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EU Financial Instruments in Practice: SMEs' Investments in Energy Efficiency and Renewable Energy in Croatia

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ABSTRACT

In the context of the EU development strategy based on a climate neutral economy by 2050, an important dilemma for policy makers is how to provide an incentive for companies, especially small and medium-sized enterprises (SMEs), to make energy efficiency and renewable energy projects their high priority. The aim of this paper is to provide an independent empirical assessment of EU financial instruments and its barriers, used by SMEs targeting energy efficiency and renewable energy. Ex-Ante evaluation was carried out on a sample of 320 SMEs in Istria County, Croatia. The results of the empirical research suggest that despite of a low interest of investors in green projects, the use of the innovative financial instrument would significantly contribute to an increase in the number and value of investments in energy efficiency and renewables. Similar to most of other studies, our results also confirmed that administrative and bureaucratic barriers are perceived as the biggest obstacle for SMEs. It is therefore necessary to reduce the number of bodies involved, improve the quality of information dissemination and simplify procedures.

Keywords: SMEs, Energy Efficiency, Renewable Energy, EU Financial Instruments, Croatia

JEL Classifications: C83, D04, D22, D25, Q48

1. INTRODUCTION

European Union has started a development strategy that is based on climate neutral economy by 2050. European green deal represents a set of policy initiatives with the main aim to decarbonize European economy and fulfil economic goals. New investments in energy efficiency and renewable energy sources (RES) are needed, while energy efficiency becomes the key pillar of the EU vision of decarbonisation. The implementation of energy efficiency improvement measures and new investments have multiple benefits for the energy sector, economy and society. They lead to energy and GHG emission savings and improve energy security, while their economic multiplicative effects result with the increased economic activity, aggregate demand and GDP growth. (Thema, 2019). Having in mind the fact that EU countries have in general higher energy prices in comparison with US and China, one could expect that EU firms would be more prone to invest in energy efficiency and thus control their energy costs and competitiveness.

However, new study from EIB (EIB, 2020) argues that energy efficiency is still a low priority for EU firms and only one third of all EU firms invested in energy efficiency improvement. In order to provide investment support, EU financial instruments have become very important, especially for less developed EU Member States. They create incentives for new investments and stimulate private investors to engage in energy efficiency and RES projects. However, they are often considered to be burdened with strict rules and complex administrative procedures.

Many studies confirm that the share of firms investing in energy efficiency and RES is positively correlated with the size of firms. Although large firms have bigger impact on the economy, small and medium enterprises (SMEs) represent a specific sector of economy with a huge role in employment. On the global level, SMEs comprise almost 99% of all firms and about 60% of total employment. Increasing energy efficiency and investing in RES have huge potential regarding cost savings and profitability

for firms, as well as for economy and society as a whole, by reaching decarbonisation agenda and reducing dependence on energy imports. Still, SMEs are faced with some important barriers. Therefore, the aim of this paper is to give an independent assessment of the EU financial instruments used by SMEs that target energy efficiency and RES. In doing so, we analyse the readiness of SMEs to invest in energy efficiency measures and RES in order to identify potential policy opportunities and to propose a new and innovative model of financial instruments as a policy support to increase energy efficiency and the share of RES in energy mix. Despite the existing research results in the field of energy efficiency and renewable energy, the empirical results are inconsistent and depend mainly on the specifics of the region and the policy framework. Therefore, more empirical research using different methodologies and datasets is needed to draw conclusions on a global scale that can contribute to the basis of a green transition theory. The arguments will be supported by evidence from one EU region - Istria County that has been chosen as the second most developed county in Croatia (after City of Zagreb). Croatia, as the youngest EU member state, has made significant progress in withdrawing EU funds, but there are still some limitations that will be discussed in the paper and ways to improve. Therefore, we will test the hypothesis that EU financial instruments in combination with financial grants can be an important driver that can address energy efficiency and the share of RES in the energy mix. The research was conducted on a sample of 320 SMEs by using probability sampling based on a random selection. The target companies were selected according to the established set of criteria: they are small and medium sized, located in Istria County and belong to the manufacturing sector. This policy research based on empirical results for a specific region (Istria) could shed some new light and provide interesting insights into the behaviour of entrepreneurs regarding new investments in energy efficiency and RES to optimize the use of EU financial instruments in the period 2021-2027. Assessing the leverage effect of the innovative financial instrument and taking into account the characteristics of Istrian SMEs, the authors offer a simulation of the impact of the new financial instrument for investment projects in energy efficiency and renewable energy.

The paper is structured as follows. After the Introduction, the following section provides literature review, while Section 3 describes methodology and data. Section 4 discusses research results and sets policy agenda for the new financial period. The final section summarizes key conclusions.

2. LITERATURE REVIEW

Long before the decarbonisation agenda, energy efficiency has been recognized as a way to decrease costs and increase profitability, especially in firms that are energy-intensive and consume a lot of energy. Still, most of the companies were not ready to invest even when the investment is cost-effective. This situation is known as “energy efficiency gap” (Hirst and Brown, 1990). During 80s the economic theoretical foundation was based on firms as rational economic players who ignored energy efficiency due to “hidden costs” like the lack of resources or management time that can decrease profitability of investment.

This approach was based on neoclassical view that government should intervene only when there are real market failures like information asymmetry (Shove, 1998). During 90s a considerable number of studies were conducted regarding investment in energy efficiency and they concluded that there were a wide range of organizational and behavioural barriers (DeCanio, 1998). For example, transaction cost barrier happens because firms do not make rational decision and they can even show systematic bias against certain investment outcomes such as status quo bias (Samuelson and Zeckhauser, 1988).

New EU energy strategy and decarbonisation agenda stimulate a growing research body on energy efficiency and RES investments, but most of actual energy efficiency policies have been developed in the beginning of 2000s and largely based on this barrier-based research (Harmelink et al., 2007). According to Sorrell (2011), all investment barriers related to energy efficiency and RES can be summarized in 7 main groups: Risk, lack of information, hidden costs, access to capital, principal/agent, bounded rationality and biases against energy efficiency investments due to loss-aversion or status quo bias. Stevens et al. (2018) classifies risks as either quantifiable (e.g. financial) or non-quantifiable (e.g. regulatory). According to Hill (2019), economic and financial barriers pose a significant hurdle in mobilizing private capital for energy efficiency projects. Economic and financial risks can be perceived as extrinsic and include volatile energy prices, changes in interest rates that can change the cost of capital and thus increase risks, as well as credit risks (Mills et al., 2006). Tuominen and Seppänen (2017) concluded that price risks can be reduced by energy efficiency improvements, while Kaza et al. (2014) find that higher levels of energy efficiency are associated with lower interest rates, which means lower credit risk. Although the nature of these risks is extrinsic, still most of them can be controlled and managed. For example, Borgeson et al. (2014) suggest the use of public funding schemes in order to subsidize interest rates.

The most research and policy attention has been given to energy-intensive industries and companies. However, SMEs play an important role, not just in employment and economic activity, but in energy consumption as well. As expected, SMEs are even more affected by different barriers for energy efficiency improvements. They are faced with limited capacity for economies of scale, lack of information, time or expertise to cope with regulation and administrative procedures and more difficult and/or more expensive access to capital in comparison with larger firms. Because of that, regulation has a disproportionate effect in terms of cost and administration on SMEs (Hampton and Fawcett, 2017). According to Johansson et al. (2019) and their detailed analysis of all published studies, they concluded that barriers to energy efficiency in industrial SMEs vary with factors such as size, sector, production complexity and geographic location. They also emphasize the importance of the first step of the policy design method, targeting a homogenous company group. According to Fawcett and Hampton (2020), potential for energy and carbon savings is considerably overlooked by economic and energy policy in EU. Although SMEs account for more than half of industrial and commercial energy use, their capacity for paying attention to energy and responding to policy are different, as are their decision-

making processes. A study on SMEs from Portugal (Henriques and Catarino, 2016) showed that new technologies, price incentives and information campaigns are not enough. In order to overcome specific barriers related to SMEs, it is necessary to change their energy behaviours by different policy strategies and to cover internal as well as external influences on behaviour change. Another study on Portugal by Catarino et al. (2015) shows that energy efficiency issues are not identical for all SME regarding the industrial sector. Especially interesting are their findings regarding SMEs' experience in receiving EU financial instruments and their attitude toward new investments. According to them, those firms that have never applied find the procedures complex and difficult, while firms that have already applied for EU financial instruments consider them in a more positive way. In order to evaluate different financing models, Vanstraelen et al. (2015) analysed 24 models in 11 EU countries and they identified four financing models used to provide funding for EE projects. These included financial institutions (i.e. banks, utility funds), ESCO financing, program delivery unit (PDU), and investment funds. Still, EU funds have become very important and for many less developed EU Member States even the most important source of finance.

Regarding barriers to SMEs, Cagno (2014) used a set of Dutch manufacturing enterprises. Their results show that a general common understanding of the barriers can be disputed because economic barriers play the primary role. They concluded that much greater attention should be paid to issues like how barriers affect the decision-making process, which drivers need to be addressed and policies that refer to all firms supplying enterprises with capital, technologies, services, information and competences. Italian experience is also interesting. Trianni and Cagno (2012) made a research on 128 non-energy intensive manufacturing SMEs in Northern Italy. According to their results, the major barriers are access to capital and information asymmetry-lack of information, imperfect information on cost-efficient interventions regarding energy efficiency and the form of information. They also confirmed strong differences between SMEs and large firms, therefore they recommend to avoid bundling together small (SE), medium (MEs) and medium and large (MLEs) with regard to the barriers to energy efficiency investments. Coles et al. (2016) examined energy practices of SMEs in tourism sector because this sector is a major source of CO₂ emissions. Their research results show that energy costs represent a significant share of total costs, but still it did not feature prominently in the business administration of most tourism SMEs.

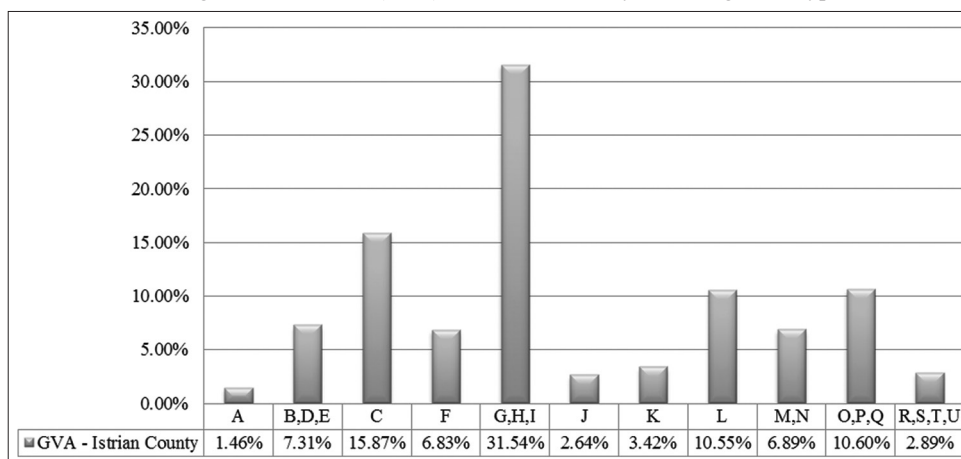
A new study from EIB (2020) has been published during COVID-19 crisis and gives some new insights regarding energy efficiency investments and the role of various factors in entrepreneurs' investment decisions. Their results are based on extensive EIB Investment Survey (EIBIS) performed on the sample of 12,000 firms from all EU countries, size groups and main sectors regarding their investment activities and barriers they are facing. EIB argues that COVID-19 crisis is a game changer in clean energy investments because it will be deeper than the one started in 2008 and Great Depression in the beginning of 1930s. Financial problems have already hit the investments, especially private ones, while, at the same time, energy and commodity prices decreased in 2020 due to

sharp drop in energy demand. Such a new economic environment discourages new investments in clean energy and energy efficiency. Despite a huge effort that European Commission is doing to reach ambitious goals of climate-neutral economy, it will have an important negative impact. Their study confirmed conclusions that have been reached by other authors regarding positive relationship between investing in energy efficiency and energy intensity and size of firms. Manufacturing firms, as the most energy-intensive ones, are more prone to invest in energy efficiency (43% in 2019), followed by infrastructure (37%) and services (30%), while construction sector had the lowest share with 25%. Again, large firms plan to invest in energy efficiency twice more than SMEs. This study gives some new insights on geographical diversification as well. According to their results, the role of energy cost in firms' investment decisions differs significantly across EU member states. Southern countries like Italy, Spain, Portugal and Croatia report high energy costs as a result of higher taxes and levies and their firms consider these energy costs as a major barrier to investment in the period 2016-2019. However, these high costs represent, at the same time, the most important economic incentive for investments in energy efficiency. This study reached many interesting conclusions regarding entrepreneurs' behaviour, but the devastating research result is that energy efficiency is still a low priority for EU firms and only one third of all EU firms invested in energy efficiency improvement. This fact is in complete contradiction with the goals and plans of decarbonisation in the EU. The latest study (Southernwood et al., 2021) on energy efficiency investments in SMEs in Cyprus, France, Germany, Greece, Ireland, Italy, Poland, Romania, Slovenia, Spain and the UK confirms the previous conclusions. They cover different sectors such as construction, manufacturing, food, services, chemicals and chemical products, hospitality, trade and commerce, heavy industry, education, energy and automotive. In terms of financing energy efficiency measures, the results of the surveys show that many SMEs do not have the necessary budget for energy efficiency investments. Self-financing is the most common case, while there is a lack of awareness of financing opportunities at local or EU level, including grants, loans, national support schemes, etc. This is exacerbated by the lack of effective support schemes, the lack of understanding of energy efficiency financing through banks and other sources, and bureaucracy, leading to a lack of motivation. Moreover, SME decision-makers consider energy efficiency improvements as low priority compared to other investments. Moreover, SMEs lack staff with the appropriate skills and knowledge to monitor and record their energy footprint. Finally, most SMEs are struggling to survive in the COVID-19 environment, so investing in energy efficiency measures is not an option in such circumstances.

3. SHORT OVERVIEW OF ECONOMIC PERFORMANCE OF ISTRIAN COMPANIES

Survey results should be analysed within a wider context of the economic specifics of the Istria County. It is the second most developed county in the Republic of Croatia, characterized by a high share of the service sector, especially tourism. Therefore, we begin the analysis with a brief overview of the economic structure of the Istria County (Figure 1).

Figure 1: Structure of the gross value added (GVA) of the Istria County according to the type of activities in 2017



According to the data of the Croatian Statistical Office (2020), activities G, H, I (wholesale and retail trade, transport and storage, accommodation, food preparation and serving) have the largest share in the structure of gross value added with 31.5%. It is followed by C (manufacturing) with 15.9%, then O, P, Q (public administration and defence, education, health care and social work) with 10.6%, while L (real estate business) represents 10.6%. All other activities have shares below 10%: B, D, E (mining and quarrying, electricity, gas, steam and air conditioning supply, food service activities, sewerage, waste management and remediation activities) 7.3%, M, N (professional, scientific, technical, administrative and support service activities) 6.9% and F (construction) 6.8%. Other activities generate a total of 10.4% of the gross value added of the Istria County. Such economic structure is particularly sensitive to external shocks and uncertainties, like the ones experienced during COVID-19 crisis. Still, the observed period from 2015 to 2018 was relatively favourable, which resulted in good business results. In the period from 2015 to 2018, there was a steady increase in the number of companies in the Istria County (Figure 2).

According to the data acquired from FINA (2019), in 2018 there were 11,006 companies in the Istria County, which represents an increase of 15.2% compared to 2015. There has also been a positive trend in the number of profitable companies during the observed period-the percentage of profitable companies was 60.4% in 2018, an increase of 6.3% compared to 2015. Nevertheless, a high percentage of loss-making companies-almost 40% can be observed despite the strengthening of economic activities and other positive economic trends.¹ Another negative feature is related to the gross profit dynamics (Figure 3).

In 2018, Istrian companies generated HRK 34.8 billion in revenues, an increase of 13.2% compared to the reference year 2015 (HRK 30.7 billion). Despite the increase in operating revenues, there was a significantly higher increase in expenses (19.7%) and consequently a decrease in gross profit (-27.6%) in the same period. Key liabilities of Istrian companies (Figure 4) indicate again negative financial position. In the balance sheets of

Figure 2: Number and structure of companies in the Istria County according to their business results in the period 2015-2018

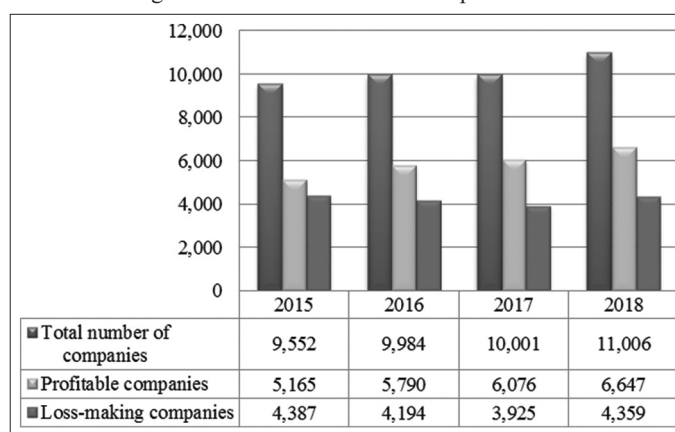
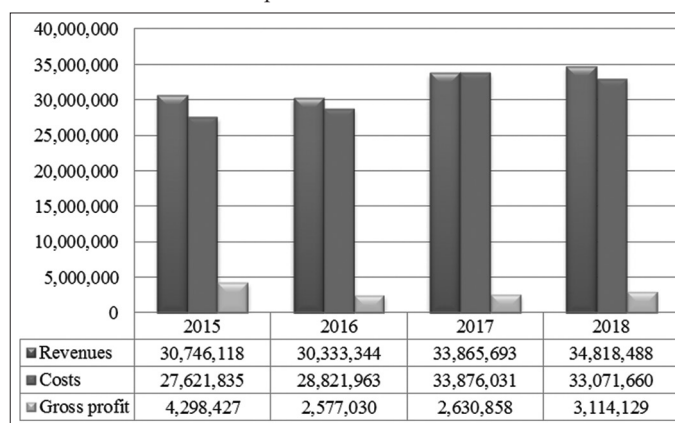


Figure 3: Revenues, costs and gross profit of Istrian companies in the period 2015-2018



Istrian entrepreneurs, there was a minimal increase in capital and reserves (+3.9%) in the observed period, with an average amount of HRK 25.49 billion.

Short-term liabilities of Istrian entrepreneurs amounted to HRK 20.47 billion on average for the year, and long-term liabilities amounted to HRK 21.76 billion. The increase in long-term liabilities in 2018 was HRK 23.1 billion, which represents an

¹ It refers to companies who have submitted annual financial statements. Crafts and local family farms are not included.

increase of 10.5% compared to 2015. On the other side, there was a continuous increase in the value of long-term assets in the analysed period and a simultaneous decrease in the value of short-term assets of Istrian companies (Figure 5).

Data show that the value of long-term assets in 2018 amounted to HRK 51.82 billion (+15.5% compared to 2015), and the value of short-term assets amounted to HRK 21.78 billion (-8.9% compared to 2015). In the same period, Istrian companies invested a total of HRK 8.86 billion, which corresponds to an annual average of HRK 2.21 billion in fixed assets. Though the gross investments in 2018 increased for 15.9% compared to 2017, it is still a decrease of 5.4% compared to the record year 2015.

The previous analysis suggests unfavourable business performance and rise of indebtedness of Istrian companies, as it could be seen on Figure 6. As shown in Figure 6, the value of quick liquidity ratio indicates the ability of a company to settle its liabilities without selling the stock, and its value should not be lower than 0.9. Considering that the value of this coefficient is 0.67 on average (with a downward trend in the observed period), we can conclude that there is a high risk for Istrian entrepreneurs that they will not be able to settle their current liabilities with highly liquid funds.

The value of the current ratio, which measures a firm's ability to pay its short-term liabilities over the observed period, continues

Figure 4: Key liability positions of Istrian companies in period 2015-2018

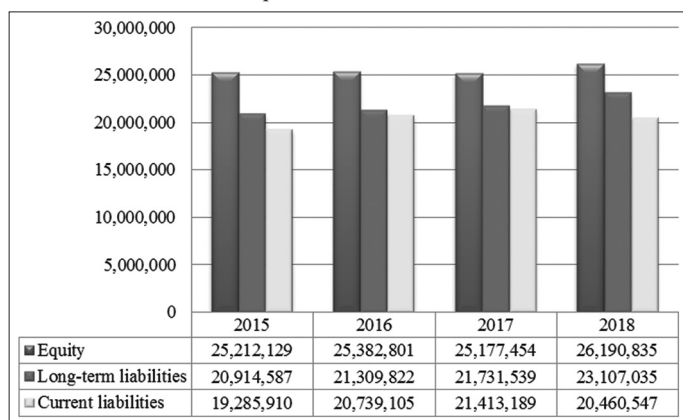
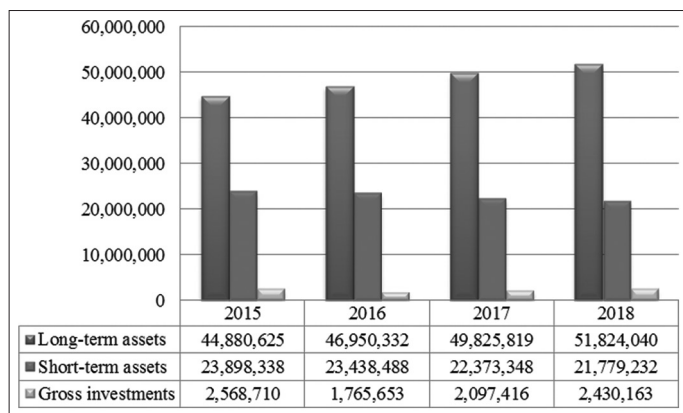
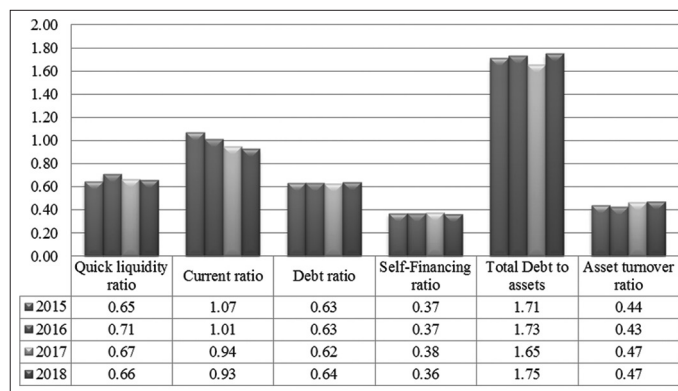


Figure 5: The assets and investments of Istrian companies in the period 2015-2018



to decline. The value of this coefficient should be 2 and not <1.5, therefore, taking into account the reported values of Istrian companies, it can be concluded that there is a significant risk of the inability to settle short-term liabilities. The trend of indebtedness of Istrian companies was shown earlier, with a trend of increasing long-term liabilities. Therefore, the high value of the debt ratio is not surprising. Namely, in the observed period, the debt ratio is 0.63 on average (the highest value was recorded in 2018) and should not exceed 0.5. The above value indicates that entrepreneurs in Istria have acquired a high share of their assets through borrowing and that there is a significant financial risk with possible future borrowing. In line with the trend of high values of the debt-equity ratio, the low value of the self-financing coefficient, the value of which should not be lower than 0.5, is also recorded in the observed period. An average value of self-financing coefficient of 0.37 indicates that <50.0% of assets were financed from own sources. Considering the above two indicators, it is obvious that the financial risk for Istrian companies is higher than average, which will affect the availability and price of capital for new investments and/or working capital in the future. The financial coefficient shows the ratio of debt to equity. The acceptable value of this coefficient ranges from 1 to 2, depending on the extent to which the company uses financial leverage. However, even values that do not exceed the upper limit of 2, but are, for example, 1.7 or 1.8, indicate that there is a risk that the company will not be able to regularly service its loan obligations, especially if the liquidity ratios are below acceptable levels. The average value of the financing ratio of 1.71 for Istrian companies and considering the low values of the liquidity indicators suggest that there is a significant risk of inability to finance loan obligations in the future. An additional analysis of debt indicators (debt factors) showed that the liabilities of Istrian entrepreneurs are much higher than the cash flows and acceptable values of debt factors. Namely, the value of the debt factor in the observed period was 6.29, which is significantly higher than the recommended value of 3.5. This is another indicator that confirms the assessment of the financial risk of Istrian companies. The turnover coefficient of total assets was chosen to evaluate the activity/efficiency of Istrian entrepreneurs. Its average value over the observed period was 0.45, which means that Istrian entrepreneurs create 0.45 monetary units per unit of their asset.

Figure 6: Selected indicators of business performance of Istrian companies in the period 2015-2018



4. FINANCIAL INSTRUMENTS OF THE 2016-2020 PERIOD

The starting point for the analysis within this paper are the results and experiences with the use of financial instruments in the past period 2016-2019. In the republic of Croatia, 10 financial instruments are currently in use within the framework of operational programme competitiveness and cohesion 2014-2020 (OPCC). The financial instruments are implemented through: Croatian bank for reconstruction and development (HBOR), Croatian agency for SMEs, innovations and investments (HAMAG-BICRO) and European investment fund (EIF).

4.1. HBOR is Currently Implementing the Following Four Financial Instruments

1. ESIF loans for growth and development at Priority Axis 3 "Business Competitiveness" of OPCC - larger investment loans with low interest rate and no regular fees charged for approval and use of the loans
2. ESIF loans for energy efficiency in public buildings at Priority Axis 4 "Promoting Energy Efficiency and Renewable Energy" of OPCC. These ESIF loans are used to finance energy efficiency investments in public sector buildings with the aim of achieving energy savings of at least 50% compared to annual heating/cooling energy consumption
3. ESIF loans for public lighting at Priority Axis 4 "Promoting Energy Efficiency and Renewable Energy" from OPCC. ESIF loans for public lighting were formed to support the achievement of energy savings in public lighting systems that will result in a reduction of electricity consumption by at least 50%
4. ESIF loans for energy efficiency for entrepreneurs at Priority Axis 4 "Promotion of Energy Efficiency and Renewable Energy" by OPCC. The objective of this financial instrument is to reduce the consumption of energy by at least 20% by increasing energy efficiency in the manufacturing and service sectors (tourism and trade) so that equal results can be achieved by using less input energy and reducing the share of conventional (fossil) fuels in total consumption energy by introducing renewable energy sources.

4.2. HAMAG-BICRO is Currently Implementing the Following Five Financial Instruments at Priority Axis 3 "Business Competitiveness" OPCC

- ESIF limited portfolio guarantee
- ESIF individual guarantee without interest rate subsidy
- ESIF individual guarantee with interest rate subsidy
- ESIF micro loans and
- ESIF small loans.

The EIF is currently implementing the ESIF venture capital fund-this financial instrument is targeted at the early stages of investments for innovative entrepreneurs in technological sectors with high growth potential, especially in the sectors identified in the smart specialization strategy of the republic of Croatia.

The highest demand from entrepreneurs for financial instruments is recorded for the instruments implemented by HAMAG

BICRO. Figure 7 shows the development of demand for financial instruments intended for entrepreneurs in the period 2016-2020.

According to the data, the highest demand for ESIF loans was in 2017 and 2018. At the end of 2019, the demand for this financial instrument has decreased by 34.5% compared to the previous year. A similar downward trend in demand can be observed in the case of interest-subsidized ESIF guarantees (-36.1% compared to 2018). According to the data, only 69 Istrian entrepreneurs used these financial instruments during the observed period, which represents only 3.9% of the total number of users in Croatia. Compared to the total number of Istrian entrepreneurs (on average 10,135), only 0.7% of them used the mentioned financial instruments. Table 1 shows the number of users of financial instruments in the Istrian County and the value of loans/guarantees. The data show that a total of HRK 13,756,247 was credited to Istrian entrepreneurs, representing an average of HRK 254,745 per entrepreneur. These are loans of relatively low value, which were mainly used for the procurement of equipment for micro and small enterprises. The ESIF financial instrument guarantee with interest rate subsidy was used by 15 Istrian entrepreneurs with a total value of HRK 66,890,313, which corresponds to an average amount of HRK 4,459,354 per enterprise. This financial instrument was used almost exclusively for tourism investments. It can be concluded that the interest of Istrian entrepreneurs in financial instruments, which are otherwise most in demand in Croatia, is extremely low (deviates from the county average by 0.8%).

5. METHODOLOGY AND DATA

As far as we know, there have been no previous surveys in Croatia on the attitudes of entrepreneurs towards investments in energy efficiency and clean energy, so this is the first systematic analysis of this kind. This work is based on the Ex-Ante assessment on EU financial instruments, the methodology of which is based on the instructions of the European Commission for the preparation of the ex-ante assessment of financial instruments for member states from article 37(2) CPR- ex-ante assessment. This study extended the Ex-Ante assessment with a larger sample and an additional analysis related to companies' attitudes towards energy efficiency investments and RES. The target companies were selected according to the established set of criteria: They are small and medium sized, located in Istria County and belong to the manufacturing sector.

The research focuses on SMEs, so companies are selected according to the number of employees, in accordance with the classification on micro (0-9 employees), small (10-49 employees) and Medium-sized enterprises (50-249 employees). We want point out that in the Istria County Micro and Small enterprises make up 99.21 of all enterprises, Medium 0.63%, and Large enterprises 0.16%.

Looking at the size of the enterprise, 292 Micro entrepreneurs, 27 Small entrepreneurs and 1 Medium-sized entrepreneur responded to the survey. Thus, the total share of Micro enterprise in the sample consists 91.25%, Small enterprises 8.44%, and medium-sized enterprises 0.31%.

Figure 7: Demand for financial instruments targeted at entrepreneurs in the period 2016-2020

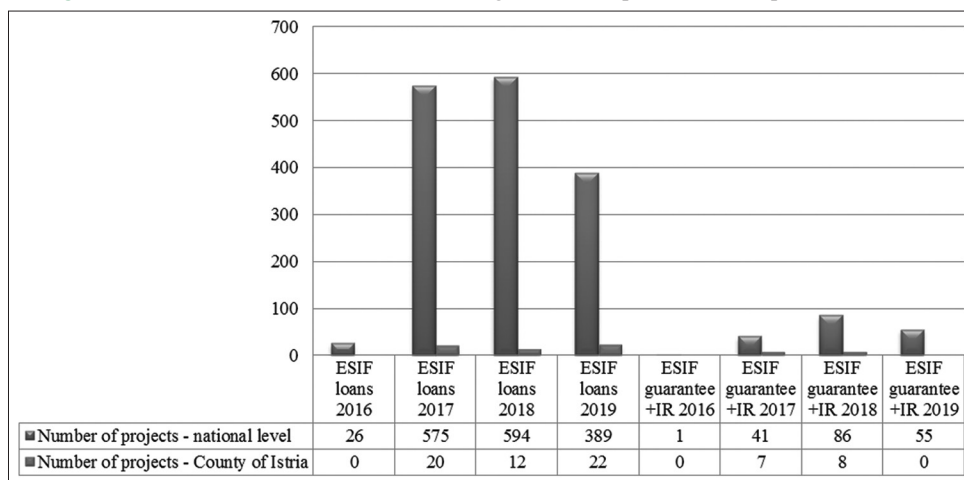


Table 1: Number of users of financial instruments in the Istria County and the value of loans/guarantees in the period 2016-2019

Position	ESIF loans 2016	ESIF loans 2017	ESIF loans 2018	ESIF loans 2019	ESIF guarantee+ Interest rate 2016	ESIF guarantee+ Interest rate 2017	ESIF guarantee+ Interest rate 2018	ESIF guarantee+ Interest rate 2019
Number of project	0	20	12	22	0	7	8	0
Total value	0	5,284,842	3,281,600	5,189,806	0	38,952,074	27,938,239	0

Source: Authors according to HAMAG-BICRO, 2019

Although the response rate is 55.17%, at the same time the number of companies surveyed (580 companies) represents a very representative sample after the surveys were completed by 2.91% of total SMEs of Istria County (320 companies).

Evaluation and ranking of responses carried out according to the ordinal scale. Respondents rated preferences according to the numerical coding offered: Insufficient (1), Sufficient (2), Good (3), Very good (4) and Excellent (5). The minimum value is encoded with a rating insufficient (1) and the highest value is excellent (5). Descriptive statistics were used for the purpose of statistical analysis.

The following table provides a view of descriptive statistics.

A survey was designed to analyse the attitude of Croatian companies towards investment plans in energy efficiency and RES, as well as their opinion on barriers to the use of EU financial instruments. The field research was conducted in the period September 2019-September 2020, which means that the negative impact of the COVID-19 crisis is included. A survey was sent to 580 companies, of which 320 responded. The first part of the survey identifies the company: Number of employees, location, sector, contact person, experience in financing investment projects with EU financial instruments. If they have experience in using EU financial instruments, a second set of questions focuses on problems and obstacles they have faced. The second part is formulated to obtain information about their investment plans. If they plan to invest in development and/or energy efficiency and RES, another set of questions refers to their preferred financing model. The fourth part analyses the

Business problems of Istrian entrepreneurs						
	Lack of working capital	Sales and Payment	Inefficiency of local public administration	Administrative and bureaucratic obstacles	Development of entrepreneurial infrastructure	Price and availability of capital
Mean	2.13	1.66	2.83	3.87	1.53	3.10
Standard Error	0.08	0.04	0.06	0.06	0.04	0.07
Median	2.00	1.00	2.00	4.00	1.00	3.00
Mode	1.00	1.00	2.00	5.00	1.00	2.00
Standard Deviation	1.37	0.76	1.13	1.12	0.65	1.28
Sample Variance	1.87	0.58	1.28	1.25	0.43	1.64
Kurtosis	-0.05	-0.97	-0.62	-1.40	-0.35	-1.12
Skewness	1.11	0.67	0.71	-0.31	0.86	0.20
Range	4.00	2.00	4.00	3.00	2.00	4.00
Minimum	1.00	1.00	1.00	2.00	1.00	1.00
Maximum	5.00	3.00	5.00	5.00	3.00	5.00
Sum	683	530	905	1239	488	991
Count	320	320	320	320	320	320
Percentile						
10%	1	1	2	2	1	2
25%	1	1	2	3	1	2
50%	2	1	2	4	1	3
75%	3	2	4	5	2	4
90%	5	3	5	5	2	5
99%	5	3	5	5	3	5

relationship with local government, public policies and financial incentive schemes.

In order to achieve the highest possible percentage of completed questionnaires, the authors of the survey were personally present in almost every company. The confidentiality of the collected

Preferred EU financing model for growth and development projects			
	Grants	In	Hybrid model (Grants+FIs)
Mean	3.35	1.48	2.17
Standard Error	0.08	0.04	0.07
Median	4.00	1.00	2.00
Mode	5.00	1.00	1.00
Standard Deviation	1.50	0.77	1.21
Sample Variance	2.24	0.59	1.46
Kurtosis	-1.17	-0.21	0.25
Skewness	-0.46	1.22	1.02
Range	4.00	2.00	4.00
Minimum	1.00	1.00	1.00
Maximum	5.00	3.00	5.00
Sum	1072	472	695
Count	320	320	320
Percentile			
10%	1	1	1
25%	2	1	1
50%	4	1	2
75%	5	2	3
90%	5	3	4
99%	5	3	5

Quality of communication of Istrian SMEs with local public administration		
	Communication with local public administration	Info of the possibilities of using EU assistance programs (grants + FI)
Mean	2.83	3.26
Standard Error	0.07	0.06
Median	3.00	3.00
Mode	3.00	3.00
Standard Deviation	1.21	1.03
Sample Variance	1.46	1.07
Kurtosis	-0.74	0.01
Skewness	-0.12	-0.54
Range	4.00	4.00
Minimum	1.00	1.00
Maximum	5.00	5.00
Sum	905	1043
Count	320	320
Percentile		
10%	1	2
25%	2	3
50%	3	3
75%	4	4
90%	4	4
99%	5	5

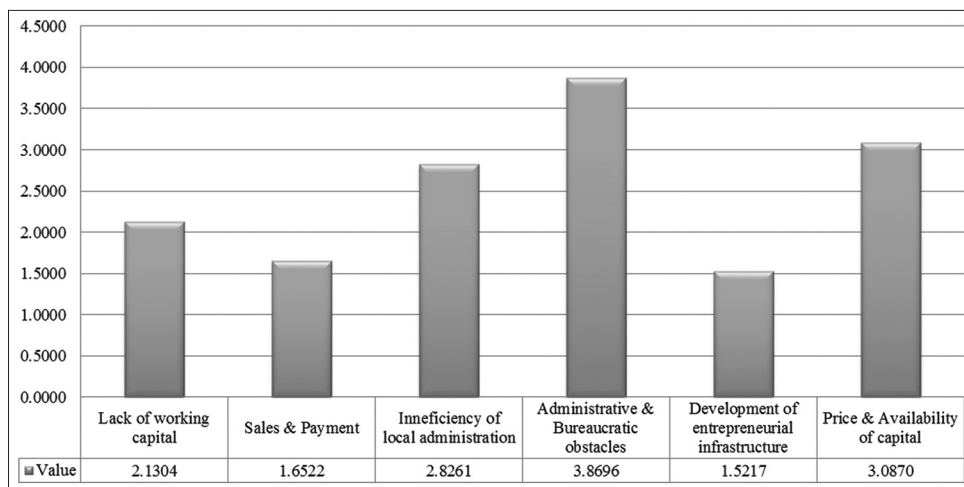
Preferred EU financing model for EE and RE projects			
	Grants	In	Hybrid model (Grants+FIs)
Mean	4.30	2.30	3.39
Standard Error	0.06	0.07	0.07
Median	5.00	2.00	4.00
Mode	5.00	1.00	4.00
Standard Deviation	1.00	1.24	1.17
Sample Variance	1.00	1.53	1.38
Kurtosis	2.80	-1.01	-1.07
Skewness	-1.69	0.39	-0.31
Range	4.00	4.00	4.00
Minimum	1.00	1.00	1.00
Maximum	5.00	5.00	5.00
Sum	1377	737	1086
Count	320	320	320
Percentile			
10%	3	1	2
25%	4	1	2
50%	5	2	4
75%	5	3	4
90%	5	4	5
99%	5	5	5

information was ensured in accordance with GDPR. The second step was to analyse all the data and discuss it with different stakeholders in order to formulate an optimal model of EU financial instruments. The results of the survey will help to understand the problems and obstacles for a more efficient use of EU financial instruments and will be the basis for the proposal of the innovative financial instrument. In addition to the data collected through the survey, the authors also collected financial data from financial agency (FINA) for all analysed companies to assess the leverage effect.

6. SURVEY RESULTS

As mentioned above, the aim of this research is to identify the biggest problems of Croatian SMEs in order to propose the new innovative financial instrument. Therefore, we wanted to test the often assumed hypothesis on the low level of entrepreneurs' trust in public institutions, which could be the main problem from which various barriers are derived. Although scientific research on the level of communication and trust of Croatian entrepreneurs in institutions on national level is currently not available, research on the general public shows a very low level of trust in many institutions. 10.0% of citizens trust the government and public administration, and only 8.0% trust political institutions such as Parliament (EVS, 2019). According to our interviews' results, one of the main reasons for the extremely low level of trust is the lack of communication between the public administration and institutions with entrepreneurs. Our research results on business problems perceived by Istrian entrepreneurs are presented in Figure 8.

Figure 8: Business problems of Istrian entrepreneurs



According to our research results, the biggest concerns of Istrian entrepreneurs are: administrative and bureaucratic obstacles with an average score of 3.87, cost and availability of capital (average score of 3.09), inefficiency of local public administration (2.83) and lack of working capital (2.13). They are least concerned by sales and payment collection and business infrastructure development.

Considering the level of communication of Istrian entrepreneurs with the local public administration, the survey results show that it can be evaluated as good (Figure 9) with average score of 2.8.

Awareness of entrepreneurs about the opportunities from the EU programmes was also evaluated as good with an even higher average score of 3.26. Based on the above survey results, it can be concluded that there is a significant space to improve the quality of communication of local institutions with entrepreneurs. Therefore, it is necessary to improve the quality of communication through new communication channels and conduct training in communication skills and technologies for the employees of local institutions. The next set of questions are related to SMEs' investment plans (Figure 10).

The results of the survey show that most entrepreneurs intend to conduct new investment projects. While 69.6% of them intend to invest or would invest in growth and development, only 4.4% of them plan to invest in energy efficiency and renewable energy sources. As expected, the survey data (Figure 11) show that the largest number of Istrian entrepreneurs would use grants from EU funds as a primary source of financing, which is an additional motivation for the analysis of EU financial instruments and a proposal of the new financial model.

According to the results, Istrian entrepreneurs prefer to use their own funds in comparison with credit and/or financial instruments. The least preferred are financial sources from new partners and/or investors. Since the most entrepreneurs consider EU grants as a most desirable source of funding, additional questions focus the SMEs' preferences on the EU assistance model. Preferred EU financing model for two kinds of investment projects - for growth and development and energy efficiency and renewable energy are compared in Figure 12.

Figure 9: Quality of communication of Istrian SMEs with local public administration

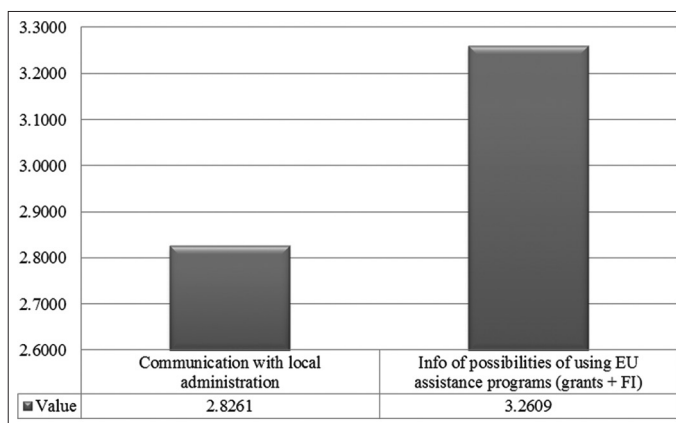
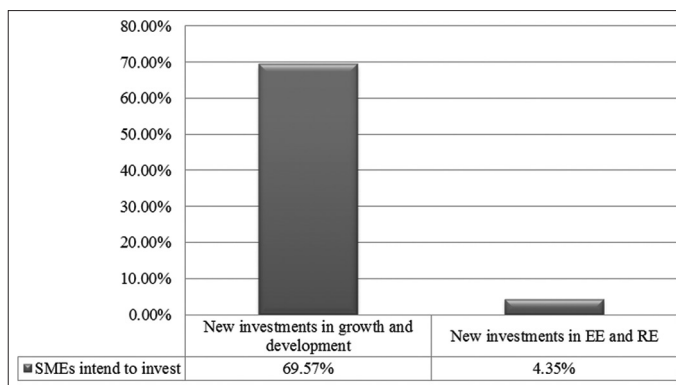


Figure 10: Planned investments of Istrian SMEs in the next programming period



As expected, grants from EU funds were selected as a preferred financing model for both categories of investment projects. Investment projects for EE and RE show lower average scores for all models, which is correlated with low entrepreneur interest in investments in improving EE and RE. Hybrid model of financing with EU grants and a financial instrument is less preferred, while the model with the lowest preferences is the model of financing with a financial instrument.

6.1. New Policy Design

Taking into account the results of the field research and the presented preferences of Istrian SMEs for financing investment projects to improve energy efficiency and renewable energy, it is obvious that there is a need to create an innovative financial instrument. The classic financial instrument, which would be a more affordable and cost-effective loan scheme, cannot achieve significant progress in increasing the number and volume of investments in the improvement of energy efficiency and the use of renewable energy, especially when taking into account the new economic circumstances due to the COVID-19 crisis.

The innovative financial instrument for the improvement of EE and use of RE, proposed in our paper, is a combination of classical financial instrument/loan with a share of at least 70.0% and a grant with a share of up to 30.0%. The source of funding is the pure financial instrument (in this context the loan) in the InvestEU program (after the end of the use of the EFSI), while the sources of grants can be the following: ERDF grants, national contribution I (central government funds) and national contribution II (local and regional authority funds). This would significantly increase the use and absorption capacity of financial instruments, which would have a direct impact on the level of investment in these areas and the achievement of energy and climate targets at national and EU level.

In order to assess the leverage effect of the innovative financial instrument, it is necessary to consider the performance and business characteristics of Istrian entrepreneurs. In the previous chapters, all relevant indicators of their business were explained in detail, so it is worth pointing out that Istrian entrepreneurs are over-indebted and exposed to the high risk of illiquidity. Thus, in the observed period, the debt-equity ratio was on average 0.63,

the self-financing ratio was 0.37, the financing ratio was 1.71, and the value of the leverage factor was 6.29. The above indicators point to a low absorption capacity of financial instruments, as debt financing is absolutely unacceptable when it approaches the level of corporate debt of 100.00%.

By incorporating part of the grant into innovative financial instruments, the effect of partial neutralization of the negative effect of increasing indebtedness on Istrian SMEs (by reducing the level of indebtedness of the net loan) could be achieved. In order to assess the corresponding need and consequently the leverage effect, FINA's business data for Istrian entrepreneurs and the conducted surveys are used.

In 2018, 993 entrepreneurs in Istria County realized investments in the amount of HRK 2.43 billion. According to the survey, in the next program period 69.56% of entrepreneurs plan to realize investments in growth and development. It is about 10.00% of entrepreneurs per year, which correlates with the current trends in the Istria region -9.57% of entrepreneurs invested on average in the period from 2016 to 2018). Only 4.35% of them plan to invest in energy efficiency improvement and renewable energy utilization projects. It is estimated that these projects in EE and RE can account for an average of 20.00% of the value of an average entrepreneurial investment. By applying the percentage of entrepreneurs who intend to invest in EE improvement and RE exploitation, it is possible to make a relevant assessment of the central value of Istrian entrepreneurs' demand for an innovative financial instrument.

Table 2 presents the estimation results of the central value of Istrian SMEs' demand for an innovative financial instrument in the next program period, taking into account the ceteris paribus assumption.

Table 2 presents the estimation results of the central value of Istrian SMEs' demand for an innovative financial instrument in the next program period, taking into account the ceteris paribus assumption. According to the calculations, it is sufficient to allocate approximately HRK 148 million to Istrian SMEs with the aim of implementing EE and RE projects. The net leverage effect of an innovative financial instrument is calculated in accordance with the recommended methodology of the Member States Guide under Article 46 and Article 37 (2) (c). The model of an innovative financial instrument has been elaborated and the calculations of the mean of the expected demand in Istria County in the next program period are presented. Table 3 shows the calculation of the net leverage effect of an innovative financial instrument. The net

Figure 11: Preferred sources of financing for investment projects

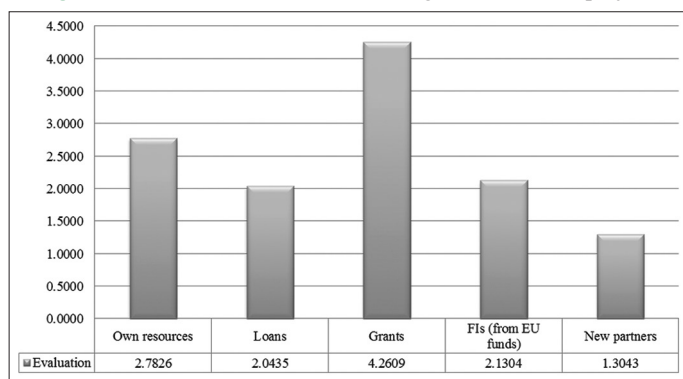
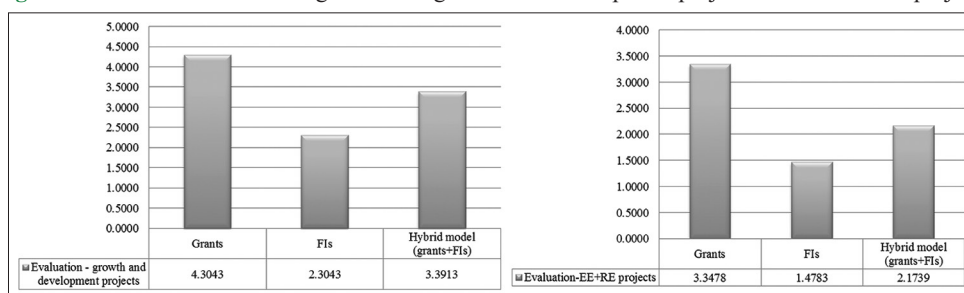


Figure 12: Preferred EU financing model for growth and development projects and EE and RE projects



leverage effect of an innovative financial instrument is 74.15%. We emphasize that this is a strictly conservative estimate of the net leverage effect, so it does not take into account the possible involvement of private funds. Table 4 shows the expected impact of the use of an innovative financial instrument in the Istria County in the program period 2021-2027.

As shown in Table 4, the use of the innovative financial instrument in the next program period in the Istria County would enable 302 investments in the energy efficiency improvement and use of renewables, with a total gross value of HRK 147,997. It is important to note that the share of co-financing from applicants/users of the innovative financial instrument is “de facto” on average 70.0% of the investment value. This allows the reuse of the same funds (after the return) by entrepreneurs in the future, i.e. the key property of the financial instrument - “reproducibility” - is preserved.

The aim of this paper is to propose an innovative financial instrument that could contribute to increasing the absorption capacity of the republic of Croatia from the point of view of the use of EU aid (grants and financial instruments), thus stimulating competitiveness and economic growth. However, in addition to the innovative financial instrument, it is necessary to create and implement a comprehensive set of technical implementation measures, quality information dissemination and decentralization of the operational institutional framework in order to achieve the desired investment effects. The European commission itself has recognized the need to simplify procedures, reduce bureaucratic obstacles and decentralize in order to increase the efficiency of

cohesion policy (EC, 2018). Indeed, a simpler and more efficient approach is needed and will be introduced from 2021:

- Reduction of administrative burden through synergies and alignment of implementation rules across funds, increased use of audits and the possibility to adopt existing management and control systems
- Differentiated implementation through softer management and control systems for programs with a good track record
- Flexibility in the form of a mid-term review to adjust, where necessary, the priorities of recent program years to take account of new priorities, a stocktaking of progress in implementing the investment-related guidelines issued alongside the country-specific recommendations, and performance
- Increased use of financial instruments, including through voluntary participation in the new InvestEU Fund.

A focus on results rather than costs.

This refers in particular to the Invest EU Fund, i.e. the use of financial instruments and their combination with grants. The EC document (EC, 2018) stresses that market-based financial instruments are an effective complement to grants from the EU budget. EU-level intervention works to achieve economies of scale in the use of innovative financial instruments, mobilizes private sector investment across the EU and makes the most effective use of EU institutions and their expertise. The EU intervention opens the door to a diversified portfolio of European projects and provides innovative financial solutions that can be further developed or applied as such in all EU member states. Thus, the

Table 2: Total amount of demand from Istrian SMEs for an innovative financial instrument in the next programming period (in 000 HRK)

Position	2021	2022	2023	2024	2025	2026	2027	Total
Number of entrepreneurs investing (2018)	993	993	993	993	993	993	993	6.951
Total investment value (2018)	2,430,163	2,430,163	2,430,163	2,430,163	2,430,163	2,430,163	2,430,163	17,011,141
The average value of the EE and RE project	486,033	486,033	486,033	486,033	486,033	486,033	486,033	3,402,228
Central demand value	21,142	21,142	21,142	21,142	21,142	21,142	21,142	147,997

Source: Authors

Table 3: Calculation of the net effect of an innovative financial instrument for improving the EE and RE (in 000 HRK)

Position	Contribution ESIF (FI)	Contribution ESIF (grant)	National contribution (grant)	Contribution LRGU (grant)	National contribution of mediator	Total
Innovative financial instrument	72.518	31.079	8.880	4.440	31.079	147.997
MCF			8.288			
Total	72.518	31.079	8.880	4.440	31.079	147.997

Source: Authors

Table 4: Number and amount of investments in the improvement of EE and the use of RE in the Istria County in the period from 2021 to 2027 (according to sources of financing in 000 Kuna)

Position	2021	2022	2023	2024	2025	2026	2027	Total
Number of undertakings/investors in the Istria County	43	43	43	43	43	43	43	302
Total	43	43	43	43	43	43	43	302
Source of funding								
Financial instrument/loan	14.800	14.800	14.800	14.800	14.800	14.800	14.800	103.598
Grant	6.343	6.343	6.343	6.343	6.343	6.343	6.343	44.399
Total	21.142	21.142	21.142	21.142	21.142	21.142	21.142	147.997

Source: Authors

multiplier effect is much greater than the initiative could achieve in a single member state, especially for large investment programs. Intervention at EU level also guarantees flexible support for intermediaries and end-users where necessary, often in urban areas that do not necessarily use ESI funds.

In addition, the Invest EU fund will integrate all centrally managed financial instruments into a single, flexible multi-policy guarantee instrument at EU level, allowing economies of scale and attracting private investors. The Invest EU fund is based on the European Fund for Strategic Investments and will address market failures and sub-optimal investments by providing an EU guarantee. As an instrument for the implementation of EU policies, the InvestEU Fund will promote investment in full synergy with relevant EU policies and programmes, such as connecting Europe facility, horizon Europe, digital Europe programme or single market programme. It will ensure complementarity with investments under European structural and Investment Funds and EU support in the form of grants from relevant spending programs. In addition, the programme will allow for the linking of financial instruments and grants from other programmes, in particular for projects that do not generate sufficient revenue.

7. CONCLUSIONS

The aim of this paper is research of limitations and barriers for industrial SMEs in financing energy efficiency and RES projects in Croatia and to carry out an independent evaluation of the EU financial instruments used by SMEs in the field of energy investments. The paper also aimed to assess the possibility of implementing an innovative financial instrument to provide new incentives for the energy efficiency and RES projects in the 2021-2027 programming period. The empirical research so far is contradictory and the literature review shows an imbalance in geographic scope of the papers within the field. Since empirical results strongly depend on characteristics of the region, as well as various methodologies and data sets, our goal is to contribute to the policy research literature by presenting our results on industrial SMEs in one region in Croatia-Istria County. The most commonly used method used in most empirical studies is based on either questionnaires or semi-structured interviews. Our paper also uses questionnaires and Ex-Ante evaluation on a sample of 320 SMEs. The assessment of the leverage effect of the innovative financial instrument is done and the economic and financial specificities of Istrian SMEs are taken into account, which allows simulating the impact of the new financial instrument for investment projects in the field of energy efficiency and renewable energy.

The results of the conducted research and analysis indicate that the use of the innovative financial instrument and its feasible decentralised implementation would greatly contribute to an increase in the number and value of investments of SMEs in energy efficiency and RES projects. According to our conservative estimates, the new financial instrument could contribute to 302 new investments in energy efficiency and renewable energy in the next programming period in Istria County, with a total investment value of HRK 147,997 million. As our research confirmed, administrative and bureaucratic barriers are perceived as the

biggest obstacle. Therefore, it is necessary to reduce the number of agencies involved in the preparation and implementation of an innovative financial instrument, improve the quality of information dissemination and communication with applicants, simplify the procedures for applying for and implementing projects, and simplify the control and audit processes as well. Such a new policy design with innovative financial instrument would significantly contribute to an increase in the absorption capacity of the republic of Croatia and provide an important impetus for new investments in energy efficiency and renewable energy. This is particularly important in the context of the very ambitious climate targets of European Commission and the urgent need to implement policies that promote decarbonisation.

8. ACKNOWLEDGMENT

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REFERENCES

- Borgeson, M., Zimring, M., Goldman, C. (2014), *The Limits of Financing for Energy Efficiency*. Technical Report, California: Lawrence Berkeley National Laboratory.
- Cagno, E. (2014), Barriers and drivers for energy efficiency: Different perspectives from an exploratory study in the Netherlands, *Energy Procedia*, 61, 1256-1260.
- Catarino, J., Henriques, J., Egreja, F. (2015), Portuguese SME toward energy efficiency improvement, *Energy Efficiency*, 8(5), 995-1013.
- Coles, T., Dinan, C., Warren, N. (2016), Energy practices among small- and medium-sized tourism enterprises: A case of misdirected effort? *Journal of Cleaner Production*, 111 399-408.
- Croatian Statistical Office. (2020), *Statistical Yearbook of Republic of Croatia*. Croatian Statistical Office.
- DeCanio, S.J. (1998), The efficiency paradox: Bureaucratic and organizational barriers to profitable energy-saving investments. *Energy Policy*, 26(5), 441-454.
- EIB. (2020), *Going Green. Who is Investing in Energy Efficiency, and why it Matters*. Kirchberg: European Investment Bank.
- European Commission. (2018), *A Modern Budget for a Union that Protects, Empowers and Defends The Multiannual Financial Framework for 2021-2027*, 2018, Available from: <https://eur-lex.europa.eu/legal-content/hr/TXT/?uri=CELEX:52018DC0321>
- EVS. (2019), *Values in Croatia from 1999 to 2018*. European Values Study. Available from: <https://europeanvaluesstudy.eu/2019/02/values-%E2%80%8B%E2%80%8Bin-croatia-from-1999-to-2018>
- Fawcett, T., Hampton, S. (2020), Why and how energy efficiency policy should address SMEs. *Energy Policy*, 140, 111337.
- Financial Agency. (2019). *Financial Database*. Lausanne: Fédération Internationale de Natation.
- HAMAG-BICRO. (2019) *Database*. HAMAG-BICRO.
- Harmelink, M., Harmsen, R., Nilsson, L. (2008), *From theory Based Policy Evaluation to SMART Policy Design: Lessons Learned from 20 Ex-post Evaluations of Energy Efficiency Instruments*. European Council for an Energy Efficient Economy Summer Study Proceedings.
- Henriques, J., Catarino, J. (2016), Motivating towards energy efficiency in small and medium enterprises, *Journal of Cleaner Production*, 139, 42-50.
- Hill, D.R. (2019), *Energy Efficiency Financing: A Review of Risks*

- and Uncertainties. Montreal, Canada Paper Presented at the 42nd International Association of Exhibitions and Events. International Conference May 29-June 1.
- Hirst, E., Brown, M. (1990), Closing the efficiency gap: Barriers to the efficient use of energy. *Resources, Conservation and Recycling*, 3(4), 267-281.
- Johansson, I., Mardan, N., Cornelis, E., Kimura, O., Thollander, P. (2019), Designing policies and programmes for improved energy efficiency in industrial SMEs. *Energies*, 12(7), 1338-1355.
- Kaza, N., Quercia, R.G., Tian, C.Y. (2014), Home Energy Efficiency and Mortgage Risks. *Cityscape*, 16(1), 279-298.
- Mills, E., Kromer, S., Weiss, G., Mathew, P.A. (2006), From volatility to value: Analysing and managing financial and performance risk in energy savings projects. *Energy Policy*, 34(2), 188-199.
- Samuelson, W., Zeckhauser, R. (1988), Status quo bias in decision making. *Journal of Risk and Uncertainty*, 1, 7-59.
- Shove, E. (1998), Gaps, barriers and conceptual chasms: Theories of technology transfer and energy in buildings. *Energy Policy*, 26(16), 1105-1112.
- Sorrell, S. (2011), Barriers to Industrial Energy Efficiency: A Literature Review. UNIDO Working Paper, No. 10.
- Southernwood, J., Papagiannis, G.K., Guemes, E.L., Sileni, L. (2021), Energy efficiency solutions for small and medium-sized enterprises. *Proceedings*, 65(19), 1-6.
- Stevens, D., Fuerst, F., Adan, H., Brounen, D., Kavarnou, D., Singh, R. (2018), Risks and Uncertainties Associated with Residential Energy Efficiency Investments. Rochester, NY: Social Science Research Network, Scholarly Paper ID 3254854.
- Thema, J., Suerkemper F., Couder J., Mzavanadze, N., Chatterjee, S., Teubler, J., Thomas, S., Üрге-Vorsatz, D., Hansen, M.B., Bouzarovski, S., Rasch, J., Wilke, S. (2019), The multiple benefits of the 2030 EU energy efficiency potential. *Energies*, 12, 2798, 1-19.
- Trianni, A., Cagno, E. (2012), Dealing with barriers to energy efficiency and SMEs: Some empirical evidences. *Energy*, 37(1), 494-504.
- Tuominen, P., Seppänen, T. (2017), Estimating the value of price risk reduction in energy efficiency investments in buildings. *Energies*, 10(10), 1545-1556.
- Vanstraelen, L., Marchand, J.F., Casas, M., Creupelandt, D., Steyaert, E. (2015), Increasing Capacities in Cities for Innovating Financing in Energy Efficiency: A Review of Local Authority Innovative Large Scale Retrofit Financing and Operational Models. Technical Report, CITYnvest Project.