serbia's key advantage, bearing in mind that it achieves the best result of all the countries in the region, followed by Croatia and Bulgaria, and the worst countries from this aspect are Albania and Bosnia.

Table 3: Indicators within Goal 9 which require priority of development policy by analysed countries (2017-2022)

Country	The critical indicators which are below the average score of the group of analysed countries	Number of critical indicators
Serbia	I_3, I_4	2
North Macedonia	I_2, I_4, I_5, I_6, I_7	5
Albania	I_1, I_2, I_4, I_5, I_7	5
Bosnia and Herzegovina	I_1, I_2, I_3, I_4, I_5, I_6, I_7	7
Bulgaria	I_1, I_3, I_6	3
Croatia		0

Source: Author's calculation

Table 3 shows that Bosnia and Herzegovina, with 7 critical indicators, is the worst-positioned analysed country, especially considering that it has the worst performance in all analysed indicators. This would mean that this country must take immediate action in all these areas of innovation and infrastructure development. Similar results are achieved by Albania and North Macedonia, with 5 critical indicators each. Serbia is in the second-best place, bearing in mind that it has only 2 critical indicators, and right after Serbia is Bulgaria, with 3 critical indicators. It is interesting that Croatia does not have critical indicators, considering that for each indicator within *Goal 9 of sustainable development*, it had a score above the average of the analysed countries in the surrounding area.

Conclusion

The results obtained from the comparative analysis of Serbia and neighbouring countries with regard to the 9th goal of sustainable development lead to the following conclusions:

- Serbia achieves poor performance in two indicators - Quality of overall infrastructure and Logistics Performance Index: Quality of trade and transport-related infrastructure, which points to the necessity of directing public policies to the improvement of transport infrastructure, information and communication infrastructure, improvement of the innovation system, and trade quality.
- North Macedonia particularly records bad results in the science sector, when it comes to the ranking of universities and the number of scientific journals, which requires a policy of reforms in the field of science and innovation activity in order to raise the quality in this sector.
- Albania achieves the worst results in ranking of universities, transport

infrastructure, quality of trade and allocation for research and development activities, which is the worst of all analysed countries.

- Bosnia & Herzegovina records the worst results regarding indicators 2, 3, 5 and 6 comparing all 6 neighbouring countries. It implies that this country should focus public policies on the development of the overall infrastructure, on the improvement of universities and scientific journals, and quality of science, while encouraging the population to use mobile broadband subscriptions.
- Bulgaria could improve its position by encouraging the population to use the Internet, directing policies towards the development of the overall infrastructure (transport, education, information and communication), and strengthening the quality and number of scientific and technical journal articles.
- Croatia is the only country out of all the analysed countries that does not have critical factors, i.e. in all indicators it achieves a score above the average for the six-year period for countries in the region (out of a total of 6 countries).

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Ivana Janjić [1]
Innovation Center, University of Nish

Ivana Milošević [2]
Leoni Wiring System Prokuplje

Anđela Milenković [3]
Innovation Center, University of Nish

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APPLICATION OF QUANTITATIVE METHODS FOR INVENTORY FORECASTING IN SUPPLY CHAINS ON THE EXAMPLE OF LEONI COMPANY

Abstract

In order to effectively manage the supply chain, it is important to effectively manage the inventory within it. The application of quantitative forecasting methods contributes to the accuracy and validity of forecasting and defining stock flows. The subject of this paper is to review the use of quantitative methods of inventory forecasting, namely exponential smoothing, adaptive filtering, the method of moving averages and regression analysis. The aim of the paper is to show inventory forecasting using the mentioned quantitative methods on the example of the company "Leoni Wiring System Prokuplje". The results of the research indicate that applied quantitative methods of forecasting in the supply chain provide reliable and accurate forecasts on the basis of which material orders can be defined in order to ensure the smooth functioning of production, on the example of the company "Leoni Wiring System Prokuplje".

Keywords: *supply chain, inventory, quantitative methods, forecasting*

JEL classification: C13, L62

ПРИМЕНА КВАНТИТАТИВНИХ МЕТОДА ПРОГНОЗИРАЊА ЗАЛИХА У ЛАНЦИМА СНАБДЕВАЊА НА ПРИМЕРУ КОМПАНИЈЕ „ЛЕОНИ“

Апстракт

У циљу ефикасног управљања ланцем снабдевања значајно је ефикасно управљати залихама унутар њега. Примена квантитативних метода прогнозирања доприноси тачности и валидности предвиђања и дефинисања токова залиха. Предмет овог рада је сагледавање начина употребе квантитавних метода прогнозирања залиха, и то експоненцијалног изравнања, адаптивног филтри-

[1] ivana91ekfak@gmail.com, ORCID ID 0000-0003-3142-8467

[2] ivanica.96@hotmail.com, ORCID ID 0000-0002-4197-5539

[3] milenkovic.andjela998@gmail.com, ORCID ID 0000-0001-5779-1526

рања, методе покретних просека и регресионе анализе. Циљ рада је да се на примеру компаније „Leoni Wiring System Prokuplje“ прикаже прогнозирање залиха применом споменутих квантитативних метода. Резултати истраживања указују да примењене квантитативне методе предвиђања у ланцу снабдевања дају поуздане и тачне прогнозе на основу којих се могу дефинисати наруџбине материјала у циљу несметаног функционисања производње, на примеру компаније „Leoni Wiring System Prokuplje “.

***Кључне речи**: ланац снабдевања, залихе, квантитативне методе, прогнозирање*

Introduction

Supply chains are attracting increasing attention from theorists and practitioners. The increasing volatility of demand, shortened product life cycles as well as the increased rate of innovation, have conditioned the trend of efficient management of supply chains. In order to reach effectiveness, it is necessary that all members of the supply chain understand their importance and strive for its optimization. In recent literature, the term supply chain resilience is also mentioned, which means the ability to survive in modern business conditions. The resilience of the supply chain and its survival, as well as the techniques to achieve this goal, are the subject of consideration by all members of the supply chain, who benefit from its survival and improve their business, because without it, there is no individual progress (Anđelković et al., 2013). Also, supplies optimization is an imperative and condition for the efficient functioning of the supply chain (Anđelković & Milovanović, 2021; Negri et al., 2021).

Due to the major changes in the market, which have been present in the last few years, the management of supply chains encounters numerous challenges. The Covid-19 pandemic led to a complete disruption of supply chains, which continued in the years after the pandemic, primarily due to the emergence of the crisis in Ukraine, as a result of which a large number of sectors were affected. One of the sectors that suffered the most damage is the automotive industry. Manufacturers and suppliers (e.g. "*Leoni*", "*Fujikura*", "*Nexans*") are increasingly striving for collaboration in order to reduce the effects of the crisis. German companies in particular suffered great damage, due to their withdrawal from the market of the Russian Federation, but also due to interruptions in their production. Their car exports to Ukraine and the Russian Federation have decreased, while Chinese companies are slowly taking over the market share (Burger, 2022). The war in Ukraine has affected the global economy. There was an increase in the price of energy in Europe due to the introduction of sanctions against the Russian Federation. Also, world trade has been limited and disrupted, there have been interruptions in food supply. Forecasts by the World Trade Organization have indicated that the same unfavourable situation will continue. In addition to the impact on trade in goods, the war in Ukraine affects the exchange of services, primarily transport services. Also, the disruption of supply chains around the world is predicted to cause a major crisis.

An important aspect of the efficient functioning of supply chains is effective inventory management. The subject of this paper is an overview of the use of quantitative methods of

inventory forecasting. The aim of the paper is to show and explain the implementation of quantitative methods for inventory forecasting on the example of the company "*Leoni Wiring System Prokuplje*".

1. Literature review

1.1. Concept and management of supply chains

Supply chains have always occupied the attention of a large number of theorists and practitioners. The supply chain includes the flows of information, money and knowledge that are continuously managed by the members of the supply chain. Supply chains involve a large number of entities. Manufacturers, suppliers, transporters, wholesalers, retailers, buyers are just some of the potential participants in a supply chain. As the number of members increases, so does the complexity of managing them. In order for the product to reach the final consumer, it is necessary to go through the entire supply chain, so it can be concluded that the satisfaction of the final consumer depends on all members of the supply chain, and not only on the manufacturer who produced the product. Therefore, it is necessary to effectively manage the entire supply chain in order to maximize the satisfaction of the end customers. Supply chains include three basic phases. The first phase is procurement, the second is production and the third is distribution. Within each of these phases, there are multiple participants who cooperate with each other (Felea & Alăstroiu, 2013).

Earlier, traditional supply chains were characterized by no great connection between participants and the focus was on storage and inventory. However, today, a large number of supply chain members rely on a significant connection between them. That is why there is a need for its optimization, in order to synchronize all elements that add value, but also to eliminate activities that do not add value. Today, there is also an increasing use of information and communication technologies, which help control and exchange information in the supply chain. They enable better and faster communication between members, which shortens the period from procurement to the product delivery process. In order to realize the advantages that the application of information and communication technology implies, members of the supply chain purchase software that enables the performance of the aforementioned functions. Some of them are *Vanguard Software Corporation*, *ILOGI*, *Inc* (*Mountain View*, *CA*), *Dra Systems*, *SynQuest* (*Atalanta, GA*) and others (Mitrović & Mitrović, 2019). Also, the application of the Internet in supply chains can increase the degree of integration. By using it, it is possible to increase operational efficiency, speed up processes in the supply chain, faster exchange of information and delivery of products, and greater control over operations. If we look at individual members of the supply chain, for example manufacturers, the application of the Internet will lead to a reduction in the risk of interruption of the production process. In addition to the aforementioned advantages, there are still obstacles and limitations, which primarily relate to the technical and social aspects of use (Lee et al., 2022).

A number of methods can be used to improve the efficiency of supply chain management. The application of cloud computing is a good solution for supply chain management. The main purpose of cloud computing is to share resources over a network, most often over the Internet. It allows resources to be: used only when needed, provisioned flexibly, measured and billed. However, there are also certain disadvantages of cloud computing. They relate to:

inadequate legal regulation, lack of clarity regarding the licenses that are needed, the problem of providing a guarantee by the provider and difficulties in managing digital identity (Regodić et al., 2019). Also, the use of scientific research methods, quantitative, qualitative or their combination, contributes to improving the efficiency of supply chain management (Yue & Xu, 2019). When it comes to supply chains, these methods gain special importance when applied to forecast inventory flows.

1.2. Inventory flows in supply chains

Inventory management is the process of continuous monitoring and control of inventory levels. All inventory can be classified into three basic categories, according to the ABC approach. Group A contains inventory that generate 70% of the company's revenue. Group B consists of inventory that generate 25% of income, while group C consists of the least valuable inventory, which participate in total income with only 5%. Classification is important because it allows management to define what level of attention should be given to different groups of inventories. It is logical that the greatest attention will be directed towards group A, because they generate the largest percentage of total revenues, then less to group B and least to group C (Priniotakis & Argyropoulos, 2018). Inventory and its optimization represent important aspects of the business of any company and the supply chain as a whole. They affect direct costs, but also every member of the supply chain, which leads to a direct impact on the time of delivery of products to consumers. This is especially important in modern business conditions, where competitiveness is based first on time and then on quality. On the one hand, a lack of inventory can lead to consumer dissatisfaction, which can lead to a change of manufacturer and a negative reputation. On the other hand, excessive inventory leads to high inventory holding costs, which is also an unfavourable situation. Therefore, all members of the supply chain strive for inventory optimization, as the primary goal of supply chain inventory management.

Efficient customer response (ECR) is the most common method of inventory management. It is especially applicable in modern business conditions, because its goal is to adapt to changing customer requirements, through the integration and cooperation of members of the supply chain. Although most authors believe that this concept appeared first in the food industry, some authors state that it originated from the fashion industry. However, due to the good results that it achieved first in the area of the food industry, its development and origin is linked precisely to this branch of the industry. The application of the ECR system enables the management of product categories, continuous replenishment of stocks and the application of technology in inventory management. However, despite the numerous advantages that this system provides, its implementation implies an expensive and long-term process. At the level of individual members of the supply chain, a change in internal operations is required. In addition, a greater degree of cooperation and integration is needed, which all affects the complexity of the application of this system (Stanković & Popović, 2009).

In modern business conditions, the application of algorithms and algorithmic procedures is increasing, which are combined in order to predict the trend of a certain phenomenon, such as, for example, inventory movements, based on the analysis and comparison of a large amount of data. Quantitative forecasting methods mostly rely on data. When choosing a quantitative method, it is necessary to consider a large number of factors such as the context of the forecast, then the relevance, but also the availability of historical data used in the forecast,

the target degree of accuracy, as well as the time period of the forecast. Quantitative methods can be combined with human judgment, which provides a number of advantages. A survey of 240 US corporations found that only 11% use forecasting software, and 60% routinely adjust generated forecasts based on individual judgment. Research shows that the synergy of these two methods leads to greater accuracy and less probability of creating errors in the analysis process compared to the independent results that both prediction models provide (Zellner et al., 2021). There is a large number of quantitative forecasting methods, however, the four most popular in theory and practice stand out, namely exponential smoothing, adaptive filtering, the method of moving averages and regression analysis.

1.3. Methodology

The following quantitative methods were used for forecasting inventory flows in the supply chain:

a. exponential smoothing;
b. adaptive filtering;
c. moving average method and
d. regression analysis.

Exponential smoothing is a simple technique used to "smooth out" most residual effects (Gelper et al., 2007). Exponential smoothing is considered by some scientists to be a naive method of forecasting. However, today it is used in many areas, starting from inflation forecasting to forecasting related to tourism management needs. Exponential smoothing has a significant place because of the simplicity it exhibits compared to much more complex and sophisticated approaches in forecasting. The starting idea is that there is a certain regularity in the behavior of the observations along with random fluctuations in the series. By applying the exponential smoothing procedure to the available data, a smoothed series with damped random fluctuations is obtained. Such a flattened series indicates the underlying tendency present in a given time series. The series of smoothed values is then used as a baseline for forecasting future values of the time series. That, together with the fact that exponential smoothing uses only the last values of the series, makes the method a useful tool for forecasting future trends in time series (Lepojević & Janković-Milić, 2011).

The application of the *adaptive filtering technique* involves two phases. The first phase is adjusting a set of weights to historical data, and the second is using those weights to make a forecast. It is also necessary to calculate the standard error associated with this forecast. The weights are adjusted to reduce the error observed with the forecast. The sum of the weights must be equal to number one (Đorđević et al., 2011).

The method of moving averages is most often used to determine the trend (T) if the cyclical component does not exist, or to determine the product of the trend and the cyclical component (TC) if the cyclical component exists. A moving average is an artificial construction of a time series in which each original data of the time series is replaced by the arithmetic mean of that data, a certain number of previous data and the same number of subsequent data. The total number of members whose arithmetic mean is sought is odd, and represents the order of the average. Thus, if we replace each original time series data with the arithmetic mean of that data, one previous and one subsequent data, we get a three-member moving average. If we replace each original data of the time series with the arithmetic mean of that data, two previous and two subsequent data, we get a five-member moving average.

For the selected period of length L (even or odd number of years), we calculate the arithmetic averages of consecutive values of the occurrence for the selected length and by centring the average we replace the corresponding empirical data of the time series. Moving averages can be formed based on 3, 4, 5 and more members of the time series that determine the order of the moving averages. Moving averages of odd, third order are formed from three time series data (Đorđević, 2009).

Regression analysis is a statistical study in which two or more mass phenomena are observed and the connections between them are analysed, as well as the shape and direction of those connections. The basic task of regression analysis is to assess the form of dependence (regression model) between observed phenomena, that is, to show how the studied phenomenon (dependent variable) changes on average with the change in the value of other phenomena (independent variables). In practice, there is often a situation where it is necessary to establish a functional relationship between two or more variables, where a visual representation is reached through a graph. First of all, in the first step, the values of the variables that are put into a relationship, and which depend on each other, are collected. After that, the variables are displayed in the coordinate system, and by connecting the points, a curve is created that shows the dependence of the entered variables. The most common approximate curves are straight line, parabola, cubic parabola, 4th order parabola, hyperbola, exponential curve, geometric curve, logistic curve, etc. (Bogićević, 2013). The appropriateness of the regression model is checked using the coefficient of determination, while in the multiple regression equation, the unknown quantities are actually regression coefficients that are determined based on the measured values of the objective function using the "method of least squares" (Ilić & Mijailović, 2014).

The data on the basis of which the analysis was made were taken from the SAP and FORS systems of the company LEONI Wiring Systems Southeast d.o.o. Prokuplje. For the purposes of data processing, the SPSS statistical package for the social sciences (Statistics Statistical Package for the Social Sciences), version 22.0, was used.

The research is based on the following hypothesis:

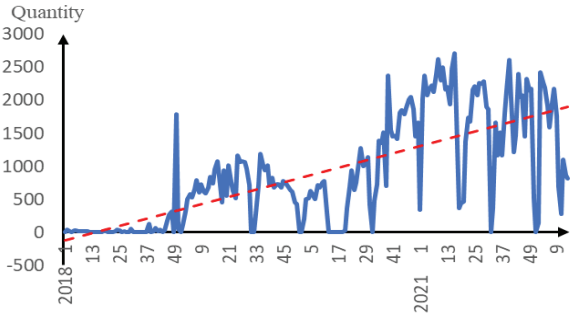
Quantitative methods of forecasting in the supply chain provide reliable and accurate forecasts on the basis of which materials can be ordered so that optimal inventory is maintained for the smooth functioning of production.

4. Research results and discussion

4.1. Forecasting inventory flows on the example of material "sibo" from the supplier MTA Advanced Automotive Solutions

Supplier MTA Advanced Automotive Solutions (MTA) is one of the most important suppliers of Leoni. The MTA supplier material - "sibo" - is a fuse housing that is an integral part of every cable manufactured by the Leoni Company. The forecasting of the amount of "sibo" material that needs to be procured from the MTA supplier was carried out on the basis of empirical data of the ordered amount of "sibo" material in the period from 2018 to the 14th week of 2022 (Figure 1).

Figure 1: Empirical data - ordered quantities of "sibo" materials in the period from 2018 to week 14 in 2022



Source: Authors

SPSS software was used for forecasting. The values of the smoothing constants are generated by the software itself and provide optimal forecasts. In order to evaluate the accuracy of the forecast and help in the selection of the forecast that should be used, three popular measures for determining the accuracy of the forecast have been established - the coefficient of determination (R-squared), the mean absolute deviation (MAE) and the standard error of the forecast (RMSE).

Table 1: Indicators of model fit

Model	No. of Predictors	Model Fit statistics		
		R-squared	RMSE	MAE
Orders MTA	0	0.691	453.23	259.753

Source: Authors

According to the data from Table 1, the coefficient of determination is 0.691. This coefficient shows that the selected smoothing model explained 69.1% of the total variability in the supply of "sibo" materials of MTA suppliers. The RMSE value shows the average deviation of the forecasted values from the empirical data. In this case it is 453.23. The mean absolute deviation (MAE) is 259.75 and shows the mean absolute deviation between the empirical and forecast values.

Table 2 shows data on the forecast for the procurement of "sibo" materials in the period from the 15th to the 17th week in 2022. In addition to the point values, the table also contains data for the 95% confidence interval of the forecast values. It is noticeable that all forecast values, made for the period from the 15th to the 17th week in 2022, are identical. This result arose because exponentially smoothed forecasts start from the assumption that there is no trend in the time series. Therefore, this example clearly illustrates the risk of forecasting further deliveries of MTA suppliers in the long term, and hence one should be very careful in these forecasts, except in the case that it is necessary to make a forecast for a short-term period. The advantage of this smoothing method is

that it is not demanding on the length of the time series and is fully automated. Hence, it is widely used in situations where it is necessary to form a forecast in a relatively short period of time. The main disadvantage of exponential smoothing is that it does not allow the treatment of series with trend and season.

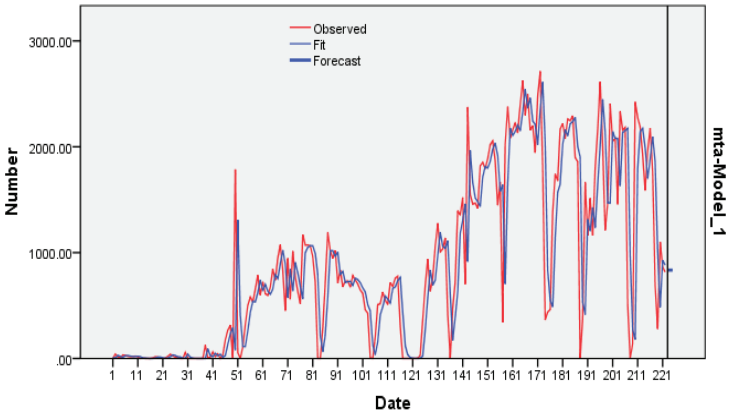
Table 2: Data on the forecast of procurement of "sibo" material from the MTA supplier in the period from the 15th to the 17th week in 2022

Model		15th W 2022	16th W 2022	17th W 2022
Order MTA	Forecast	835.21	835.21	835.21
	UCL	1728.42	1935.97	2110.16
	LCL	-58	-265.54	-439.74

Source: Authors

In Figure 2, the direct and forecast values of MTA suppliers are shown, it is clearly evident that there are no large deviations between empirical data and direct values, which indicates that the applied forecasts are also valid.

Figure 2: Empirical data, smoothed and forecasted values of "sibo" material from the MTA supplier



Source: Authors

Examining Figure 2, it is noticed that the deliveries of "sibo" material from the MTA supplier have a growing tendency, and therefore the suitability of the model based on the approach that considers the presence of a trend in the data should be checked. In this sense, the results of Holt's data smoothing approach are presented below. From Table 3, it can be seen that the coefficient of determination is 0.588. Therefore, the selected smoothing model explained 69.1% of the total variability of the "sibo" material delivery. The RMSE value shows that the average deviation of the predicted values from the empirical data is 454.34, while the mean absolute deviation (MAE) is 262.30.

Table 3: Indicators of model fit according to Holt's approach

Model	No. of Predictors	Model Fit statistics		
		R-squared	RMSE	MAE
Order MTA	0	0.588	454.339	262.299

Source: Authors

In Table 4, data on the forecast of procurement of "sibo" material from MTA suppliers in the period from the 15th to the 17th week in 2022 according to Holt's approach are presented.

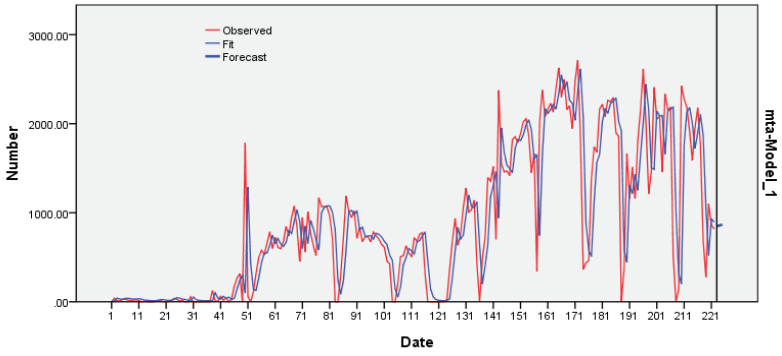
Table 4: "Sibo" material procurement forecasts for the period from the 15th to the 17th week in 2022 according to Holt's approach

Model		15th W 2022	16th W 2022	17th W 2022
Orders MTA	Forecast	849.47	858.62	867.78
	UCL	1744.88	1951.74	2127.96
	LCL	-45.95	-234.5	-392.4

Source: Authors

Table 4 gives the score point values and the corresponding 95% confidence interval of the predicted values. In contrast to the forecasted values using exponential smoothing, here a growing trend is observed in the forecasted values of "sibo" material from the MTA supplier for the mentioned period. The reason for this is the fact that Holt's approach starts from the assumption that there is a trend in the time series.

Figure 3: Empirical data, smoothed and forecasted values of "sibo" material from MTA supplier according to Holt's approach



Source: Authors

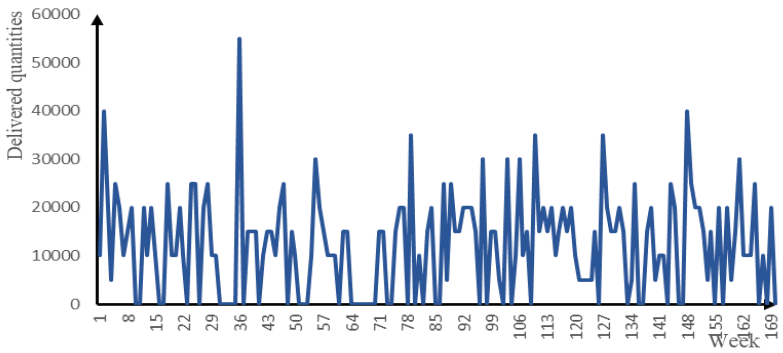
From Figure 3, the empirical values of the observed phenomenon, the corresponding smoothed values and the forecasted values can be seen. It is noticeable that there are no large deviations between the empirical data and the smoothed values.

If we compare the results obtained by exponential smoothing and Holt's method, contrary to expectation, we conclude that all three indicators of representativeness of the model support the choice of exponential smoothing as an excellent quantitative method for forecasting the delivery of "sibo" material from the MTA supplier. Namely, the measure of explained variability is higher with exponential smoothing, and the corresponding deviation measures are smaller compared to Holt's approach. This proved the hypothesis on which this research is based, that quantitative methods of forecasting in the supply chain provide reliable and accurate forecasts on the basis of which materials can be ordered so that optimal inventory are maintained for the smooth functioning of production, in the case of exponential smoothing.

4.2. Forecasting the delivery of the supplier "Hirschmann" to the company "Leoni" in 2022 using adaptive filtering

Deliveries from the supplier "Hirschmann" include several different components. For forecasting purposes, a component was selected, which is managed under the "Leoni" number "418009681". The forecast was made on the basis of empirical data from Figure 4, which shows the delivery of the supplier "Hirschmann" in the period from 2019 to the 14th week in 2022. The source of the data shown in Figure 4 is the FORS ERP system used in the "Leoni" company.

Figure 4: Deliveries of the component "418009681" in the period from the 1st week of 2019 to the 14th week of 2022



Source: Authors

From Figure 4, it can be seen that the delivery of material "418009681" is not characterized by the presence of a trend. Also, it can be noticed that there were no deliveries in all weeks in 2020. The reason for this is the disruption caused by the Corona virus pandemic.

Due to the relatively large number of weeks in which the delivery of this component was missing, which can be seen in Table 5, weekly data were grouped into quarterly ones.

The thus obtained quarterly delivery values were further used as a basis for applying adaptive filtering methods and forecasting the delivery of component "418009681" in the second quarter of 2022.

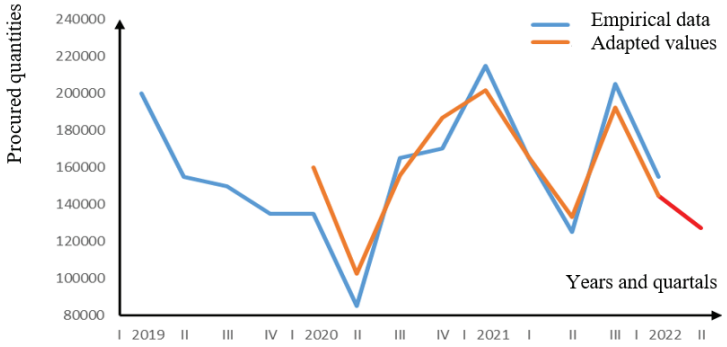
Table 5: Delivery of component "418009681" in the period from the first quarter of 2019 to the first quarter of 2022

Years and quarters	Delivered quantities	Adapted values	Error	Coefficients			
				w_1	w_2	w_3	w_4
I 2019	200000						
II	155000						
III	150000						
IV	135000			0.25	0.25	0.25	0.25
I 2020	135000	160000	-25000	0.208	0.083	0.202	0.188
II	85000	102573.5	-17573.5	0.17	0.045	0.159	0.144
III	165000	155543.9	9456.13	0.361	0.349	0.464	0.482
IV	170000	186949.6	-16949.6	0.219	0.276	0.347	0.365
I 2021	215000	201638.8	13361.2	0.376	0.428	0.426	0.49
II	165000	165554.2	-554.233	0.142	0.243	0.246	0.398
III	125000	133269	-8269.02	0.038	0.108	0.139	0.294
IV	205000	192400.1	12600	0.177	0.291	0.378	0.482
I 2022	155000	144657.7	10342.4	-0.009	0.178	0.228	0.288
II		127174.2	-127174	-0.214	-0.093	0.063	0.07

Source: Authors

By applying the adaptive filtering method to the quarterly deliveries of this component in the period from the first quarter of 2019 to the first quarter of 2022, a forecast for the second quarter of 2022 was obtained.

Figure 5: Empirical data and adapted values for the component "418009681"



Source: Authors

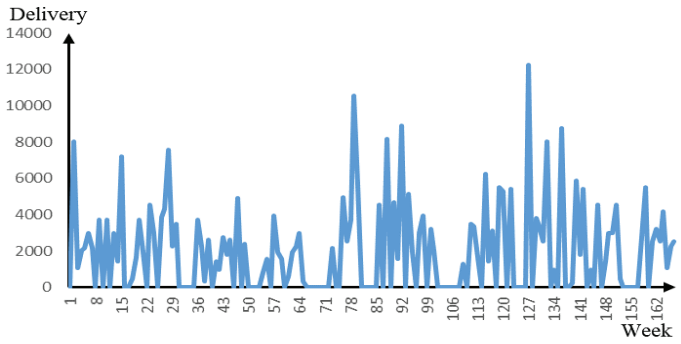
Based on Figure 5, it can be noted that there is a relatively high degree of matching between the empirical and adapted values of quarterly purchases. This represents a

kind of confirmation of the validity of the forecast of materials under Leoni number "418009681" for the 2nd quarter of 2022 and once again shows that the quantitative method of adaptive filtering is an excellent method for forecasting optimal inventory flows, which also confirms the hypothesis of this research.

4.3. Forecasting the delivery of the component "491048880" from the supplier "Coroplast" in 2022 using the moving average method

The graphic representation (Figure 6) of the delivery of the component "491048880" (waterproof tape) of the company "Coroplast" in the period from the 1st week of 2019 to the 11th week of 2022 indicates the absence of a trend when it comes to these data. Also, it is noticeable that there have been no deliveries for several weeks, due to the pandemic caused by the Corona virus.

Figure 6: Deliveries of the component "491048880" of the company "Coroplast" in the period from the 1st week of 2019 to the 11th week of 2022



Source: Authors

In the forecasting of deliveries of the component "491048880" of the company "Coroplast", four-member moving averages were used first, and then thirteen-member moving averages (because 13 weeks represent one quarter of the year). Next, appropriate measures of representativeness were determined (mean absolute deviation and standard error - mean square deviation) and compared to see which forecast was better.

Table 6: Four-way moving averages and measures of representativeness for deliveries of the component "491048880" of the company "Coroplast"

Years and weeks	Delivery size	Moving averages	Absolute deviation	Squared deviation
2019 1	0		315	198450
2	8040			445.47
3	1080			
4	2040			
5	2160	2790	630	396900
6	3000	3330	330	108900

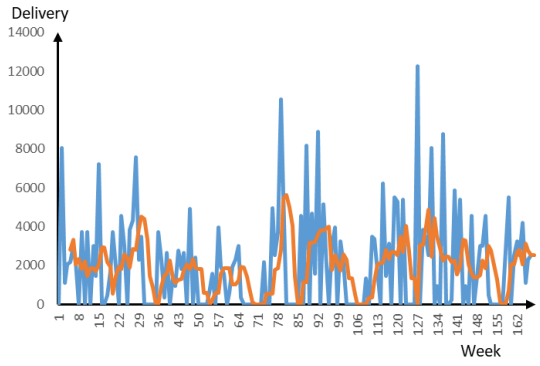
7	2160	2070	90	8100
8	0	2340	2340	5475600
9	3720	1830	1890	3572100
10	0	2220	2220	4928400
…	…	…	…	…
2022 8	4200	2070	2130	4536900
9	1080	3120	2040	4161600
10	2280	2760	480	230400
11	2520	2520	0	0
12		2520		

Source: Authors

From Table 6, it can be seen that the forecasted value for the 12th week of 2022 is 2520, and the mean absolute deviation of moving averages from empirical data is 315, while the standard error - the average deviation of moving averages from empirical data is 445.47.

Below is a graphical presentation of empirical data and four-hour moving averages of the waterproof tape "491048880". On the basis of Figure 7, it can be observed that the given moving averages well approximate the movement of deliveries of this component, so it can be considered that the forecasted value for the 12th week of 2022 is good.

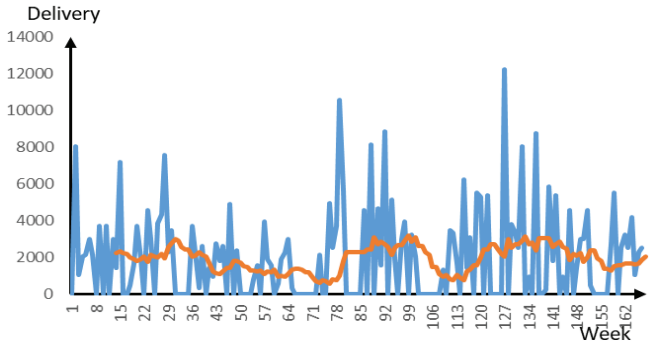
Figure 7: Empirical data and four-member moving averages for the component "491048880" of the company "Coroplast" in the period from the 1st week of 2019 to



Source: Authors

In the next step, thirteen-member moving averages were determined (Figure 8) and the delivery of this component was forecasted for the 12th week of 2022. The results are shown in Table 7.

Figure 8: Empirical data and thirteen-member moving averages for the component "491048880" of the company "Coroplast" in the period from the 1st week in 2019 to the 11th week in 2022



Source: Authors

The forecasted delivery value is 2049.23 while the mean absolute deviation is 724.61 and the standard error is 727.09.

Table 7: Thirteen-member moving averages and measures of representativeness for deliveries of the component "491048880" of the company "Coroplast"

Year and week	Delivery size	Moving averages	Absolute deviation	Squared deviation
2019 1	0		724.61	528667.5
2	8040			727.09
3	1080			
4	2040			
5	2160			
6	3000			
7	2160			
8	0			
9	3720			
10	0			
11	3720			
12	0			
13	3000			
14	1440	2224.61	784.615	615621.3
15	7200	2335.38	4864.65	23664483
16	0	2270.76	2270.76	5156393
…	…	…	…	…
2022 9	1080	1633.84	553.84	306745.56
10	2280	1680	600	360000
11	2520	1855.38	664.61	441713.6
12		2049.23		

Source: Authors

If the measures of representativeness of four-member and thirteen-member moving averages are compared, it is noticed that the values of both measures, mean absolute deviations and standard errors, in the case of four-member moving averages are smaller than those of thirteen-member moving averages. Hence, forecasts obtained on the basis of four-term moving averages are better than forecasts based on thirteen-term moving averages and that the hypothesis of this work was confirmed in the case of moving average method.

4.4. Application of regression analysis in forecasting the required number of workers based on the order number of cables G2X project

For the purposes of formulating a regression model that would describe the relationship between the number of workers engaged in the production of cables for the G2X project, on the one hand, and the order of cables from the G2X project by the customer, on the other hand, data was collected on the number of workers engaged in the production of the segment G2X in the period from 2019 to the 14th week of 2022 (Table 8), as well as data on orders for cables of the G2X segment (Table 9). The data was taken from the SAP system used by the human resources department for employee attendance. Also, the SAP system is used by the department for production planning and control, through which it receives orders from its premium customer. The number of hired workers in the observed period represents the dependent variable, while the size of the orders represents the independent variable.

Table 8: Empirical data on the number of workers who worked on the G2X segment in the period from 2019 to 14 weeks of 2022

Number of workers who worked on the G2X segment from 2019 to the 14th week of 2022				
Year	*2019*	*2020*	*2021*	*2022*
January	269	284	1093	880
February	293	309	1074	1082
March	344	295	1037	992
April	391	0	1050	957
May	476	284	1211	
June	429	274	975	
July	444	248	997	
August	381	176	1030	
September	453	540	977	
October	418	882	948	
November	396	818	908	
December	350	803	905	

Source: Authors

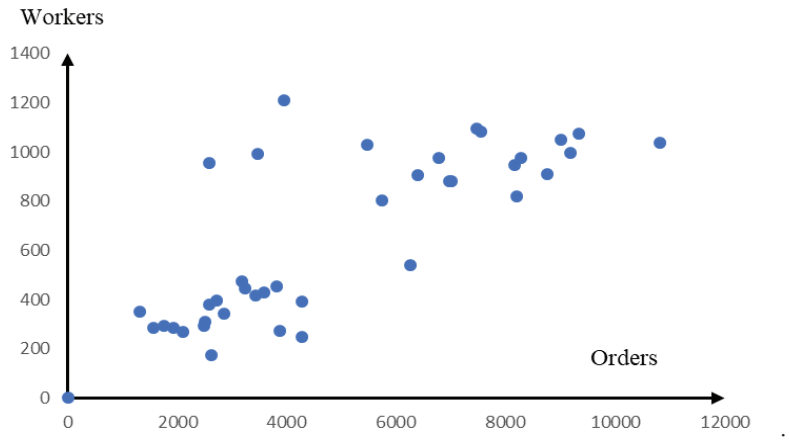
Table 9: Empirical data on the number of G2X cables ordered by the customer in the period from 2019 to the 14th week of 2022

Cable orders on the G2X project by the customer in the period from 2019 to the 14th week of 2022				
Year	*2019*	*2020*	*2021*	*2022*
January	2098	1928	7481	7006
February	2497	2510	9345	7541
March	2860	1755	10821	3470
April	4284	0	9018	2596
May	3179	1567	3948	
June	3583	3867	8280	
July	3248	4273	9189	
August	2585	2621	5468	
September	3824	6252	6773	
October	3438	6965	8156	
November	2730	8200	8764	
December	1310	5738	6402	

Source: Authors

The SPSS program was used for data processing. In order to check whether there is a linear relationship between the number of workers and the size of orders, the data on the values of these two series during the observed period are presented graphically in the form of a scatter diagram. According to Figure 9, there is a direct linear connection between these two phenomena, i.e., with the increase in orders, the number of hired workers also increases.

Figure 9: Workers and order size in the period from week 1 of 2019 to week 14 of 2022



Source: Authors

Table 10 provides data on the correlation between the variables. According to the data in the table, we conclude that there is a strong correlation between the number of hired workers and the size of orders. This coefficient is statistically significant.

Table 10: Pearson correlation

	Order size
Number of workers	0.793 (.000)

Source: Authors

In order to get a clearer picture of the value of the observed variables that were taken into consideration during the analysis, descriptive measures were determined, which is shown in Table 11.

Table 11: Descriptive statistics

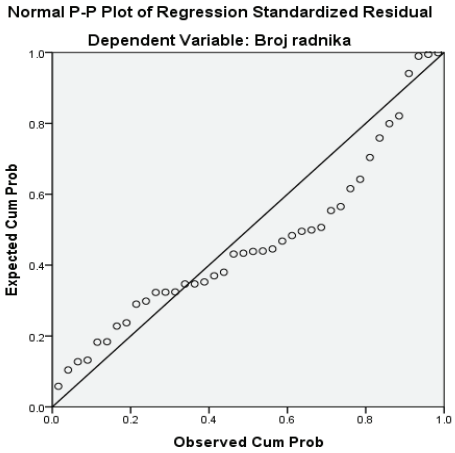
	Arithmetic mean	Standard deviation	Size of samples
Number of workers	641.8250	343.38645	40
Order size	4889.2500	2751.57928	40

Source: Authors

According to these data, the average number of employed workers in this period was 642, with a standard deviation of 343, while the average order amount was 4889, and the standard deviation was 2752.

Before formulating the regression model itself, it is necessary to check whether the assumptions for conducting the regression analysis are met. In that case, Graph 6 indicates that the assumption of a linear relationship between the observed variables is met. The assumption that the stochastic term is equal to zero on average was checked by determining the unstandardized values of the residuals in SPSS, and then those values were summed in Excel and it was obtained that the sum is equal to zero. This assumption is fully fulfilled. The verification of the assumptions related to the residuals was started by reviewing the Normal Probability Plot (P-P) diagram - Figure 10, and the Regression Standardized Residual Scatterplot - Figure 11. On the Normal P-P Plot diagram, it can be seen that the points representing the standardized values of the residuals do not lie very close to the imaginary diagonal that is extending from the lower left corner to the upper right corner. It should be noted that there are certain problems with the fulfilment of the assumption related to the normal distribution of residuals.

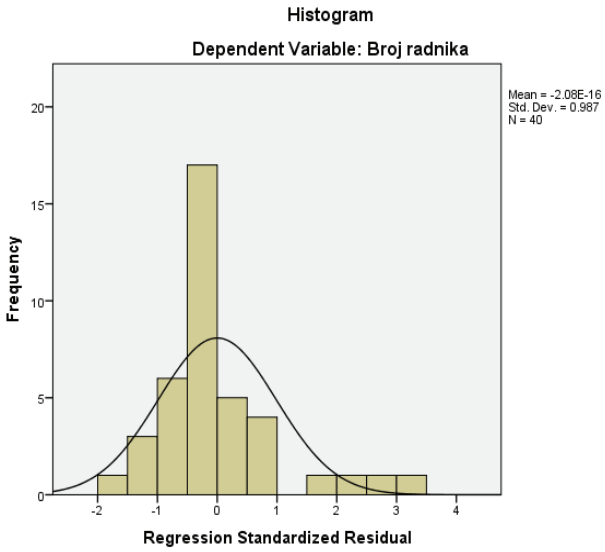
Figure 10: Normal probability plot (P-P pilot)



Source: Authors

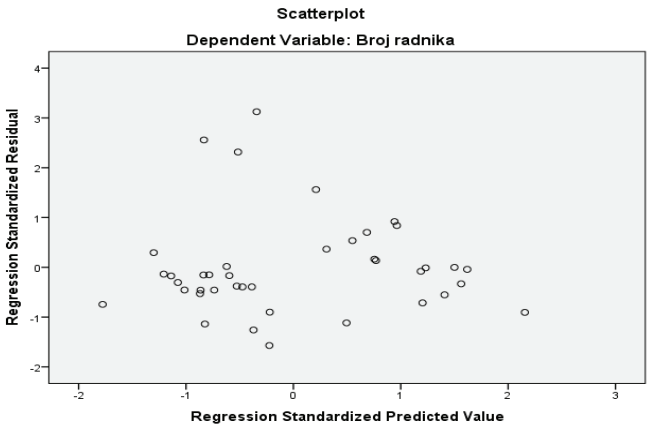
Figure 11 confirms the statement that there are certain deviations of the residuals from the normal distribution. After the standardization of the residuals, their graphic representation via histogram clearly points to certain deviations from the Gaussian curve, thus providing another clear confirmation that there is a certain violation of the assumption of normality of the residuals.

Figure 11: Histogram Regression Standardized Residual



Source: Authors

In Figure 12, it can be seen that not all points (residuals) are approximately correctly distributed within the given rectangular surface, and that most of them are clustered in the centre around point 0, but also that a certain number deviates from it. Accumulation of these points in the form of some geometric figure and deviation from the uniform distribution in the centre of the rectangle indicates that some of the initial assumptions related to the distribution of residuals have been violated. Also, based on Figure 12, one can consider if there are any atypical points. Namely, these are cases whose standardized residuals fall outside the range of ±3.3. According to Figure 12, there is no indication that atypical points are occurring.



Source: Authors

Bearing in mind the results of the verification of the fulfilment of the assumptions for carrying out the regression analysis, it is possible to state that there is no serious violation of these assumptions, with the exception of the assumption related to the normality of the residuals, and that the model as such is sustainable, that is, it is possible to continue with the assessment and evaluation of the model itself.

Since the fulfilment of the assumptions of the regression model has been checked and it has been established that it is possible to carry out the regression analysis procedure, the parameters of the model are determined in the next step. According to Table 12, the value of the regression constant is 157,941, which indicates that the company must employ 158 workers at any given time. The estimated value of the slope coefficient is 0.099. This value shows that if the order of G2X segment cables were to increase by 100 pieces, it would be necessary to hire 10 new workers. The estimated values of the corresponding constant and coefficient are statistically significant.

Tabel 12: Coefficients

Model	Unstand. Coeffi.		Stand. Coeff. Beta	t	Sig.
	B	Std. Error			
(Constant)	157.941	68.980		2.290	0.028
Order size	0.099	0.012	0.793	8.025	0.000

Source: Authors

As already mentioned, there is a strong correlation relationship between the dependent variable and the independent variable (according to *Pallant (2013)*), there is a strong relationship between the variables if the correlation coefficient is above 0.5), which can be seen from Table 13. Also, this table shows that changes in the number of hired workers are explained by 62.9% changes in order sizes. If the stricter criterion given as the corrected coefficient of determination is interpreted, it is somewhat smaller and according to it the degree of explained variability is 61.9%.

Table 13: Representativeness of the model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.793	0.629	0.619	211.91270
Dependent Variable: Number of workers				

Source: Authors

A kind of evaluation of the validity of the model and the indicator of the explained variability can be found in Table 14. The evaluation of the statistical significance of the coefficient of determination was carried out through the analysis of variance. This test tests the hypothesis that the coefficient of determination takes the value 0. As the value in column Sig. is 0.000, it is a confirmation that the coefficient of determination does not differ from zero, so the model is statistically significant.

Table 14: ANOVA test

Model		Sum of Squares	df	Mean Square	F	*Sig.*
1	Regression	2892190.096	1	2892190.096	64.404	0.000
	Residual	1706465.679	38	44906.992		
	Total	4598655.775	39			
Dependent Variable: Number of workers						
Predictors: (Constant), Order size						

Source: Authors

It can be noticed that in this part of the paper, once again, the hypothesis of this research has been confirmed in the case of regression analysis.

Conclusion

Customer demands for faster and reliable delivery have created a need for fast, flexible and timely flow of information and products along the entire supply chain. In this sense, supply chain management is becoming increasingly important and only through continuous improvement of processes and activities, supply chain members can ensure lower costs and higher levels of customer satisfaction. One of the elements that plays a key role in achieving this goal is inventory. Inventories are part of the working capital necessary for the smooth functioning of production and require the involvement of large financial investments that cause a significant amount of capital costs. For the successful management of the supply chain, it is necessary to have a good organization, a good plan and a forecast about the exact required supplies and their flows, so that the resources are used rationally. Then, forecasting plays the most important role in supply chain management.

This research shows the application of quantitative methods of inventory forecasting, namely exponential smoothing, adaptive filtering, moving average methods and regression analysis, on the example of the company "Leoni Wiring System Prokuplje". The results of the research indicate that the hypothesis on which the research is based has been confirmed, i.e., that applied quantitative forecasting methods in the supply chain provide reliable and accurate forecasts on the basis of which materials can be ordered so that optimal stocks are maintained for the smooth functioning of production, on the example of the company "Leoni Wiring System Prokuplje".

Given that inventory requires the involvement of large financial investments that cause a significant amount of capital costs, it is important to determine the optimal flows and quantities of inventory. Therefore, quantitative methods are a useful tool for reliable forecasting of inventory in order to maintain them at an optimal level. In this sense, the importance of this paper is that it shows the way of applying quantitative methods for inventory forecasting and contributes to the existing literature in that area. Research should continue and apply forecasting using qualitative methods or a combination of quantitative and qualitative methods, in order to reach the most accurate forecast.

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Sasho Nefovski[1]
Independent Marketing Researcher

Lenche Petreska[2]
Pavlina Stojanova[3]
International Slavic University,
Faculty of Economics and Organization of Entrepreneurship

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THE RISING TREND OF FOOD PRICES - A FACTOR IN CHANGING CONSUMER BEHAVIOUR REGARDING FOOD WASTE

Abstract

This paper aims to determine the influence of food prices in changing behaviour regarding reducing food waste in households. The motive for this research primarily originates from the ongoing global economic tendency of increasing the prices of energy sources which is also a direct factor affecting the prices of food products. Survey data were collected via questionnaires in North Macedonia. A descriptive and empirical presentation interprets the attitudes of different categories of consumers. The research concludes that prices significantly impact awareness of the importance of food. Hence, respondents agree that the amount of food waste in the home is reduced in the last year.

Keywords: *sustainability, food price, household, food waste*

JEL classification: D12, Q11, Q56

ТРЕНД РАСТА ЦЕНА ХРАНЕ - ФАКТОР У ПРОМЕНИ ПОНАШАЊА КОНЗУМЕНАТА У ПОГЛЕДУ РУКОВАЊА ОТПАДНОМ ХРАНОМ

Сврха овог рада је да одреди утицај цена хране у промени понашања у вези смањивања бацања хране у домаћинствима. Мотиви за ово истраживање примарно потичу од тренутних светских економских тенденција повећања цена извора енергија који су такође директни фактори који се одражавају на цену хране. Подаци су прикупљени анкетним упитницима у Северној Македонији. Дескриптивна и емпиријска презентација у овом раду приказује ставове различитих категорија потрошача. Ово истраживање закључује да цене значајно утичу на свест о значају хране. Међутим, анкетирани потрошачи се слажу да се количине отпада тј. бачене хране у домаћинствима смањују у последњој години.

Кључне речи: *одрживост, цена хране, домаћинство, бацање хране*

[1] nefovski@gmail.com, ORCID-ID 0000-0001-8508-7472

[2] lence.petreska@msu.edu.mk, ORCID-ID 0000-0001-8828-5167

[3] pavlina.stojanova@msu.edu.mk, ORCID-ID 0000-0002-0119-1780

Introduction

The impact of food prices will be a significant factor in household food consumption. Reducing food waste has become one of the biggest global sustainability challenges. The increase in food prices will undoubtedly make consumers spend rationally. As a result of the price trend, it is reasonable to expect that the level of food waste will decrease in a certain period. Changes in food prices can be positive or negative. From the perspective of this research, we observe such changes as positive because reducing food waste is at the heart of sustainable development (Sala and Castellani, 2019). Within the Sustainable Development Goals (SDGs), target SDG 12.3 addresses food waste. It aims to "halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including postharvest losses" by 2030 (Flanagan et al., 2018, p. 6). Previous studies highlight the need for more research targeted in this area, specifically there is a need to increase consumers' awareness and comprehension of the problem with the objective of fostering enduring changes in behaviour (Wansink, 2018; Pearson & Perera, 2018; Ponis, et al., 2017).

This research aims to provide substantive evidence, within the existing scientific literature on food waste and survey data, of the relationship between food price and consumer-level food waste. In this research, we use the elaboration of descriptive data obtained from the conducted survey, as well as empirical testing of the correlation of variables.

Recent studies have revealed that in order to have a more environmentally sustainable food system, production must be improved, food waste must be decreased, and dietary preferences must change (Willett, et al., 2019). Consumer behaviour depends on a variety of external factors, and on personal characteristics including demographic factors (de Hooge et al., 2017). Differences in food waste behaviour associated with age have been shown in existing research studies (Bravi et al., 2019; Neff et al., 2015; Quested, et al., 2013). Quested et al. (2013) pointed out that older people tend to waste less, not because of environmental concerns, but rather because their attitudes toward food waste are that wasting food is 'wrong'. Moreover, the authors argue that younger generations are more likely to express an environmental concern while still wasting food. The amount of food waste produced at the home level is one of the largest contributors to food waste in countries with high incomes, accounting for nearly half of the overall economic value of food waste.

The literature review shows that previous research has extensively observed the methods of reducing food waste. However, the impact of market prices on consumer behaviour almost does not exist. The closest topics of this issue are the motives related to saving money, the role of retail in educating and encouraging consumers to change their behaviour, etc. Existing research has shown the 'Save money' appeal is one of the most effective ways to motivate people to reduce food waste (Graham-Rowe, Jessop, & Sparks, 2015; Neff et al., 2015; Pearson & Nefovski, 2019; Thyberg & Tonjes, 2016). Several studies point out that saving money may well be a stronger motivator of individuals' actions than environmental concerns (Bravi et al., 2019), suggesting that people are more motivated by short-term self-interest in relation to their food waste behaviour, rather than long-term external issues such as benefits to the natural environment (Stancu et al., 2016).

When observing the price as a factor, and in the context of this research, it is useful to mention that some authors highlight the role of retailers in supporting consumers who already wish to live more sustainably by providing and promoting products and giving consumers

information (Trewern et al., 2021). Food retailers can therefore play an important role in supporting citizens to adopt more sustainable food consumption behaviours (Trewern et al., 2022). "Another way to influence consumers in shops is to use information as a reminder of the consumer's values; that they are an environment-friendly consumer. The idea is therefore to influence the consumer by means of a subtle reminder of how the consumer intends to behave." (Röös et al., 2021).

1. Background and literature review

To contribute to the understanding of whether and how food prices motivate consumers to reduce food waste, two fields of literature are relevant to this study. The first focuses on food pricing trends in North Macedonia and globally. The second one is focused on post-purchase behaviours and consumer habits regarding food waste.

1.1. Food prices

Food prices refer to the average price of particular food commodities globally and across countries (Roser & Ritchie, 2021). Global food prices continue to rise after the spike caused by the Covid-19 pandemic. Countries that opted for stricter measures of lockdown and restriction of movement recorded, only in March 2020, inflation of food prices of about 1% (Akter, 2020). In situations where the shock resulted in food shortages or gluts, an increase in food prices usually occurs, with the highest hike being in the most demanded foods (Kansiime et al., 2021). The price of essential food products for the lockdown has risen sharply due to the market shock and demand growth for these products of over 100% (Akter, 2020).

Prices may change customers' purchasing behaviour (Shoemaker, Dawson & Johnson, 2005) and can potentially make a contribution to influencing social norms around food consumption in a more sustainable direction (Röös et al., 2021). Few studies pointed out that higher food prices can heighten the incentive for tighter home management, which may include less food waste, outcomes consistent with comparative statics from household production models of food waste (Katare et al., 2017; Hamilton & Richards, 2019; Ellison et al., 2020; Roe, Bender & Qi, 2021).

Table 1: FAO Food Price Index

Year	Food Price Index	Meat Price Index	Dairy Price Index	Cereals Price Index	Oils Price Index	Sugar Price Index
2020	98.1	95.5	101.8	103.1	99.4	79.5
2021	125.7	107.7	119.1	131.2	164.9	109.3
2022	145.8	120.0	143.4	155.9	195.3	114.2

Source: FAO Food Price Indices, November 2022, https://www.fao.org/worldfoodsituation/foodpricesindex/en/

World prices of the main agricultural products (mainly cereals, rice and oilseeds) practically doubled in the 2006−2008 period and increased again between 2011 and 2012,

and they have not returned to their pre-crisis level (Saman & Alexandri, 2018). This trend is also present from the beginning of 2021 and during the whole 2022. The effects of high food prices can be found in the population's welfare, such as food insecurity (Saman & Alexandri, 2018). The FAO Food Price Index (FFPI) experienced large fluctuations between 2020 and 2022 (Table 1).

According to the data from the most recent month between July and October 2022 for which food price inflation data are available, there was high inflation in almost all low- and middle-income countries. Inflation levels exceeded 5% in 83.3% of low-income countries, 90.7% of lower-middle-income countries, and 95.3% of upper-middle-income countries.

According to the International Monetary Fund, Haver Analytics, and Trading Economics, North Macedonia is among the top 10 countries for real food price inflation[4] (Table 2). Food inflation reached as much as 25 per cent in Bosnia and Herzegovina, Montenegro, and North Macedonia (World Bank, 2022).

Table 2: Food Price Inflation by Country

Country	Nominal Food inflation (% Year-over-Year)	Country	Real Food Inflation (% Year-over-Year)
Zimbabwe	321	Zimbabwe	52
Lebanon	208	Lebanon	46
Venezuela	158	Iran	32
Turkiye	99	Sri Lanka	20
Argentina	87	Rwanda	17
Sri Lanka	86	Hungary	15
Iran	84	Colombia	15
Rwanda	41	Uganda	15
Suriname	40	Turkiye	13
Lao PDR	39	North Macedonia	13

Source: FAO The World Bank, Food Security Update, November 2022, https://www.worldbank.org/en/topic/agriculture/brief/food-security-update

According to the State Statistical Office in North Macedonia (2022) data, the Consumer Price Index in October 2022, in comparison with the previous month was 101.4, while the Retail Price Index was 100.6. The Consumer Price Index in October 2022, in comparison with October 2021, increased by 19.8%, while Retail Price Index increased by 15.4%.

1.2. Consumers' behaviour

There is a rapidly growing population in the world, and the increasing consumption is causing a decrease in the world's resources (OECD, 2012). The exponential population growth (7.6 billion) translates into more need for ecosystem services such as food, water, shelter, and energy (Msengi et al., 2019). Chalak et al. (2016) noted that food waste figure as high as 35 per cent is attributed to consumers, whereas European Commission reveals that

[4] Real food inflation is defined as food inflation minus overall inflation.

60 per cent of food waste in industrialised countries occurs at the consumer level (European Commission, 2018).

The economic theory of consumer behaviour postulates a strong connection between price and consumption (Gourville & Soman, 2002). For example, there is a research that shows that consumers often only weigh in one or two factors, for example, taste and price, or price and health impact (Kalnikaité et al., 2013). Other study mentions that the overall low level of food prices in developed countries leads to an undervaluation of food by consumers and a disregard for the natural resources that have been used to produce it (Gjerris & Gaiani, 2013; Aschemann-Witzel et al., 2015). On the other hand, pricing mechanisms are also suggested as an instrument to tackle the problem of food waste, with the application of price reductions of suboptimal food allowing the sale of food that would otherwise be wasted at the retail level, such as imperfect food items (Tsalis et al., 2021; Aschemann-Witzel et al., 2020). Additional research shows that food waste was higher among price and convenience-oriented consumers, and lower for value-conscious consumers (Aschemann-Witzel, Giménez & Ares, 2018).

After gathering survey data to understand consumer behaviour regarding food waste, Singapore's National Environment Agency in 2017 launched the "Waste less - Save more" campaign to promote the adoption of rational food purchase, storage, and preparation practices that help consumers save money while reducing food waste (NEA & AVA, 2017). The outreach program includes educational resources for use in classrooms as well as resource materials for newspapers, television, and community-led initiatives, which featured an educational skit. The Oregon Department of Environmental Quality in the U.S. used the 'Wasted food – Wasted Money' slogan within public awareness campaign that encourages Oregon restaurants, grocery stores and commercial food service providers to make small changes to prevent and reduce wasted food (The Oregon Department of Environmental Quality, 2017).

Marketing theory argues that most of the daily consumer decisions to buy food are happening in the spur of the moment, without much thought. For self-initiated change to occur, people need to be convinced that their food waste-related behaviours are problematic (Stöckli, Niklaus, & Dorn, 2018).

2. Methodology

This study aims to test the correlation between consumer groups and features, motivation and attributes about food prices.

2.1. Sample and data collection

The development of the questionnaire was led by the authors of this paper. Nominal and ordinal scales were used in the questionnaire, including the Likert scale. The research was conducted in October 2022. The existing literature review shows that the most common method for collecting this type of data is through online questionnaires (Abd Razak et al., 2018; Neff et al., 2015; Young et al., 2017) and traditional paper-based questionnaires (Yu & Yu, 2007; Fanning, 2005).

In this study, a survey was distributed on paper and online through Google forms. The structured questionnaire was delivered to N=191 consumers. The total number of N=146 individuals participated in the survey, which represents a response rate of 76%. The majority of the respondents were females (53%) compared to males (47%). A demographic analysis of this sample is given to illustrate the characteristics of individuals who participated in the survey (Table 3).

Table 3: Sample description

Demography	Frequency	Percent (%)
Age		
18 to 25	15	10.3
26-30	9	6.2
31-35	38	26.0
36-40	11	7.5
41-45	18	12.3
46-50	4	2.7
51-55	38	26.0
56-60	4	2.7
61-65	3	2.1
66+	6	4.1
Gender		
Male	68	46.6
Female	78	53.4
Education		
High school	9	6.2
Bachelor degree	133	91.1
MSc / PhD	4	2.7
Household Composition		
Single person household	3	2.1
Adult couple	43	29.5
Family with children	59	40.4
Family, only adults (16+)	25	17.1
Shared household, non-related	1	0.7
Other (specify)	15	10.3
Total	146	100%

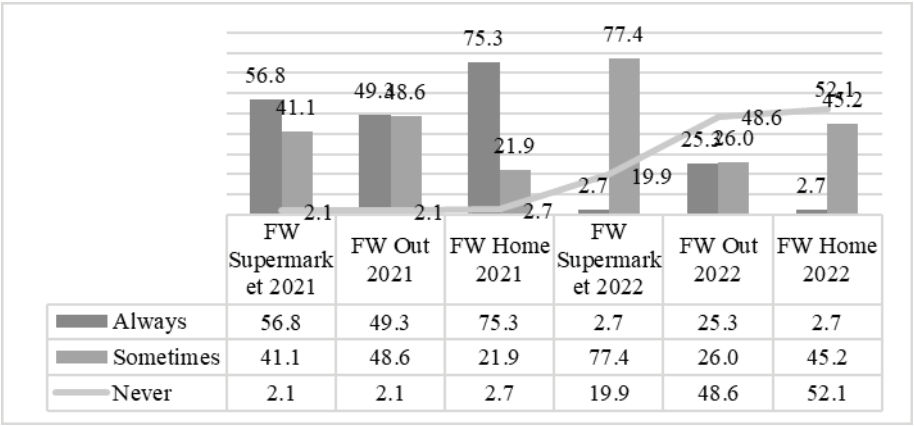
Source: Authors

2.2. Descriptive analysis

Descriptive analysis is used to determine the distribution, types, and outliers of data, as well as the similarities across variables. The primary goal of the research was to determine the trend of food waste during the period when global food prices increased. For this purpose, two of the questions in the questionnaire refer to the frequency of food waste that consumers estimate. The first refers to the period before 2021, and the second to current habits. The

results remarkably reflect the change in consumer behaviour during the observed period. The result shows the change in behaviour and transition from the "I always generate food waste" category to the "sometimes" or "never" category.

Figure 1: Food waste before 2021 versus 2022



	FW Supermarket 2021	FW Out 2021	FW Home 2021	FW Supermarket 2022	FW Out 2022	FW Home 2022
Always	56.8	49.3	75.3	2.7	25.3	2.7
Sometimes	41.1	48.6	21.9	77.4	26.0	45.2
Never	2.1	2.1	2.7	19.9	48.6	52.1

Source: Authors

The percentage of respondents reporting that they never produce food waste at home grew remarkably from 2.7% in 2021 to a fantastic 52% in 2022. These extreme results coincide with the claim of a study that the achievement of a 10% change in the consumption of beef, for example, follows the price increase of up to 20 to 30% (Röös et al., 2001). The lowest change in the behaviour is notable when observing food consumption outside home.

Results do not confirm that the only motive for this behaviour is price. However, the results of the question that refers to the concern reported by consumers regarding the trend of increased food prices support this assumption (Table 4). Namely, 53% of the respondents reported that they strongly agree that they are very concerned about the rising trend of food prices. Most consumers (strongly) disagree that they do not worry about the cost of the food that finishes in the garbage.

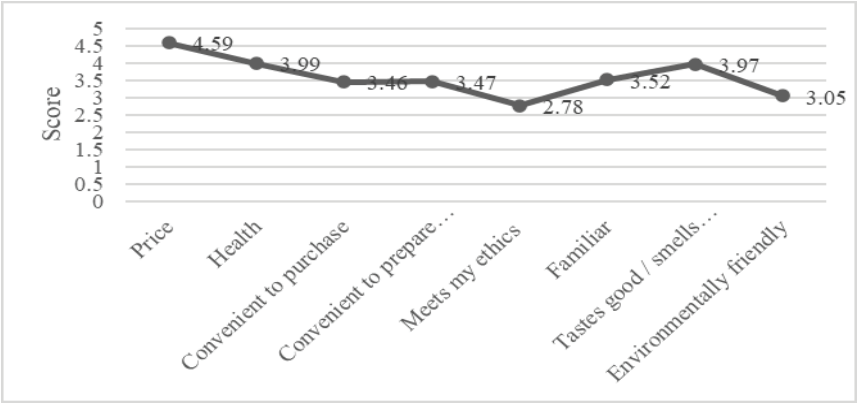
Table 4: Statements regarding food prices

	Significantly higher food prices in comparison to 2021 and before		Do not really worry about the cost of the food that I throw away		Buying food in markets with the most favourable offers/prices		I am concerned about the trend of rising food prices		A belief that the rising food prices will reduce the amount of FW	
	No.	%	No.	%	No.	%	No.	%	No.	%
Strongly disagree	0	0.0	58	39.7	0	0	0	0	0	0
Disagree	0	0.0	70	47.9	19	13.0	0	0.0	0	0.0
Average	16	11.0	18	12.3	14	9.6	62	42.5	16	11.0
Agree	8	5.5	0	0.0	49	33.6	7	4.8	55	37.7
Strongly agree	122	83.6	0	0.0	64	43.8	77	52.7	75	51.4

Source: Authors

The survey did not register results of agreement with this statement. Finally, the majority of respondents show a tendency to agree with the statement that the trend of increased food prices will have an impact on the reduction of food waste in households.

Figure 2: Food waste before 2021 versus 2022



Source: Authors

Finally, this study considers the average grade of the importance of different features in the consumer food purchasing process. (Figure 2). The "price" factor recorded the highest average score of 4.59 (from 5). Also, 88 respondents stated that price is an extremely important feature when buying food for a home. The survey notes that the feature related to ethical issues recorded the lowest average score of 2.78.

2.3. Statistical analysis

The Spearman coefficient was used to correlate between two quantitative variables and the significance of the obtained results was judged at the 5% level. Spearman correlation was performed using IBM SPSS 25 software.

Table 5: Concerns about the trend of rising food prices – test statistics

Spearman's rho	Concerned about the trend of rising food prices	Motivating factor - Save money	Concerned about the trend of rising food prices	Relevant features - Price
Corr. Coef.	1.000	.816**	1.000	.815**
Sig. (2-tailed)		0.000		0.000
N	146	146	146	146
Corr. Coef.	.816**	1.000	.815**	1.000
Sig. (2-tailed)	***0.000***		***0.000***	
N	146	146	146	146

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Authors

There is a significant positive correlation between participants' rating of the level of concern about the trend of rising food prices and the motivation for reducing FW to save money, $p<0.001$. There was also a significant positive correlation between participants' rating of the level of concern about the trend of rising food prices and the perception of the price as a relevant feature for making a decision when purchasing food with a 99% confidence interval.

A significant negative correlation is recorded between the participants' rating of education and the level of concern about rising food prices, $p<0.027$, with a 95% confidence interval. On the other hand, there is no correlation when testing the relationship between education versus the level of motivation and education versus consumer concerns about the price of wasted food ($p> 0.05$).

Table 6: Education versus food waste – test statistics

Spearman's rho	Education	Concerned about the the trend of rising food prices	Education	Level of motivation to reduce FW	Education	Do not worry about the cost of the wasted food
Corr. Coef.	1.000	-.184*	1.000	-0.079	1.000	0.056
Sig. (2-tailed)		0.027		0.344		0.503
N	146	146	146	146	146	146
Corr. Coef.	-.184*	1.000	-0.079	1.000	0.056	1.000
Sig. (2-tailed)	***0.027***		0.344		0.503	
N	146	146	146	146	146	146

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Authors

Conclusion

As previously discussed in the literature, consumers are the highest generators of food waste (Albisu, 2015; Buzby & Hyman, 2012; Calvo-Porral et al., 2017; Stangherlin & de Barcellos, 2018). Prices have a strong influence on consumer purchase behaviour. This study concludes that food price pressures have positive implications in the case of pro-environmental behaviour. The dramatic percentage of the reduced amount of food waste generated by consumers in the last three years, both in the households and out, is clearly shown. In addition, the study registers a significant correlation between the level of concern about rising food prices and the motivation for reducing food waste to save money. As expected, compared with the other eight features, the price has the highest mean score for the importance of the food purchasing decision. The highest percentage of respondents (more than a half) strongly agree that increasing food prices will affect consumer behaviour by reducing household food waste.

Limitations

One of the limitations of the study is the moderate sample size of 146. However, the indicators from this study could be applied in further research since this is an ongoing project, which will lead to the generalisation of future results about the impact of food prices on the behaviour change among consumers regarding food waste. The other limitation is geographical. The survey was distributed only among respondents from North Macedonia and reflected their perception of this issue which could differ from the global trends.

Finally, this study relies on the results of self-reported measures that can cause biased estimates of actual behaviour (Armitage & Conner, 2001). Hence, the data gathered may be a better reflection of what the participant thinks, or would like to do, than what is actually done (Pearson & Amarakoon, 2019). For this reason, additional qualitative research in the form of focus groups may uncover more specific details on the research topic.

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Electra Pitoska[1]
Professor, Department of Accounting and Finance,
School of Economic Sciences,
University of Western Macedonia, Greece

Georgios Damianos[2]
Graduate engineer & Master's student
School of Economic Sciences,
University of Western Macedonia, Greece

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THE ATTITUDE OF GREEKS TOWARDS FOOD WASTE

Abstract

The subject of the present paper is an empirical study of the attitude and behaviour of Greek consumers on the issue of food waste. In March 2022 an empirical investigation was organized as a continuation of previous research on this issue. In order to conduct the research in a short time, the convenience research method was chosen. A structured questionnaire with cross-references from previous research (Pitoska & Grana 2021) was used to collect data. Finally, it seems that the issue of food waste is known in Greece but there are big limitations for informing consumers so the country will approach the European goals for reducing food waste.

Keywords: *food waste, recycling, consumer, households*

JEL classification: *D1, D12*

ОДНОС ГРКА ПРЕМА ОТПАДУ ОД ХРАНЕ

Апстракт

Предмет овог рада је емпиријско истраживање о ставовима и понашању грчких потрошача по питању отпада од хране. У марту 2022. године организовано је емпиријско истраживање као наставак претходног истраживања о овом питању. Да би се истраживање спровело за што краће време, изабран је метод истраживања погодности. За прикупљање података коришћен је структурирани упитник са унакрсним референцама из претходног истраживања (Pitoska & Grana 2021). Прикупљено је укупно 450 упитника са одговорима. Чини се да је проблем расипања хране познат у Грчкој, али постоје велика ограничења за информисање потрошача, па ће се земља приближити европским циљевима смањења бацања хране.

Кључне речи: *отпад хране, рециклажа, потрошач, домаћинства*

[1] ipitoska@uowm.gr, ORCID ID: 0000-0002-8436-0294

[2] crossandroads@yahoo.com, ORCID ID: 0000-0001-9789-4570

Introduction

Food waste has a direct impact on the environment (e.g., energy, climate change, resource availability), the economy (e.g., resource efficiency, price volatility, rising costs, consumption, waste management, commodity markets), and society (e.g., health, equality). It is a problem that affects both global food security and good environmental governance. According to various studies, between 1/3 and 1/2 of the food produced worldwide is not eaten (Gustavsson et al., 2011; Bio Intelligence Service, 2010), which has an adverse effect on homes as well as the rest of the food supply chain. The transition to a resource-efficient Europe is vital to prevent and reduce food waste.

For this important issue, the European Commission funded the project FUSIONS (Food Use for Social Innovation by Optimizing Waste Prevention Strategies), which was aimed to estimate food waste generation in the EU (https://www.eu-fusions.org/) and implemented in 2007-2012 with financial support from the EU's Research and Innovation 7th Framework.

As part of the program, a paper was prepared in Stockholm on 31 March 2016 and entitled "Estimates of European food waste levels". The authors of the paper were: Åsa Stenmarck (IVL), Carl Jensen (IVL), Tom Quested (WRAP), Graham Moates (IFR) and contributing partners: Michael Buksti (Communique), Balázs Cseh (HFA), Selina Juul (SWF), Andrew Parry (WRAP), Alessandro Politano (UniBo), Barbara Redlingshofer (INRA), Silvia Scherhaufer (BOKU), Kirsi Silvennoinen (LUKE), Han Soethoudt (Wageningen UR), Christine Zübert (UHOH), Karin Östergren (SP).

The task described in this report was to obtain an EU-28 estimate for food waste. In this report information from Greece is not enough and especially information about food waste by households (e.g., Table 14. Summarizing evaluation of data provided by member states page 63). This was the occasion to start an empirical investigation which is ongoing and of which this paper forms a part.

1. Food waste and the food waste policy in the EU

There is a distinct difference between food loss and food waste, according to the Federation of Polish Food Banks' Working Group of Rational Use of Food. Food waste refers to the irrational financial management of food in the hospitality industry and consumer households. Food loss is the measurement of the reduction in the edible mass of food caused by improper management, mistakes, and irregularities during production, distribution, and trade (Wrzosek, Kooyn-Krajewska, & Krajewski, 2012).

The reasons driving consumers to waste food are varied and are largely contingent upon the country- and area-specific circumstances. Consumer habits are shaped by social factors, specific consumer attitudes and views about food, and, finally, by consumers' poor information, knowledge, and skills. Remarkably, the psychographic profile of consumers has received increasing attention in the relevant literature about waste issues (Russell, Young, Hardin, & Robinson, 2017).

According to a Mass Flow Analysis by Caldeira et al. (2019a), around 638 Mt of food commodities were available for human consumption in the EU7 in 2011 (Kemna et al., 2017), generating approximately 129 Mt (fresh weight) of food waste along the whole food supply chain.

Table 1: Food waste generated in the EU-28 by food group (2011 data)

Food waste generated in the EU-28 by food group (2011 data)					
Plant-based				**Animal-based**	
Vegetables 24%	Fruit 22%	Cereals 12%		Meet 11%	
	Oil Crops 10%	Potatoes 7%	Sugarbeet 4%	Dairy 5%	
				Fish 3%	Eggs 2%

Source: Caldeira et al. (2019a)

Hence, food waste accounts for 20% of the food produced. This estimate is significantly higher than that of the FUSIONS project (88 Mt), which was used as a reference for policymaking (e.g., in the Farm to Fork Strategy (EC, 2020)). Vegetables (24%) and fruit (22%) are the food groups that produce the largest amounts of food waste, followed by cereals (12%), meat (11%), and oil crops (10%). The fish and eggs food groups, which make up the smallest parts of the food supply chain, also generate the lowest quantities of food waste in absolute terms, despite the fact that much of these food groups (50% and 31% respectively) go to waste.

The EU has been working to expand and improve the measurement of food waste levels in order to guarantee that national initiatives to reduce food waste are supported by a strong evidence base and encourage the sharing of innovation and best practices. The updated Waste Framework Directive, which took effect on May 30, 2018, mandates that Member States monitor food waste levels, reduce food waste at every stage of the food supply chain, and report on their progress. Additionally, it establishes requirements for Member States to:

- create programs to prevent food waste (specific or as a component of general waste prevention programs);
- promote food donation and other redistribution for human consumption, giving human use priority over animal feed and reprocessing into non-food products;
- offer incentives for the use of the waste hierarchy, such as facilitating food donation (articles 4 and 9 of the revised Waste Framework Diversion).

2. Food waste and consumer behaviour

The increasing number of food markets has been accompanied by the evolutionary effect of food waste and loss and is associated with irrational food management. The problem of food waste has taken on environmental and economic dimensions and has been closely related to the social and moral conditions affecting consumers.

For the last few decades, food waste has reached alarming proportions with economic, social, and environmental implications. Regarding the impact of food waste on the environment, it is estimated that 8% of greenhouse gas emissions from human activities are produced by food waste. Wasted food in landfills releases methane, which is 25 times as harmful as CO2 (Garnett, 2008; Hall et al., 2009). The problem of food waste is mainly caused by consumers whose tendency to buy food in larger quantities than necessary has now been a regular habit. Remarkably, 53% of all food waste is household waste, that is, it is produced during consumption (Gustavsson, Cederberg, Sonesson, van Otterdijk, & Meybeck,

2011). Vast amounts of food waste are observed in middle- and high-income countries, which implies that food is thrown away despite being still safe for consumption.

As regards food waste in Greece, ranked third among the worst European Union countries in terms of understanding the "best before" label, the extant research has demonstrated that only 22% of the Greek citizens fully understand the specific warning about food (WWF, 2020).

In addition, the number of Greek consumers who would throw away food after the "best before" date, irrespective of whether it is safe to consume, is twice the average in the European Union (WWF, 2020). Greece is fourth among the worst EU countries in terms of food waste, which accounts for 196 kg for each Greek citizen compared to 173 kg of annual food waste for each European (WWF, 2020). In addition, Greek households waste 98.9 kg of food surplus annually, and about 1.4 million people, namely, 12.9% of the population, were food insecure in 2015, whereas 5.1% of food production for human consumption is wasted per year, more than double the European average (WWF, 2020).

3. Factors - reducing food waste and consumer attitudes

Food waste and loss occur during all stages of the food supply chain, from food storage, transport, and processing to food shops and restaurant kitchens, hotels, and households (Lundqvist, de Fraiture, & Molden, 2008). It is a global phenomenon observed at various stages of the food supply chain. With a view to achieving more efficient food management, the European Union drafted a report in 2016, "Estimates of European food waste levels", in the EU-28. Data collection and analysis from all 28 EU members demonstrated that food waste accounts for 88 million tonnes (Stenmarck et al., 2016).

In recent years, the international literature has focused on food waste, particularly in households. It has also explored the drivers for consumer attitudes toward food waste and emphasized the social, environmental, and psychological factors underlying individuals' behavior toward food waste (Russell et al., 2017). Due to the complex attitudes affecting the amount and occurrence of household food waste, it is rather hard to make any relevant predictions (Quested, Marsh, Stunell, & Parry, 2013). In addition, actions aimed at reducing household food waste are characterized as rather poor and inefficient. Despite the fact that the psychological underlying mechanisms are not primarily explored, there is a significant focus on the methods to identify motivation and/or barriers to prevent household food waste reduction (Graham-Rowe, Jessop, & Sparks, 2015). Consumers who positively evaluate the effectiveness of waste management activities are in favor of sustainability-related behaviors (Swami, Chamorro-Premuzic, Snelgar, & Furnham, 2011), mainly adopted by people who are convinced that their welfare is threatened. Subjective-personal rules have also been found to play a significant role in shaping waste management attitudes (Barr, 2007).

Research in the environmental factors involved in food waste (Dunlap, Van Liere, Mertig, & Jones, 2000) has shown that people who are more concerned about their bodies than the environment display a less environmentally friendly attitude (Schultz & Zelezny, 1999). On the other hand, other studies highlight that there is a rather weak or moderate correlation between environmental concern and environmentally friendly attitudes (Bamberg, 2003).

In the framework of the European project "Fusions Drivers"(Canali et al., 2014), the results revealed the following groups of factors typically affecting consumer behaviour towards food waste:

- social factors, such as household type, stage of family life, and relevant lifestyle,
- consumers' attitudes and views about food,
- consumers' poor information, knowledge, and skills.

The European Parliament report "Tackling food waste: The EU's contribution to a global issue" underlines that social urbanisation trends and changes in diet, as well as consumers' overall culture, are key determinants of consumer behaviour (EPRS, 2016).

An interesting model of the factors affecting consumer behaviour towards food waste has been proposed by Aschemann-Witzel, de Hooge, Amani, Bech-Larsen, & Oostindjer (2015). The model includes two groups of factors, socio-demographic and psychological, which are fundamental for explaining consumers' attitudes toward food waste.

Activities aimed at reducing food waste can be also affected by financial factors. The financial crisis may trigger some alternative or new patterns of behaviour called "freeganism" or "dumpster diving". In addition, the tendency to avoid wasting food can be part of a lifestyle and a consumer's identity (Aschemann-Witzel et al., 2015).

It has also been demonstrated that attitudes towards food waste depend on consumers' understanding of the information on product packaging, in particular, information about the date of minimum durability and expiry date (Newsome et al., 2014). However, the correct use of the terms "expiry date/use by" and "best before" is not sufficiently understood by consumers, who interpret them differently depending on food type (Van Boxstael, Devlieghere, Berkvens, Vermeulen, & Uyttendaele, 2014).

Consumers are aware of the principles of rational household food management. Rational storage management in warehouses and markets usually requires a schedule compliant with reducing food waste methods. Educational activities focused on waste-minimising behaviours, which should be carried out at an early age, play a significant role in reducing food waste (Radzyminska, Jakubowska, & Staniewska, 2016).

In the extant literature, consumers' attitudes and behaviours toward food waste are affected by various factors. Consumer knowledge and awareness do not fully reflect the activities of anti-food waste supporters (Radzyminska et al., 2016).

Food waste typically occurs during consumption. Households produce the greatest amount of wasted food; thus, food waste is mainly consumer-related. The major concern of all those involved in food waste is, first, to inform consumers about the significance of the specific problem and then provide valuable information on more efficient food management. In addition to consumers' benefits, social and economic advantages are also perceived among the major goals of actions aimed at raising awareness of food waste. Various methods to reduce food waste have been suggested: shopping lists, checking expiry dates, budget control, refrigerator maintenance, cooking meals with leftovers, freezing food and composting.

4. Empirical study

This research is organized as a continuation of previous research on food waste in Greece and the attitude of Greek consumers on this issue.

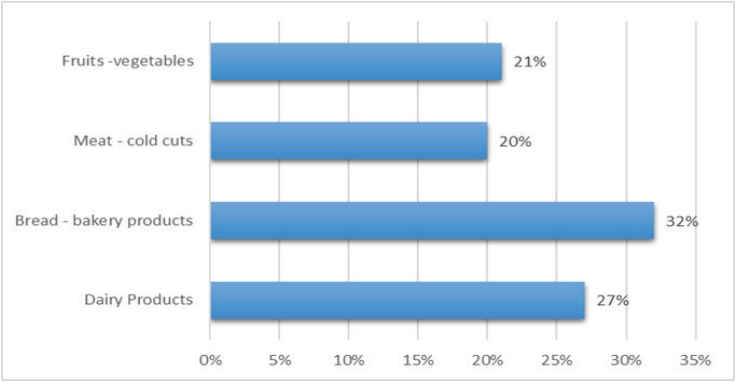
The research was carried out to investigate food waste and, more specifically, the amount of food waste in Greece, as well as consumer attitudes and behaviour. In order to conduct the research in a short time, the convenience research method was chosen. For data collection, a cross-referenced structured questionnaire from previous research (Pitoska & Grana 2021) was used. The questionnaire with 15 questions was administered via Google Forms from 01/03/2022 to 31/03/2022. A total of 450 answered questionnaires were collected.

Data analysis demonstrated that 41% of the survey participants are aware of the problem of "Food Waste". It appears that only 8% of the respondents are totally ignorant and a smaller number (17.3%) have only got a vague and rather general idea.

The main source of information is the Internet (48.7%), the media (16.0%) as well as social institutions (16.7%), whereas it was also stated the relevant information is based on other sources 18.7%. Only half of the survey participants (52.7%) estimate that food waste has got a direct impact on their income, and 30% of them do not have an opinion on this question. 30.7% and 25.30% of all survey participants "often" and "always" check expiry dates, respectively. Finally, the subjects stated that they "sometimes" (25.3%) or "rarely" (12.7 %) check expiry dates and only 6 % never check dates.

In addition, 52.0% of the respondents answered that they had knowingly and intentionally consumed food after the expiry date, whereas 56.6% has purchased food in damaged packaging provided that the content has not been visibly affected. The subjects appear to distinguish between "expiry date/use by" and "best before" on food products (65.3%). Survey participants stated that they throw away the following food categories (Graph 1).

Graph 1. The most frequently wasted type of food



The participants who plan their meals for the next 3-4 days are 25.3%. It seems that most people neglect or do not care to plan meals and the necessary food purchases.

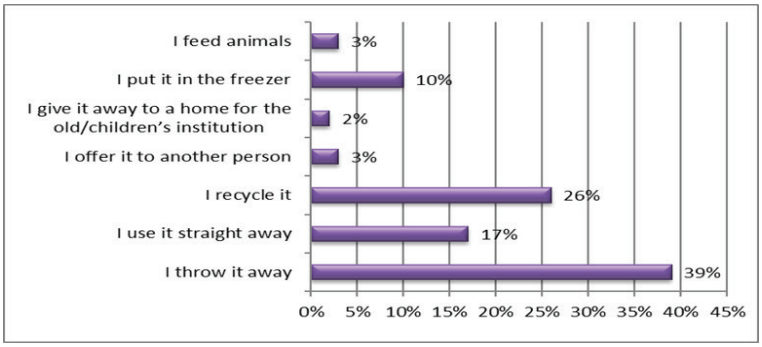
The participants appear to make efforts to adopt management practices for efficient purchase planning and organisation, as the majority use a shopping list, and try to buy only food list items.

Table 2 Management practices for efficient purchase

	Use a shopping list	Buy only food list items
Never	7.3%	8.0%
Rarely	20.0%	22.0%
Sometimes	34.7%	37.3%
Often	19.3%	26.7%
Always	18.7%	6.0%

Food management practices for "use-by" food demonstrate that the subjects do not adopt sustainability-related attitudes, as the number of answers to questions about whether they are willing to offer food either to another person or vulnerable groups (i.e., a home for the old) is too low, whereas 10% of the respondents answered that they store food in a freezer and 17% consume food straight away. Only 26% of them use recycling methods and 39% tend to throw away food close to its expiry date. To this question, a matching of the answers with the previous survey of 2021 of Pitoska & Grana is recorded.

Graph 2. Management practices for "use-by" food



The reasons for "throwing away" food are shown in Table 3.

Table 3. Reasons for throwing away food

Reasons for throwing away food	Percentage %
It has expired	78.7
Food I really do not need	31.3
Nasty appearance/condition	46.7
We have not finally eaten leftovers	59.3
We forgot the food was in or out of the fridge	63.9
It did not taste good (but not rotten)	60
Rotten food	77.3
Ruined cooked food (burnt, overcooked, too salty, etc.)	65.3

The analysis demonstrated that consumers who answered, "I feel sorry when I throw away food", represent 61.3%. However, 19.3% are not bothered at all when throwing food.

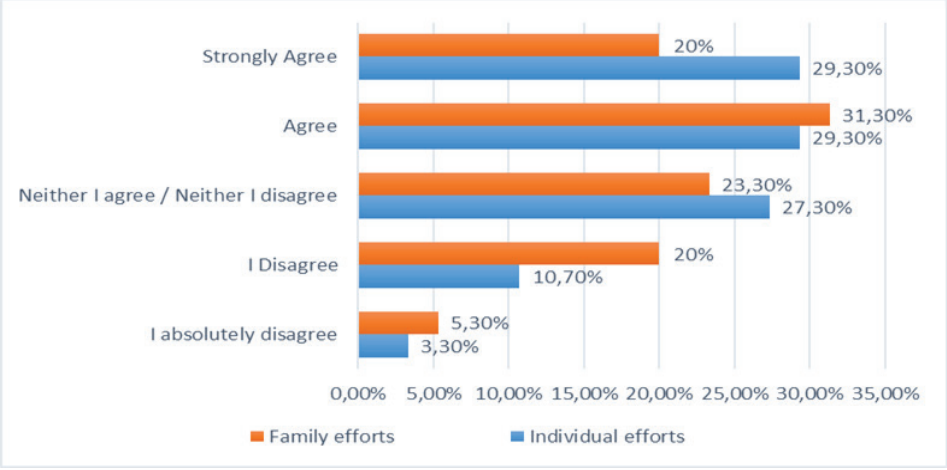
The extent to which consumers are also concerned about the amount and cost of the food they throw away is reflected in the table below.

Table 4. Degree of interest for the amount and cost

	I do not care about the amount of food I throw away	I am not concerned about the cost of the food that I will throw away
I absolutely disagree	30.0%	39.3%
I disagree	38.7%	27.3%
Neither do I agree / Neither do I disagree	16.0%	14.7%
Agree	11.3%	11.3%
Strongly Agree	4.0%	7.3%

It seems that individual/personal efforts (58.60%) to reduce household food waste are slightly stronger than the overall family effort (51.30%).

Graph 3. Individual & family efforts to reduce the amount of food thrown away



According to the responses of the participants, they would reduce the food they throw/waste if they had better information. The information that, according to what was stated, would lead them to reduce the food waste, is recorded with the corresponding percentages in table 5.

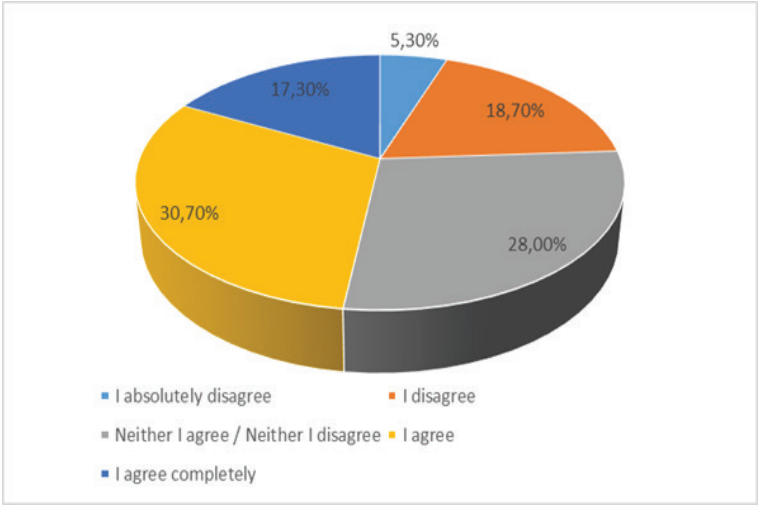
It seems that the information that consumers have on the issue of food waste is insufficient. Despite the fact that the country's economy has gone through a ten-year economic recession, consumers do not seem to have corresponding information about food waste that also affects their disposable income.

Table 5. Estimates for effective information

	For more efficient / better food storage	For a more efficient way of shopping for food	On the environmental impact of food waste	For the cost of food that is thrown away
I disagree	19.4%	18%	20%	15.3%
Neither do I agree / Neither do I disagree	25.3%	23.3%	24.0%	24.7%
I agree	55.3%	58.6%	56.0%	60.0%

When it comes to whether food packaging that ends up in our trash is a bigger environmental issue than food waste, participants said they consider discarded food packaging to be a big burden (48%) on the environment. The estimates are shown in more detail in the following graph.

Graph 4. Estimates of the environmental burden of food packaging



Finally, they were asked to state whether they recycle in general in their daily life and to what extent. The responses showed that 21.3% recycle everything that can be recycled, 30 % recycle quite a bit, as recycling is not possible for all items. 34.0% recycle sometimes and 14.7% never.

Conclusion

The problem of food waste has taken on alarming proportions in recent decades with economic, social, and environmental implications.

Today's food supply chain is globalized. Food waste is a complex situation that affects all sectors of the food supply chain and consumers themselves. The only variation difference

is the different quantities at each stage of the chain. For modern societies, food waste is a major problem, exacerbated by the population's consumption behaviours in relation to food.

The EU has been working to expand and improve the measurement of food waste levels in order to guarantee that national initiatives to reduce food waste are supported by a strong evidence base and encourage the sharing of innovation and best practices. The updated Waste Framework Directive, which took effect on May 30, 2018, mandates that Member States monitor food waste levels, reduce food waste at every stage of the food supply chain, and report on their progress.

Reducing food waste by at least half by 2030 is one of the major goals set by the United Nations (UN) for Sustainable Development. Greece, among all European Union member countries, is committed to reducing food waste, as waste prevention is a key measure suggested by Circular Economy policies and European Green Agreement requirements.

Food waste and loss occur along the entire food supply chain, from food storage, transport, and processing to food shops, restaurant kitchens, hotels, and households. The problem of food waste is mainly caused by consumers whose tendency to buy food in larger quantities than necessary has now been a regular habit.

The empirical investigation, the convenience survey carried out in Greece in March 2022 showed that there is moderate knowledge about the dimensions of the problem of food waste with the main source of information being the Internet.

Only half of the survey participants estimates that food waste has got a direct impact on their income despite the fact that they check expiry dates of the food they buy. Also, it seems that Greek consumers knowingly and intentionally consumed food after the expiry date, and purchased food in damaged packaging provided that the content has not been visibly affected.

Food that is thrown away without being consumed falls into all categories (dairy, meat, bread, fruits & vegetables). The participants appear to make efforts to adopt management practices for efficient purchase planning and organisation, as the majority use a shopping list, and try to buy only the food list items.

Consumers seem to feel sorry when they throw away food, but at the same time they do not adopt behaviours related to sustainability.

It seems that individual/personal efforts to reduce household food waste are slightly stronger than the overall family effort.

According to the participants, they would reduce the food they throw/waste if they had better information. It seems that the information that consumers have on the issue of food waste is insufficient. Despite the fact that the country's economy has gone through a ten-year economic recession, consumers do not seem to have a piece of corresponding information about food waste that also affects their disposable income. Furthermore, a moderate degree of recycling in general is recorded.

Finally, it seems that the issue of food waste is known in Greece but there are big margins for informing consumers so the country will approach the European goals for reducing food waste.

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Jasmina Ognjanović[1]
University of Kragujevac,
Faculty of Hotel Management and Tourism
in Vrnjačka Banja

Ernad Kahrović[2]
State University of Novi Pazar,
Department of Economics

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BUSINESS PLAN AS A SUPPORT FOR THE SUSTAINABLE DEVELOPMENT OF ENTREPRENEURS

Abstract

Contemporary business on the market is characterized by numerous challenges that at the same time represent business opportunities for entrepreneurs. Identified opportunities must be elaborated within the framework of a business plan. The business plan is an instrument of the planning process that should indicate the possibilities, potential, and limitations of the realization of a business idea. The aim of the paper is to determine the contribution of the business plan to the success of the company, to state the advantages and disadvantages of its preparation, and to describe in detail the structure of the business plan. It can be concluded that a business plan directs an entrepreneur in business, but in today's turbulent conditions, it is difficult to define a precise plan. It is recommended to create a business plan by key points while leaving the detailed elaboration of the plan for later.

Keywords: *business plan, entrepreneur, sustainable entrepreneurship, planning*

JEL classification: *L26, O21*

БИЗНИС ПЛАН КАО ПОДРШКА ОДРЖИВОМ РАЗВОЈУ ПРЕДУЗЕТНИКА

Апстракт

Савремено пословање на тржишту карактеришу бројни изазови које истовремено представљају пословне прилике за предузетнике. Уочене прилике морају бити разрађене у оквирима бизнис плана. Бизнис план представља инструмент процеса планирања који треба да укаже на могућности, потенцијал и ограничења реализације пословне идеје. Циљ рада јесте да утврди допринос бизнис плана пословању предузећа, искаже предности и недостатке његове израде и детаљно опише структуру бизнис плана. Може се закључити да бизнис план усмерава предузетника у пословању, али у данашњим

[1] jasmina.lukic@kg.ac.rs, ORCID ID 0000-0002-6036-5269

[2] ekahrovic@np.ac.rs, ORCID ID 0000-0002-0892-4908

турбулентним условима тешко је дефинисати прецизан план. Препоручује се израда бизнис плана по кључним тачкама, док се детаљније план разрађује касније.

Кључне речи: *бизнис план, предузетник, одрживо предузетништво, планирање*

Introduction

Entrepreneurship is a dynamic and complex process that involves undertaking a series of activities and using identified opportunities in order to create new entrepreneurial ventures (Wei et al., 2018). Contemporary business of entrepreneurs is characterized by changes in the market, great competition, and increasingly demanding customers (Boškov, 2016). Such changes become a source of new business opportunities. In order to reduce uncertainty and make the right use of perceived business opportunities, business planning is increasingly becoming the focus of entrepreneurs. Business planning is a key instrument in the process of generating new ideas and a necessary prerequisite for starting an entrepreneurial venture and its realization (Boškov, 2016; Wei et al., 2018).

The number and availability of business plan trainings indicate a country's efforts to attract entrepreneurs with good business ideas (McKenzie & Sansone, 2019). With the help of a business plan, the investor's strength, opportunities and financing potential are assessed (Watson & McGowan, 2019). The information provided by the business plan is of crucial importance in the decision-making process and deciding whether to invest in the venture or not (Watson & McGowan, 2019). A properly prepared business plan is a way of teaching and learning an entrepreneur, and accordingly, it is a valuable tool in acquiring the competencies needed for entrepreneurship (Souto & Rodríguez-Lopez, 2021). As part of the business plan, the entrepreneur provides an overview of potential business ventures, presents market opportunities through previously conducted research, describes products/services, offers marketing and sales plans, and provides financial projections of planned activities (Watson & McGowan, 2019).

Newly founded companies face different difficulties (Bajramović & Ahmatović, 2012b). Research shows that 15% of new businesses fail in the first year, 13.5% in the second year, and 11.2% in the third year, while after 10 years a fifth of entrepreneurs remain in business (19.6%) (Bajramović & Ahmatović, 2012b). Empirically, the literature has not yet confirmed whether the cause of such results is an insufficient commitment to planning, specifically defining and developing a business plan in detail. Second, the problem of entrepreneurship in Serbia is the lack of practice in creating business plans, except when external stakeholders (banks, investors) require it (Bajramović & Ahmatović, 2012a). As stated by the authors Wei et al. (2018), and according to the data from the Chinese Panel Study of Entrepreneurial Dynamics (CPSED), 62% of entrepreneurs define a business plan. Third, the authors Ivanišević et al. (2013) state that managers must be especially committed to planning since the practice has shown that failures in business planning have created major difficulties in business. The creation of unrealistic business plans is most often due to the lack of expertise of the entrepreneur

and the entrepreneurial team, which can be overcome by hiring experts (Bajramović & Ahmatović, 2012a).

Based on the above, the aim of the paper is to determine the contribution of the business plan to the success of the company based on the review of the existing literature, to state the advantages and disadvantages of its preparation and to describe the structure of the business plan in detail. In addition to the introduction and conclusion, the paper contains four parts. The first part describes the importance of entrepreneur education for spotting business opportunities and management of the company. In the second part, the business plan and its role in business are described, along with the purpose of its compilation and the users of the business plan. The third part confronts the arguments "FOR" and "AGAINST" writing a business plan, while the fourth part shows the structure of the business plan.

1. Entrepreneurship education

Entrepreneurial learning is a major issue in the academic literature due to the growing interest in entrepreneurship programs and courses aimed at stimulating entrepreneurial activities and opening new businesses, identifying, developing, and exploiting business opportunities (Souto & Rodríguez-Lopez, 2021). There are divided opinions in the literature about how different approaches to entrepreneurial education affect the success of an entrepreneurial venture. Lyu et al. (2021) believe that entrepreneurship education at the university level, which focuses on the creation of entrepreneurial ventures, is proven to contribute to future economic development. On the other hand, short courses and programs on entrepreneurship contribute to the acquisition of business plan writing skills, while they are not suitable enough for the actual establishment and management of a company (Watson & McGowan, 2019).

Interest in entrepreneurship education and courses offered by a higher education institution is influenced by the mainstream culture in a country (Lyu et al., 2021). Such activities are very often promoted by the state, taking into account the dominance of entrepreneurial activities, both in developing countries and emerging countries. The content of entrepreneurship education is often based on topics such as entrepreneurial traits, personality characteristics, economic success, entrepreneurial awareness, and mindset (Lyu et al., 2021). The skills of writing and developing a business plan are also part of the entrepreneurship education curriculum (Lyu et al., 2021).

The outcome of entrepreneurship education is the development of awareness and skills among entrepreneurs on how to recognize a business opportunity and see a chance where others do not; identify the opportunities, strengths, weaknesses, and dangers of an entrepreneurial venture; manage business assets and human resources; constantly work on business differentiation and development of innovative products and services. On the other hand, the identification of entrepreneurs and firms with high growth potential is also of interest to researchers in an effort to identify key traits of successful entrepreneurs (McKenzie & Sansone, 2019) and examples of good business practices.

Despite numerous and successfully implemented courses in the field of entrepreneurship, the literature indicates a lack of consensus regarding the definition of entrepreneurship education, course content, and the most effective way of harmonizing

theory and practice (Lyu et al., 2021). In addition, the goals of entrepreneurship education within different university settings are additionally influenced by the social, cultural and political context (Lyu et al., 2021). Bearing in mind the above, it can be concluded that entrepreneurial activity is a rather complex undertaking that depends on numerous factors, which should be included in the framework of entrepreneurship education. One of the key tools for establishing entrepreneurial ideas on a good basis is the business plan.

2. Business plan as part of the entrepreneur's planning activities

The task of planning activities is to define business goals and plans for their successful implementation. This is the initial stage in the business of all companies and requires a special kind of commitment since it can affect the use of perceived business opportunities (Krstić et al., 2014; Wei et al., 2018). An important part of an entrepreneur's planning is the business plan, which belongs to the group of one-time decisions that are made in situations of solving problems of a non-repetitive nature (Đuričin et al., 2012). Writing a business plan is seen as the only activity within the planning phase that is directly correlated with the company's performance (Welter et al., 2021).

Transition, privatization, and the financial crisis were key factors in the development of entrepreneurship and imposed the need to create a business plan due to the arrival of foreign financial institutions and the inflow of foreign direct investments (Bajramović & Ahmatović, 2012a). A business plan can be defined as a document that describes the state and expected future of a company (Watson & McGowan, 2019). The logic behind the creation of a business plan is to predict the future of a new venture through market analysis and research, forecasting, and strategy in order to reduce uncertainty (Watson & McGowan, 2019). Therefore, through the business plan, the entrepreneur thoroughly researches the market and evaluates the possibilities of profitable use of capital (Boškov, 2016). In the business plan, the entrepreneurial venture is described in detail, the economic and financial dimensions are evaluated in order to assess the feasibility and profitability of the business (Bajramović & Ahmatović, 2012a). It should also be noted that defining such a plan does not guarantee success, but it can increase the probability of success through reliable, comprehensible, and true information that projects business activities (Boškov, 2016).

A business plan is created in two situations: the establishment of a new company and the development of an existing company (Bajramović & Ahmatović, 2012b). In the case of establishing a company, a potential entrepreneur develops an idea and looks at the realistic possibilities of its realization, the necessary funds, and this document applies to subsidized funds. In the case of the development of an existing company, a business plan is created in order to analyse the market position of the company, the possibility of improving the existing assortment or introducing new products, assessing the profitability of the new production program, in order to obtain funds from financial institutions, funds, investors and business partners (Boškov, 2016). It can be concluded that defining a business plan brings external and internal benefits. From an external perspective, the business plan gives investors an overview of the entrepreneur's possibilities and a plan

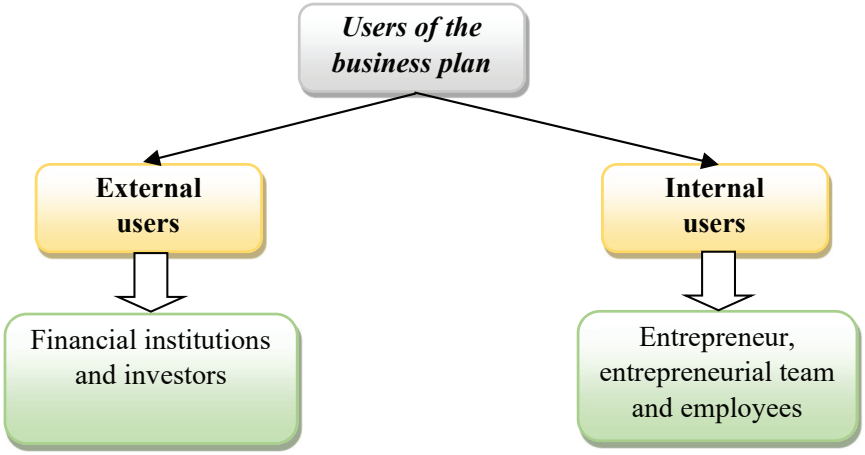
for the realization of the perceived business opportunity (Jones & Penaluna, 2013). From an internal perspective, the entrepreneur has developed a road map that he follows while performing business activities (Jones & Penaluna, 2013).

A realistic business plan is increasingly becoming a necessity for entrepreneurs for successful long-term business, the purpose of which will not only be to obtain financial resources but will also be used for their own needs and control of business activities (Bajramović & Ahmatović, 2012a). By developing a business plan, the possibilities of the company in the current market are reviewed in detail (Hormozi et al., 2002). In addition, research shows that the use of a business plan improves the growth and profitability of a firm (Eschker et al., 2017). Authors Schiraldi & Silva (2012) state that business plans are important for the following reasons:

- The plan can help the entrepreneur to perfect and improve his concept;
- Determine if the concept/business model is worth pursuing;
- Improve chances of success;
- Continue business according to the defined plan.

The purpose of the business plan is twofold: it helps the company in collecting the necessary financial resources (1), and facilitates the management of the growth and development of the company (2) (Bajramović & Ahmatović, 2012b). According to the defined purposes of the business plan, its users can be grouped: external users and internal users (Figure 1). Business plans are primarily used for external stakeholders in order to finance business ventures (Bajramović & Ahmatović, 2012a; Schiraldi & Silva, 2012; Eschker et al., 2017) which include banks, financial institutions, and venture capitalists. (Wei et al., 2018). The internal users of the business plan include entrepreneurs, the entrepreneurial team, and employees. According to Hormozi et al. (2002) these users include new business owners, existing business owners who need financing for expansion, and any business owner who wants to increase the success of their business.

Figure 1: External and internal users of the business plan



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Bearing in mind the number and variety of business plan users, it would be useful to include stakeholders in the process of creating a business plan in order to check its value (Omerbegović-Bijelović, 2006). Research shows that drawing up a business plan has a positive effect on the establishment of a new business venture (Wei et al., 2018), which means that the creation of this plan requires the provision of appropriate resources, primarily humans, who have the appropriate knowledge, abilities, and experience in writing such plans.

3. Business plan: "FOR" and "AGAINST"

The key dilemma faced by entrepreneurs is whether to write a detailed business plan or just "storm the castle" (Watson & McGowan, 2019). Creating a business plan is often presented as the ideal outcome of the planning process before creating a new entrepreneurial venture in practice (Watson & McGowan, 2019). However, there is also a different opinion. Focusing on creating a business plan, an entrepreneur often neglects other aspects of business that are much more important. Therefore, you cannot write a business plan if you have not previously secured customers for your product/service (Coulter, 2010), provided free financial resources and the technology for creating a new product. Therefore, it is recommended to only draft a business plan (Coulter, 2010), with the specification and elaboration of key elements, while the detailed elaboration of this plan can be carried out by entrepreneurs in the course of business when they have insight into a larger number of factors and activities that directly and indirectly affect the business. In the literature, you can also find arguments "FOR" and "AGAINST" the detailed creation of a business plan before starting a business.

The advantages of creating a business plan for an entrepreneur can be identified and summarized as follows: a business plan affects performance improvement; enables comparison with achievements and thus represents a standard of control; represents a data structure on the basis of which the success of managerial activities can be measured; it is a means of harmonizing the goals of interest groups and a means of education for all employees (Đuričin et al., 2012). Also, the creation of a business plan has a positive effect on the development of the enterprise, its progress, and the achievement of defined goals (Watson & McGowan, 2019). On the other hand, advocates of business planning believe that the detailed elaboration of the plan contributes to the efficient allocation of resources (Wei et al., 2018).

Some authors also mention the disadvantages of detailed elaboration of the business plan. Jones & Penaluna (2013) believe that outside the scientific boundaries, the business plan increasingly loses its credibility. The business plan's fictional nature as a record about an opportunity that is rarely fully understood means that any rigid adherence to it would inevitably result in the wrong outcome. This is perhaps the biggest critique of it (Jones & Penaluna, 2013). Eschker et al. (2017) even come to the conclusion that using a business plan did not help businesses succeed. Watson & McGowan (2019) also agree with this conclusion, considering that the business plan has limited opportunities to influence the performance, profitability, and persistence of newly founded entrepreneurial ventures. McKenzie & Sansone (2019) come to similar results because they conclude that the results from the business plan are not correlated with the

survival, employment, sales, and profit of the company. In addition, the business plan is not precise enough when it comes to predicting the return on investment in younger firms (Eschker et al., 2017). Another challenge faced by business plan creators is the high confidence that students have when it comes to developing business ideas (Jones & Penaluna, 2013). Attending training and courses in entrepreneurship is not enough to create a reliable business plan. The key thing in creating a business plan is the experience of (potential) entrepreneurs, which students in most cases do not have. Third, creating a business plan requires a lot of time, which can limit the flexibility of new ventures, delay the time to enter the market (Wei et al., 2018), and delay the action of entrepreneurs (Watson & McGowan, 2019). Such situations lead to some business opportunities being missed on the market (Wei et al., 2018), which will benefit competitors.

Despite the increasing criticism of the creation of a business plan, significant resources are still spent on its promotion within the framework of providing support in education and starting a business (Watson & McGowan, 2019). Considering the importance of planning in the process of managing entrepreneurial ventures, the creation of a business plan cannot be completely ignored. A certain type of plan must exist, in order to look at the idea and evaluate the possibilities of its realization because it is better to "make mistakes on paper than on the market". The level of development of the business plan will depend solely on the business idea, the experience of the entrepreneur, available resources, and the current business situation in the market.

4. Content and form of the business plan

The utility value of a business plan primarily depends on its content, i.e. on information on how to develop a business idea. The form of a business plan is usually similar for all companies - it contains similar sections and follows an established form, but the length of the plan depends on the type of company (Hormozi et al., 2002). The form of the business plan differs depending on whom it is intended for (Bajramović & Ahmatović, 2012b). For internal needs, entrepreneurs can choose the form and content themselves, while in the case of drawing up a business plan for the needs of external stakeholders, it is necessary to adhere to certain standards (Bajramović & Ahmatović, 2012b).

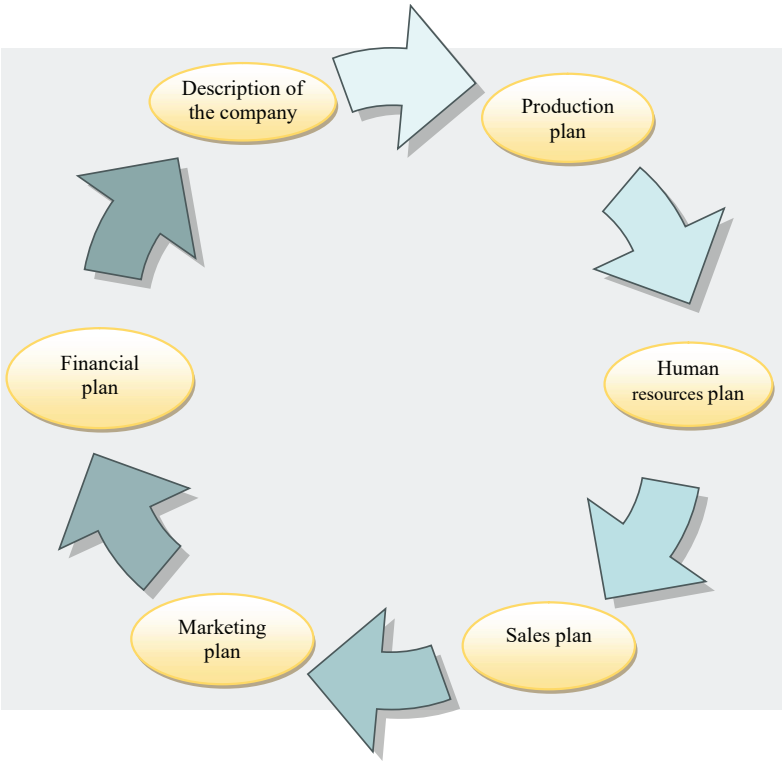
The creation of a business plan is based on the use of appropriate resources (human, material, intangible) and appropriate information (primary and secondary). That is why it is especially important to respect the principle of truthfulness (Boškov, 2016) in order to use resources and information to their full potential. It is concluded that the first and most important step in the process of defining a business plan is to harmonize the capabilities and strengths of the entrepreneur with the needs of internal and external users (Stankov et al., 2016). In addition to numerous material and financial resources, the process of reviewing and evaluating the possibilities of business ventures and ideas requires, above all, a high-quality entrepreneurial team (Stankov et al., 2016). The time frame for which a business plan is created is usually one year, with the fact that it can be updated on a quarterly and monthly basis (Đuričin et al., 2012).

A business plan consists of a formal part and an essential part (Bajramović & Ahmatović, 2012b). The formal part includes the title page, content, and other elements

defined by the financier, while the essential part includes the elaboration of key aspects of the realization of the business idea. Accordingly, the business plan should contain the following elements (Stankov et al., 2016; Boškov, 2016) (Figure 2):

- Description of the company;
- Production/operational plan;
- Human resources plan;
- Sales plan;
- Marketing plan;
- Financial plan;
- Business implementation plan.

Figure 2: Elements of a business plan



Source: Authors

In the *company description part*, basic information about the company is presented, for those companies that are already operating, or key information about the potential entrepreneur and his idea, if the company is not yet registered. Based on the data presented in this part, external stakeholders can see the business potential of the company and the entrepreneur.

The production plan is a part of the business plan in which the possibility of producing new products and services is elaborated. The entrepreneur must estimate

the production capacity, estimate the value of the production assets, define the planned volume of production, work out the technological process, estimate the production time per unit of product/service, the number of employees who will be involved in the production process, the required level of inventory.

The human resources plan is based on the assessment of the required number and qualification structure of employees. Investing in human capital represents a certain type of investment, so an entrepreneur must assess the value of each employee before starting a new business venture. Within this plan, it is necessary to plan the recruitment and selection of candidates, employment, employee training, employee performance evaluation, and employee rewards.

The sales plan is based on an assessment of the number and structure of potential customers based on market research. So, within this plan, entrepreneurs identify the customers of the potential product/service and analyse how many of them would buy their product. Part of this plan is determining the selling price of the product/service.

The marketing plan deals with the description of the market, future customers, suppliers, business partners, monitoring of demand trends, analysis of market opportunities and designing a program of marketing activities. If these activities are too extensive for the entrepreneur, he can hire specialized institutions for market research. Within this plan, it is necessary to analyse the elements of the customer relationship management, marketing mix, to make a SWOT analysis (Pavlović & Krstić, 2016; Nedeljković et al., 2022).

The financial plan foresees the necessary funds for the realization of the business idea. It is based on the assessment and analysis of financial indicators on the basis of which the economic justification and efficiency of investing in a specific project are determined (Pavlović & Krstić, 2016). Within this plan, the projection of income, expenses, cash flow, and construction of financial investments are made.

A business plan is a tool of the planning process that helps to see the real possibilities of a business idea. However, this plan is not a guarantee of success and poor performance can occur if some aspects of the business are changed or left out of the analysis. Some of the causes of bad results of business ventures elaborated in the business plan are a wrong market analysis, the great fascination of the entrepreneur with the idea, and unrealistic assessments of business possibilities, it is not enough to be the first in a business, it is also important to be the best (Boškov, 2016). On the basis of what has been said, it can be concluded that the business plan is based on the assessment of the entrepreneur and his experience in the specific business field, so the importance of this plan solely depends on human resources - the entrepreneur and his team.

Conclusion

A business plan is a basic planning tool based on which opportunities, limitations, and resources are assessed in order to realize a business venture. The essence of the business plan is to test the perceived business idea, to present the financial potential of the idea to investors, and to serve as a means of control for the entrepreneur in future business. The entrepreneur and the entrepreneurial team have the key role in defining the business plan and in its realization. In this sense, the paper particularly emphasizes

the role of entrepreneurship education in spotting a business opportunity and later in its elaboration and realization. Users of the business plan can be internal (the entrepreneur and his team) and external (financial investors).

The literature confirms the contribution of a business plan to an entrepreneur's business, but it should also be emphasized that in today's turbulent conditions, it is difficult to define a precise plan. It is recommended to create a business plan based on key points while leaving the detailed elaboration of the plan for later. The form and content of the business plan are generally similar for most companies. It differs depending on whether it is compiled for external or internal users. The elements of a business plan can be summarized as follows: company description, production plan, human resources plan, sales plan, marketing plan, and financial plan.

The work provides a good theoretical basis for conducting future empirical research on how much entrepreneurs use a business plan, whether there are differences in the use of a business plan according to activities, how the definition and implementation of the idea elaborated in the business plan affect the competitiveness of the company. All of the above can be research directions for future studies.

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