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COMPARATIVE ADVANTAGES OF APPLYING AN INNOVATIVE SUBSURFACE IRRIGATION SYSTEM IN AGRICULTURE OF THE REPUBLIC OF SERBIA–ECONOMIC ASPECTS

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Abstract

The aim of the research in this paper is to confirm the economic justification of the application of innovative subsurface irrigation "Agrokapilaris". In the introduction, an overview of irrigated areas in the Republic of Serbia is given, from which it is clear that irrigation was applied in 2022 by 4.6% more compared to the previous year and that this is a small but at least some progress, with a tendency to further increase areas with irrigation systems. Also, the key features of the innovative subsurface irrigation are given. The innovative subsurface irrigation has been used for some time on plots in Serbia. In this paper authors examine further development and economic profitability of this irrigation model, on the example of its application in the plastic greenhouse production of vegetables on the agricultural property of the Secondary Agricultural and Chemical School in Obrenovac, Serbia. The assessments of the economic effectiveness of investments in this type of irrigation system in plastic greenhouse vegetable production, on an area of 0.5 ha, showed, based on static calculations that the investment will succeed in 4.02 years. According to the dynamic calculation, the investment project will succeed in 4.26 years, which clearly shows the quick return of the invested funds in this type of irrigation system, that is, justified investments.

Key words: *subsurface irrigation, vegetable, investment, evaluation, static and dynamic methods, return, profit*

INTRODUCTION

In order to achieve sustainable development, agricultural production must not have a negative impact on the environment or degrade its resources, but should be designed in a way that it is technically applicable, economically profitable and socially acceptable [19]. Accordingly, the concept of development based on the principles of using new technologies and renewable energy sources, which imply minimal use of water resources with their optimization and preservation of ecological status, is imposed on agriculture.

According to [1], predicted climate changes and the progressive pressure of the human population on nature and resources will contribute to the reduction of water resources.

According to [2], the frequency of 100-year droughts will increase at least 10 times. Due to the upcoming changes, efficient, controlled management of water resources is necessary.

Irrigation has a strategic role in the process of agricultural production and agricultural development in general [8] and the management of water resources and management of systems for the use and protection of water is gaining more and more importance [3]. Along with that, the intensification of irrigation could lead to a positive restructuring of agricultural production both in the field of vegetable growing, cattle breeding and in the field of industrial plants. In the conditions of intense climate changes, when rainfall isn't enough for cultivated plants either in terms of intensity/quantity or schedule, during their vegetation cycle, it is impossible to imagine agricultural production without the use of irrigation, as well as the achievement of quality yields in satisfactory quantities, with all that, economically justified. With the intensive application of irrigation, with the use of all the necessary agro technical measures that accompany production, the genetic potential of the cultivated calves can be reached and developed [11, 13].

In the Republic of Serbia, a total of 54,639 ha of agricultural land were irrigated in 2022, which is 4.6% more than in 2021 [14].

Irrigation research includes business entities and agricultural cooperatives engaged in agricultural production and services in agriculture and/or managing irrigation systems.

In the total irrigated areas, arable land and gardens have a dominant share of 51,008 ha (93.4%). They are followed by orchards (2,943 ha) with 5.4%, while other agricultural areas participate in irrigation with only 1.3% or 688 ha (Figure 1/a).

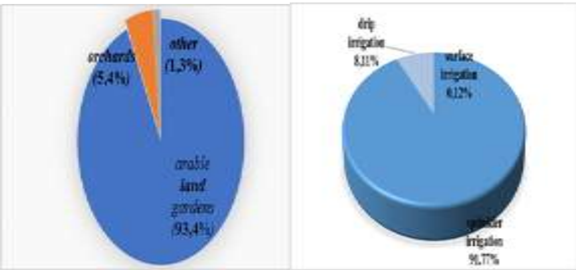

Fig. 1. Irrigated areas under crops (a) and by type of irrigation (b) in the Republic of Serbia, 2022, %
Source: Statistical Office of the Republic of Serbia [14].

The most common type of irrigation in 2022 was sprinkling, applied by 91.8% (on 50,143 ha). Drip irrigation was applied to 8.1% of the area or 4,433 ha), while only 0.1% of the area or 63 ha was surface irrigated (Figure 1/b).

According to the same data source, for irrigation in 2022, most of the water was drawn from watercourses (89.8%), while the remaining amounts were taken from groundwater, lakes, reservoirs and water supply networks.

Irrigation as an old ameliorative measure has existed almost as long as human civilization and it has improved and intensified over time. Its representation in the world is not equal and is conditioned by the natural features of the area, the water needs of the cultivated plants and many other economic, social and natural factors. There are several methods of irrigation, but the research in this paper refers to underground/subsurface irrigation or sub-irrigation.

Subsurface irrigation is irrigation below the surface of the soil, at a certain depth, which is generally aligned with the depth of the rhizosphere of the cultivated plant. It is a relatively recent method of irrigation, since its beginnings date back to the sixties of the last century, and it was first used in America.

The principle of subsurface irrigation involves bringing water to the surface intended for irrigation through canals, i.e. through pipes and distributing water below the surface of the soil into the rhizosphere zone, through a system of laterals with water emitters [5]. A pictorial representation can be seen in the Figure 2.

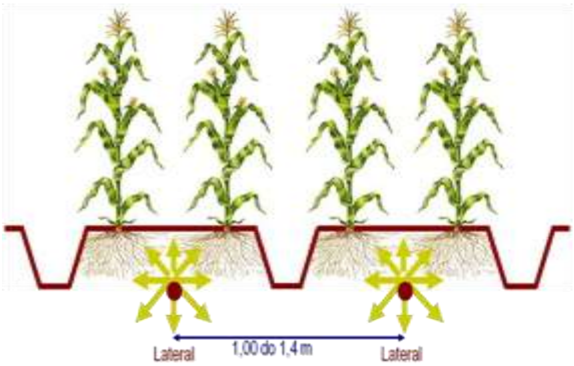

Fig. 2. Subsurface irrigation - installation of laterals with water emitters
Source: Zloh Zdenko, internal documentation [20].

When it is about Republic of Serbia, subsurface irrigation is mainly applied on plots of larger areas, from 1 to 130 ha. The total areas covered with subsurface irrigation systems range from 15,000 to 20,000 ha, and about 80% are present in the area of AP Vojvodina [10].

As all types of irrigation, subsurface irrigation has a number of advantages and a number of disadvantages. The potential advantages are mainly reflected in lower water consumption, providing the possibility of automation and remote control of the system, not disturbing the movement of agricultural mechanization on the irrigated surface, greater water application uniformity and others [9]. The main limiting factors of subsurface irrigation are clogging of drippers, soil salinization and damage caused by rodents. The solution for this could be regular flushing of pipelines and laterals, use of herbicides and acids that prevent root growth and treatment against rodents. If all these factors were harmonized, the lifetime span of the subsurface irrigation system would be about 20 years [6].

The implementation of innovations and new technologies through applying new technical solutions for optimizing water consumption in the irrigation process, opportunities are created for improving agricultural production and sustainable rural development. Unlike Serbia, in economically developed countries, there are precise and official data on the application and justified use of new technologies and renewable energy sources in agriculture [17, 16]. One of the most considerable problems worldwide is water shortage. Regarding agriculture is a sector with high water needs through the use of irrigation systems, "smart systems" that use water wisely are priceless [4]. In order to promote the use of new technologies and renewable energy sources in agriculture in Serbia, the research in this paper is focused on the comparative advantages and economic effects of using an innovative subsurface irrigation system with solar panels. The innovative solution "Agrokapilaris" was created as a result of many years of research and experimental work on monitoring the water-physical properties of the soil on test fields with different agricultural crops. One of the several locations where this system was installed is the sample location "Grabovac" at the Secondary Agricultural and Chemical School in Obrenovac, on the production area of the plastic greenhouse of 5 acres which will be shown in this paper.

Agrokapilaris represents an innovation in irrigation that could overcome the problems related to extreme droughts in the long term. Structurally, this system is very precise because it strictly controls optimal water consumption and has a self-regulating mechanism for giving water to plants. This system is placed below the depth of tillage, at a parallel distance that depends on the plant being grown. Certainly, in vegetable growing, these distances are shorter, while in fruit production they are longer.

The Agrokapilaris innovation is a specific construction, it is a small dimensions underground channels network made of non-degradable plastic foil, in the shape of the letter "V", within which there are hoses for water transport with built-in elements for turn on water into the system (Figure 3). The plastic foil enables capillary moisture to rise laterally and ascendingly, preventing water from flowing into the deeper layers of the soil, which prevents loss of water. Every drop of water goes to the root system in the form of capillary moisture. Droppers are not used as water emitters, so there is no clogging of them, which makes this system different from other existing and so far applicable systems for subsurface irrigation in practice.

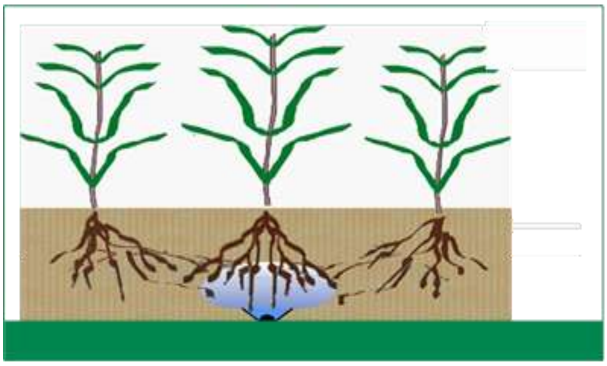

Fig. 3. "Agrokapilaris" working concept
Source: Zloh Zdenko, internal documentation [20].

The main differences between this system and conventional irrigation systems are as follows:
-Long lifespan (possible service life is 70 years);
-Good working system under extremely low pressures (for using this system, a pressure of 0.2 bar is enough, which means watering several times the area with the same energy consumption compared to the drip irrigation system);
-Self-regulation when giving water to the soil, i.e. plants, without clogging the drippers [20].

MATERIALS AND METHODS

For the purposes of research, the data of the Statistical Office of the Republic of Serbia, the results of previous research related to the issue of subsurface irrigation by local and foreign authors, previous research related to innovative subsurface irrigation and data collected from the plastic greenhouse of the Secondary Agricultural and Chemical School in Obrenovac were used.

The methods used to evaluate the economic effectiveness of investments in agriculture are significant not only in the field of application of new technologies and renewable energy sources in agriculture, but in general in the application of the concept of sustainable development on agricultural holdings. Consequently, this part of the research represents an important segment of the overall presentation when it is about the evaluation of the economic effects both of applying the innovative subsurface irrigation system and solar panels in agriculture, in which the important role of the economic effectiveness of investments for sustainable development on the agricultural holdings is underlined. In this research, the authors emphasize the methods for evaluating the economic effectiveness of investments in agriculture, such as [15]:

- Static methods for evaluating the economic effectiveness of investments;
- Dynamic methods for evaluating the economic effectiveness of investments;
- Methods for evaluating the economic effectiveness of investments in conditions of uncertainty and risk.

The research results are presented in tables and graphs.

RESULTS AND DISCUSSIONS

By implementing investments in the irrigation system, the positive effects of sustainable use of natural resources are realized, the quality of the environment and the general, socio-social and economic development of society are improved [7].

The evaluation of the economic effectiveness of investments in agriculture is based on the foundations that will ensure maximum economic effects during the period of exploitation of the investment object, that is, on the highest possible level of obtained effects per unit of invested funds. Accordingly, the evaluation of the economic effects of the application of the innovative system of subsurface irrigation and solar panels in agriculture, regardless of the conditions in which the production process takes place, should be based on quantitative and qualitative provisions, which will ensure the direction of cash flows, that is, investment in the most profitable business activities on the agricultural holding [12].

Investments in the irrigation system depend on the type of mobile equipment, the location of captured water, the distance of the energy source, the terrain configuration, etc.

In the plastic greenhouse of the Secondary Agricultural and Chemical School in Obrenovac, on the agricultural sample location “Grabovac”, an experiment was conducted in order to monitor the results achieved by the introduction of the innovative method of subsurface capillary irrigation. Three crops were observed: red pepper (first and second category), radish and onion.

The values obtained during the calculation are shown per acre, in euros.

With the introduction of an innovative subsurface irrigation system in the plastic greenhouse, a change occurred:

-in the amount of income (increase in yield and prices),

-and in terms of costs (reduction in water consumption for irrigation, reduced use of fertilizers and plant protection products) for all crops. In the process of evaluating the economic effects of the application of subsurface irrigation and solar panels on the agricultural holding, we started from assumptions that are reflected in: investments in fixed assets (Table 1), total investments (Table 2), sources of financing (Table 3), formation of total income (Table 4), total expenses (Table 5), income statement (Table 6) and economic flow (Table 7).

Investments in fixed assets refer to the purchase and installation of an innovative subsurface irrigation system, the purchase and installation of solar panels, the purchase and installation of a digital weather station, and the purchase and installation of soil and air sensors. All investments refer to the acquisition of new fixed assets, and the investment is shown in total amount (purchase price + VAT). The total income is formed from income from the sale of products and income from subventions.

Direct material includes: onion bulbs; radish seeds, pepper seedlings, fertilizers, pesticides, packaging, binder and foil.

Table 1. Investment in fixed assets (EUR)

Ord. No.	Description	Value (with VAT)
I	**Constructions and buildings**	**6,925.17**
1.	Irrigation system "Agrokapilaris"	6,925.17
II	**Equipment and mechanization**	**2,311.79**
1.	Weather station with software	1,020.66
2.	Solar energy power system, electric valves and i electric motor	1,015.55
3.	Soil and air sensors	275.58
TOTAL		**9,236.96**

Source: Author's calculation based on [18].

The calculation of depreciation (amortization) refers only to the basic price (purchase value without VAT). The value of investments in fixed assets accounted for Euro 9,236.96, VAT included (Table 1).

The value of total investments is Euro 10,160.65 as shown in Table 2.

Table 2. Total investments (EUR)

Ord. No.	Description	Existing funds	New investments	Total investments	Participation in total investments (%)
I	**Fixed assets**	**0.00**	**9,236.96**	**9,236.96**	**90.91**
1.	Constructions and buildings	0.00	6,925.17	6,925.17	68.16
1.	Equipment and mechanization	0.00	2,311.79	2,311.79	22.75
II	**Current assets**	**0.00**	**923.70**	**923.70**	**9.09**
TOTAL		**0.00**	**10,160.65**	**10,160.65**	**100.00**

Source: Author's calculation based on [18].

Table 3. Financial resources (EUR)

Ord. No.	Description	Existing funds	New investments	Total investments	Participation in total investments (%)
I	**Own resources**	**0.00**	**10,160.65**	**10,160.65**	**100.00**
1.	Fixed assets	0.00	9,236.96	9,236.96	90.91
2.	Current assets	0.00	923.70	923.70	9.09
II	**Other sources**	**0.00**	**0.00**	**0.00**	**0.00**
1.	Fixed assets	0.00	0.00	0.00	0.00
TOTAL (I+II)		**0.00**	**10,160.65**	**10,160.65**	**100.00**

Source: Author's calculation based on [18].

Table 4. Total income formation (EUR)

Ord. No.	Product/subventions/Services	Unit of Measure (UM)	Years of the project								
			I			II			III - X		
			Price per UM	Quantity in UM	Total	Price per UM	Quantity in UM	Total	Price per UM	Quantity in UM	Total
0	1	2	3	4	5=3x4	6	7	8=6x7	9	10	11=9x10
1	Income from product sales				4,790.62			5,554.97			6,323.61
1.1.	Onion	bunch	0.31	1,970	603.12	0.31	2,280	698.13	0.31	2,600	796.11
1.2.	Radish	bunch	0.23	5,114	1,196.08	0.23	5,930	1,387.03	0.23	6,750	1,578.83
1.3.	Red pepper 1st category	kg	1.06	2,500	2,657.96	1.06	2,900	3,083.24	1.06	3,300	3,508.51
1.4.	Red pepper 2nd category	kg	0.77	436	333.45	0.77	505	386.57	0.77	575	440.16
2	Revenues from subventions				3,462.58						
2.1.	Subventions for the purchase of irrigation systems (50% of the purchase price	piece	3,462.58	1.00	3,462.58						
TOTAL					**8,253.20**			**5,554.97**			**6,323.61**

Source: Author's calculation based on [18].

The total financial resources accounted for 10,160.65, of which 90.91% fixed assets and the remaining of 9.09 representing current assets (Table 3).

Table 5. Total costs (EUR)

Ord. No.	Costs	Years of the project				
		I	II	III	IV	V
I	**Material costs**	**1,988.46**	**2,042.98**	**2,097.48**	**2,097.48**	**2,097.48**
1.	Direct material	1,938.46	1,992.98	2,047.48	2,047.48	2,047.48
2.	Energy and fuel	50.00	50.00	50.00	50.00	50.00
II	**Non material costs**	**1,677.28**	**1,677.28**	**1,677.28**	**1,677.28**	**1,677.28**
1.	Amortization	462.10	462.10	462.10	462.10	462.10
2.	Labour	987.74	987.74	987.74	987.74	987.74
3.	Interest on the loan	0.00	0.00	0.00	0.00	0.00
4.	Costs of production services	136.00	136.00	136.00	136.00	136.00
5.	Non material costs	91.43	91.43	91.43	91.43	91.43
TOTAL (I+II)		**3,665.74**	**3,720.26**	**3,774.76**	**3,774.76**	**3,774.76**

Source: Author's calculation based on [18]

Table 6. Profit and loss statement (EUR)

Ord. No.	Description	Years of the project				
		I	II	III	IV	V
I	**TOTAL INCOME**	**4,790.62**	**5,554.97**	**6,323.61**	**0.00**	**0.00**
1.	Income from product sales	4,790.62	5,554.97	6,323.61	0.00	0.00
2.	Other income	0.00	0.00	0.00	0.00	0.00
II	**TOTAL EXPENDITURES(1+2+3)**	**3,665.74**	**3,720.26**	**3,774.76**	**3,774.76**	**3,774.76**
1.	Business expenses	3,665.74	3,720.26	3,774.76	3,774.76	3,774.76
1.1.	Material costs	1,988.46	2,042.98	2,097.48	2,097.48	2,097.48
1.2.	Non material costs without amortization and interest on the loan	1,215.18	1,215.18	1,215.18	1,215.18	1,215.18
1.3.	Amortization	462.10	462.10	462.10	462.10	462.10
2.	Financial expenses	0.00	0.00	0.00	0.00	0.00
2.1.	Interest on the loan	0.00	0.00	0.00	0.00	0.00
III	**GROSS PROFIT (I-II)**	**1,124.88**	**1,834.72**	**2,548.85**	**-3,774.76**	**-3,774.76**
IV	**PROFIT/INCOME TAX**	0.00	0.00	0.00	0.00	0.00
V	**NET PROFIT (III-IV)**	**1,124.88**	**1,834.72**	**2,548.85**	**-3,774.76**	**-3,774.76**

Source: Author's calculation based on [18].

Table 7. Economic flow (EUR)

Ord. No.	Name	Zero moment	Year				
			1	2	3	4	5
I	**TOTAL INCOME (1+2)**	**0.00**	**4,790.62**	**5,554.97**	**6,323.61**	**6,323.61**	**13,788.45**
1.	Total income	0.00	4,790.62	5,554.97	6,323.61	6,323.61	6,323.61
2.	The rest of the project value	0.00	0.00	0.00	0.00	0.00	7,464.84
	2.1. Fixed assets	0.00					6,541.14
	2.2. Permanent current assets	0.00					923.70

II	**TOTAL ISSUANCE (3+4)**	**10,160.65**	**3,203.64**	**3,258.15**	**3,312.66**	**3,312.66**	**3,312.66**
3.	Investment value	10,160.65					
	3.1. In fixed assets	9,236.96					
	3.2. In permanent current assets	923.70					
4.	Costs without amortization and interest	0.00	3,203.64	3,258.15	3,312.66	3,312.66	3,312.66
5.	Income tax	0.00	0.00	0.00	0.00	0.00	0.00
III	**NET INCOME (I-II)**	**-10,160.65**	**1,586.98**	**2,296.82**	**3,010.95**	**3,010.95**	**10,475.79**

Source: Author's calculation based on [18].

Table 8. Economical-efficiency coefficient, (Ee>1) (EUR)

Year of investment life cycle	Total output (market value of production)	Total input (costs of production)	Ee
0	1	2	3 = 1/2
I	4,790.62	3,665.74	1.31
II	5,554.97	3,720.26	1.49
III	6,323.61	3,774.76	1.68
IV	6,323.61	3,774.76	1.68
V*	6,323.61	3,774.76	1.68

Source: Author's calculation based on [18].
*Representative year (full capacity)

Table 8 regards the economic efficiency in terms of the ratio between the total output at market price and total input expressed in costs of production. The value of economic efficiency is higher than 1, Ee>1, reflecting an increasing trends from the 1st year of investments to the 5th year.

Table 9 reflects net profit margin ratio (NPMR), calculated as the relative ratio between profit and total output (income).

The NPMR values had an increasing trend in the 2st and 2nd year of investments, and then, in the 4th, 5th and 6th years, they remained at the level of 40.31%.

Table 9. Net profit margin ratio, (NPM > i) /EUR/

Year of investment life cycle	Profit	Total output (income)	NPMR
0	1	2	3 = 1/2*100
I	1,124.88	4,790.62	23.48
II	1,834.72	5,554.97	33.03
III	2,548.85	6,323.61	40.31
IV	2,548.85	6,323.61	40.31
V*	2,548.85	6,323.61	40.31

Source: Author's calculation based on [18].
*Representative year (full capacity)
Symbol meaning: i - assumed weighted cost of capital (discount rate = 7.00%)

Table 10 presents he accounting rate of return (ARR), whose value increased from 11.07% in the 1st year of investment to 18.96% in the 2nd year, and then it remained at the constant level of 25.09%.

Table 10. Accounting rate of return, (ARR > i) (EUR)

Year of investment life cycle	Profit	Initial outlay	ARR
0	1	2	3 = 1/2*100
I	1,124.88	10,160.65	11.07
II	1,834.72	10,160.65	18.06
III	2,548.85	10,160.65	25.09
IV	2,548.85	10,160.65	25.09
V*	2,548.85	10,160.65	25.09

Source: Author's calculation based on [18].
*Representative year (full capacity)
Symbol meaning: i - assumed weighted cost of capital (discount rate = 7.00%)

Table 11 shows the payback period which reflects that in the 5th year the investment value is recovered.

Table 11. Simple payback period, (SPP<n) (EUR)

Year of investment life cycle	Net cash flow from economic flow	Cumulative net cash flow
0	-10,160.65	-10,160.65
I	1,586.98	-8,573.67
II	2,296.82	-6,276.85
III	3,010.95	-3,265.90
IV	3,010.95	-254.94
V	10,475.79	10,220.85

Source: Author's calculation based on [18].
Symbol meaning: T - investment payback time; n - years of the project

Table 12 regards Net present value (NPV) and internal rate of return (IRR), the last accounting for 20.54%.

Table 12. Net present value (NPV) and internal rate of return (IRR)

No.	Description	Zero moment	Year of investment life cycle					Cumulative
			I	II	III	IV	V	
0	1	2	3	4	5	6	7	8
1.	Net income from the economic flow (column 3 to column 7)	-10,160.65	1,586.98	2,296.82	3,010.95	3,010.95	10,475.79	***20,381.50***
2.	Discount rate (%)	7.00	7.00	7.00	7.00	7.00	7.00	
3.	Discount factor $(1+i)^{-n}$ or $1/(1+i)^{\wedge n}$, where is i = discount rate; n = years of the project	1.0000	0.9346	0. 8734	0.8163	0.7629	0.7130	
4.	Net present value of project (column from 3 to column 7)	-10,160.65	1,483.16	2,006.13	2,457.84	2,297.04	7,469.09	***15,713.26***
5.	Net present value of project (column from 2 to column 7)	5,552.61						
6.	Relative net present value of project: [(column from 2 to column 7) / |column 2|] > i	0,55						
7.	Internal rate of return: (ISR > i)	20,54%						

Source: Author's calculation based on [18].

Table 13. Dynamic payback period, (DPP < n) (EUR)

Year of investment life cycle	Present value of net cash flow from economic flow	Cumulative net cash flow
0	-10,160.65	-10,160.65
I	1,483.16	-8,677.49
II	2,006.13	-6,671.36
III	2,457.84	-4,213.52
IV	2,297.04	-1,916.48
V	7,469.09	5,552.61

Source: Author's calculation based on [18].

Table 13 and 14 present the dynamics of payback period and the breakeven point of the investment exploitation.

Table 14. Break-even point of investment exploitation (EUR)

No	Description	Year of investment life cycle				
		I	II	III	VI	V
1.	Incomes (I)	4,790.62	5,554.97	6,323.61	6,323.61	6,323.61
2.	Variable costs (VC)	2,976.20	3,030.72	3,085.22	3,085.22	3,085.22
3.	Fixed costs (FC)	227.44	227.44	227.44	227.44	227.44
4.	Gross margin (GM = I - VC)	1,814.42	2,524.26	3,238.39	3,238.39	3,238.39
5.	Break-even point (relative) (BEPr = (FC / GM) * 100), in %	12.53	9.01	7.02	7.02	7.02
6.	Break-even point (value) (BEPv = (I * BEPr) / 100), in EUR	600.50	500.51	444.12	444.12	444.12
7.	Margin of safety (MS = ((1 - (BEPv / I)) * 100), in %	87.47	90.99	92.98	92.98	92.98
8.	Incomes (I)	4,190.12	5,054.47	5,879.50	5,879.50	5,879.50

Source: Author's calculation based on [18].

CONCLUSIONS

The irrigation in the Republic of Serbia has been a sporadic measure in plant production for a long time. In last few years, it has been more intensive, but despite of it still inadequately represented. Innovative subsurface capillary irrigation, as a subject of the study, compared to classical approaches i.e. the scientifically recognized methods of irrigation, has numerous environmental and economic advantages. It was found that its application in plastic greenhouses is economically justified, because it leads to an increase in the production value of all analysed vegetable crops, as well as to a reduction of the most important groups of variable costs (fertilizer costs, plant protection products, energy costs, etc.).

Observing the years of full capacity i.e. from the third year of the project, the static evaluation of the project's effects points the following conclusions: that coefficient of economy is greater than one, which indicates the fact that the total income is greater than the total expenditure. It can be stated that the investment project is economical, which means that the investment is profitable. Accumulation rate is higher than 7.00% (assumed weighted cost of capital), which shows that the investment project is accumulative. During the exploitation of the project, the cost of the source of financing is covered and through this "earnings" are made. Based on the static calculation, it is clear that the investment project will pay off in 4.02 years. The investment payback time is, therefore, 4 years and 0.29 months (0.02 x 12 months).

According to the dynamic assessment of the project's effects, the following can be concluded: the investment in a period of five years of use (years of the project's lifetime span) would enable the investor to increase the total profit, calculated using the discount rate (i = 7.00%) at the initial moment of exploitation (n = 0), in the amount of RSD 5,552.61. The investment is profitable because the project's internal rate of return is higher than the discount/weighted rate (20.54% > 7.00%). Also, according to the dynamic calculation, the investment project will pay off in 4.26 years.

Therefore, the investment payback time is 4 years and 3.08 months (0.26 x 12 months). Regarding the assessment of the effects of the project under conditions of risk and uncertainty, with an emphasis on the bottom point of profitability in the years of full capacity (from the third year of the project), we come to the following conclusions:

-the volume of production must not fall below 7.02%;

-the realized income from sales must not be below 444.12 euro;

-a decline in production volume by 92.98% is allowed;

-a decrease in sales revenue of 5,879.50 euro is allowed.

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