

# FOSTERING ECO-INNOVATION DEVELOPMENT AND IMPLEMENTATION IN POLISH COMPANIES THROUGH OPERATIONAL PROGRAM INNOVATIVE ECONOMY

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**Summary:** The goal of the paper is to answer the question whether the EU financed projects contribute significantly to achieve sustainability goal through implementing eco-innovation. The program under investigation is Operational Program Innovative Economy and its 4<sup>th</sup> priority axis measures aimed at implementing innovation in business sector. The study brings out the knowledge to what extent the investigated projects within 4<sup>th</sup> priority axis develop and implement eco-innovation. The assessment is based on project classification into direct and indirect eco-innovation and non-environmentally oriented innovation.

**Keywords:** eco-innovation, 4<sup>th</sup> priority axis of Operational Program Innovative Economy, financing innovation, business sustainability.

## 1. Introduction

Sustainability is one of the key EU policy issue and is due to be implemented through eco-innovation. Support for eco-innovation based projects is widely covered by certain programs within EU structural funds that are being implemented in member states and their regions that meet intervention criteria. EU financed programs that are implemented in Poland are being evaluated in a systemic way and sustainability is one of the evaluation areas. Nevertheless, the evaluation research is made mostly on very general level, focus rather on whole economy or its sectors and does not address specifically the issue of reaching sustainability through eco-innovation implementation. The assessments focus often on single issues and rarely combine evaluation areas to identify more complex phenomena. There are no studies made exploring the issue of sustainability implementing through eco-innovation within EU financing framework in Poland.

The problem addressed in the paper is the evaluation of the EU financed projects impact on development of eco-innovation in business sector in Poland. The area of evaluation addressed in the paper is the Operational Program Innovative Economy and its actions oriented on R&D and implementation of their results in business sector. The focus is on the assessment of its potential and actual ecological effects and contribution of the Program to overall sustainability. In wider perspective, paper focuses on EU policy on supporting R&D activities and implementation of its results and its realization through co-financed projects.

## 2. Sustainability related goals in Operational Program Innovative Economy

The sustainability is one of the key objectives of Polish policy. The range of documents and number of policy fields included in the sustainability implementation plan is very vast [1]. Some of these are national level initiatives but some are also resulting from EU

policies. In general, EU originated instruments are more developed and fully oriented on sustainability issues. These instruments includes also financial instruments of EU structural policy [2]. Most of them agree on the crucial role of business entities in achieving sustainable development goals. Therefore, the need for instruments designed directly to support companies in their trials of achieving sustainability. This group includes such instruments as management systems, preferential credit or financial aid [3].

The key program to support competitiveness of economy in Poland within structural funds is Operational Program Innovative Economy 2007-2013 (OP IE). Its main objective refers to Lisbon Strategy, Community Strategic Guidelines and some other national level strategic documents and is formulated as: "Development of the Polish economy on the basis of innovative enterprises" [4, s. 58]. This objective is to be achieved through undertaking diversified types of actions and designation of 90% of the financial allocation for measures in the following areas: R&D, innovations, information and communication technologies. OP IE is financed from European Regional Development Fund and Polish budget.

The Program refers to its sustainability objectives by defining desirable characteristics of innovations and the results of their implementation. It says that "innovations in the enterprise sector should contribute to reduction of the pressure on the natural environment, (...) through improved effectiveness of the use of renewable and non-renewable resources, reduction of water and air pollutants and non-recyclable waste, and (...) through improvement of the effectiveness of energy use to reduce emission of "greenhouse gases". Wherever possible, it is expected that innovative changes in presently used systems and devices will lead to reduction of pressure ratios on the environment (ratios for unit of product or service), and new products or services will be implemented in such a way as to comply with the requirements in the area of environmental protection and effective use of resources, especially energy." [4, s. 56]

Main objective of OP IE is to be achieved through number of detailed objectives but none of 6 objectives refers directly to sustainability. The program is divided into 9 priority axes dedicated to different aspects of creation, diffusion and implementation of innovation. Again, none of the priority actions refers directly to sustainability.

### **3. Range and scope of the study**

The study includes on-going evaluation of projects, realized in Poland within the framework of priority axis no. 4: *Investments in innovative undertakings* of Operational Program Innovative Economy, and the structure of their potential and actual results with the focus on implemented eco-innovation within business sector. The 4<sup>th</sup> priority axis actions include financing of R&D partnership projects, R&D results implementation projects and investments.

The 4<sup>th</sup> priority axis of OP IE includes the following measures:

- 4.1 Support for implementation of results of R&D works,
- 4.2 Stimulation of R&D activity of enterprises and support in the scope of industrial design,
- 4.3 Technological credit,
- 4.4 New investments of high innovative potential,
- 4.5 Support for investments of high importance to the economy.

All the measures are directed to the companies. The characteristics of these measures are presented in Tab. 1. The characteristics include such information as the objective of the

measure, types of projects it supports and types of beneficiaries eligible of financial support.

Tab. 1. Selected characteristics of the 4<sup>th</sup> priority axis measures [based on 5]

No. and type of measure	Objective	Types of projects	Types of beneficiaries
4.1 Support for implementation of results of R&D works	improving the level of innovativeness of enterprises by supporting the implementation of R&D works realized within measure 1.4	investments projects with counseling element connected with the implementation of the results of R&D works realized within measure 1.4 or Technological Initiative I	companies
4.2 Stimulation of R&D activity of enterprises and support in the scope of industrial design	strengthening enterprises conducting R&D works	– development of R&D activities in enterprises including transforming companies into Centres of Research and Development – elaborating industrial and functional designs and implementing them into production	companies
4.3 Technological credit	supporting the investment in the scope of implementing new technologies by granting technological credit to SMEs with the possibility for partial repayment from resources of the Technological Credit Fund	projects of SMEs implementing own or acquired new technology and launching sale of products, processes or services created with the application of this technology	SMEs
4.4 New investments of high innovative potential	supporting the enterprises making new investments and projects of consultancy and training courses covering acquisition of innovative technological solutions	investment projects (including necessary training and counseling activities) in the scope of purchase and implementation of new technological solutions in production and services applied worldwide for no longer than three years or having a grade of expansion worldwide not exceeding 15%	companies
4.5 Support for investments of high importance to the economy	improving the competitiveness and the level of innovativeness of economy through supporting production and service enterprises making new, of a large value investments of a high innovative potential generating a large number of jobs (the preference is for investments connected with starting and	in sub-measure 4.5.1 Support for investments in the production sector: – new investments of innovative technologies and products including the purchase or implementation of technological solution which is applied worldwide for no longer than three years or its grade of expansion worldwide in a given branch does not exceed 15%	companies

	development of R&D activities in companies)	In sub-measure 4.5.2 Support for investments in the sector of modern services: – new investments leading to the creation or development of: (a) common services centre and (b) IT centers – new investments referring of the commencement or extension of R&D activity leading to the creation or development of the activity of R&D centers	
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It is important to mention, that measure 4.1 is tied to measure 1.4 Support for goal-oriented Projects from priority axis no. 1: *Research and development of modern technologies*. The mechanism used here joins the efforts of R&D units developing the innovation with companies implementing it. Therefore, the following analysis of the results of implementing measure 4.1 also includes the results of measure 1.4.

All the measures of the 4<sup>th</sup> priority axis are characterized by the 85% maximum share of EU fund participation in financing the projects. The form of financing for all the 4<sup>th</sup> priority axis measures is non-returnable aid. The implementing authorities and institutions responsible for making payments for beneficiaries are the following:

- Polish Agency for Enterprise Development for the measures 4.1, 4.2 and 4.4,
- Bank Gospodarstwa Krajowego (National Properties Bank) for measure 4.3,
- Department of Implementing Operational Programmes in Ministry of Economy for the measure 4.5.

#### 4. Methodology of the assessment

The assessment is based on the classification of projects on three categories: direct eco-innovation (ecologically oriented products, services or processes), eco-innovation supporting projects (with additional ecological effect) and non-ecologically oriented innovation. On the basis of the classification the analysis is made and consists of identification of major dynamics, tendencies, relationships and structure. The primary data on these projects (list of projects with their expected results, types of innovation and budget) is collected from implementing institutions and is analyzed together with the results of surveys made within Polish business sectors on eco-innovation and related topics. The surveys were made by Polish Agency for Enterprise Development in 2011 within wide research framework on sustainability implementation in business sector.

The classification of projects includes the following categories:

- direct eco-innovation projects – this category includes projects that are directly aimed at developing and implementing eco-innovation, such as ecologically improved products, services and processes;
- eco-innovation supporting projects – this category includes projects that are oriented on general innovation but include developing and implementing eco-innovation as a minor or supporting objective of the project;
- non-ecologically oriented innovation – this category includes projects that are not aimed at eco-innovation and does not produce any ecologically positive effects, some eco-innovation or positive ecological effects could result from the project but not intentionally.

It is important to mention that the projects are classified on the basis of declarations made by its implementers (companies). These declarations were sanctioned by the financing agreement signed between them and financing institution.

## 5. Results of the assessment

The following part of the paper is dedicated to the presentation and interpretation of the research results obtained through the analysis of the structure of projects realized with the 4<sup>th</sup> priority axis of OP IE. The structure of the text is divided into parts describing the successive measures of the 4<sup>th</sup> priority. Each part includes analysis of the structure with regard to the presence of eco-innovation, financial characteristics of this structure and some observation and findings related to given measure. Overall findings and conclusions referring to the whole OP IE are presented at the end of the paper.

The data used for assessment comes directly from information system on EU structural funds implementation in Poland [6]. The data is classified accordingly to the methodology presented above.

First of the analyzed measures is measure 4.1 Support for implementation of results of R&D works that is the one with complex approach used. Its complexity comes from joining it with measure 1.4 Support for goal-oriented Projects that makes it financing instrument for two-stage projects with two types of beneficiaries included. The first stage, covered by measure 1.4, is the development of innovation by R&D unit (independent or dependent to the implementing unit) that is needed by some business partner. Second stage is dedicated to the implementation of the innovation by the company. This type of project forces deep cooperation between the partner and constant need of information exchange. Undoubted value of this kind of partnership is providing perfect conditions for synergic effects and long-lasting relationship between the two units.

Fig. 1 presents the share of eco-innovation oriented projects and eco-innovation supporting projects within the whole population of projects within measure 4.1. The first look gives rather pessimistic view of eco-innovation position with overall innovation supply. Only 13% of projects have focused on them directly, while another 8% included them in the range of their effects. On the other hand, such a result represents much higher share of eco-innovation than the ones presented in other studies that amounts to 6-8% [7]. The share observed here is twice higher even without taking into account the second group of eco-innovation.

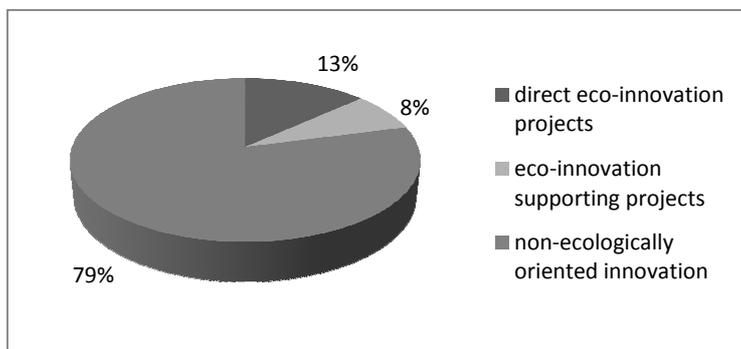


Fig. 1. The share of types of innovation resulting from measure 4.1 projects

The financial structure of measure 1.4 projects with regard to eco-innovation types is presented in Tab. 2. The share of eco-innovation in total budget of the measure is relatively high and amounts to almost 881,8 bln zł with the whole budget of 2 281,6 bln zł. The share is much higher than it should result from number of eco-innovation projects. It is even better visible on the share of eco-innovation oriented projects in total EU funding that amounts to 27%. This high values are confirmed in mean values of total project budget and mean of EU funding per project. These results confirm the importance of environmental issues within project qualification procedures and significance of EU horizontal environmental policy in the project assessment process. On the other hand, these observation shows higher demand for capital for financing eco-innovation in comparison to the non-environmentally oriented innovation.

Tab. 2. Financing characteristics of measure 4.1 projects with regard to types of innovation

Types of innovation	No. of projects	Total value of projects budgets [thous. of zł]	Total value of EU funding [thous. of zł]	Mean value of a project [thous. of zł]	Mean value of EU funding per project [thous. of zł]
direct eco-innovation projects	61	881 792,0	334 094,2	14 455,6	5 477,0
eco-innovation supporting projects	35	378 468,2	157 154,8	10 813,4	4 490,1
non-ecologically oriented innovation	364	2 281 625,8	743 075,2	6 268,2	2 041,4

Measure 4.2 Stimulation of R&D activity of enterprises and support in the scope of industrial design is focused on one type of activities: (1) transformation of companies into R&D units and (2) supporting development and implementation of industrial design. While industrial design is a good platform for sustainability oriented innovation, transformation into R&D unit does not necessarily prescribe types of innovation to be developed in the future. Since the research was made in the moment of establishing R&D units when their activities and directions of research have only been shaped none specific eco-innovation should be expected to come out from this type of projects.

Fig. 2 shows the share of direct and indirect eco-innovation projects within the whole population of projects within measure 4.2. The share of eco-innovation oriented projects, due to the specificity of the measure explained above, is rather small and amount to 5% only with another 3% for indirect eco-innovation.

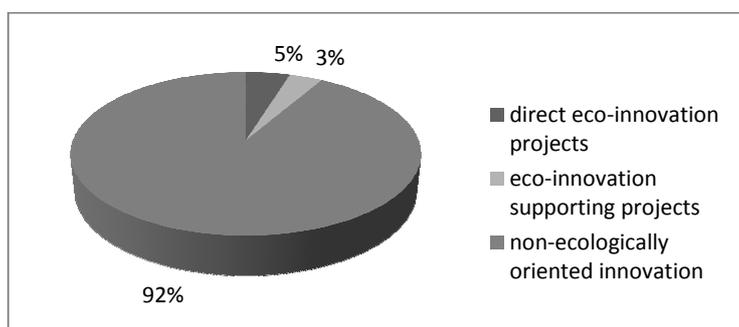


Fig. 2. The share of types of innovation resulting from measure 4.2 projects

The analysis of financial information on measure 4.2, presented in Tab. 3, does not confirm the observations made for measure 4.1 projects. First of all, eco-innovation oriented projects are less expensive than those without environmental orientation. Secondly, the share of the eco-innovation projects in total budget of the measure is smaller than the share resulting from the number of projects. The only common observation is related to the share of EU funds that is higher in the case of eco-innovation oriented projects. The reason for that lies behind the specificity of the measure (presence of eco-innovation in only one type of projects) and the better compliance and integrity of costs in the case of industrial design projects.

It is important to notice that the actual assessment of this measure on eco-innovation development and implementation should be also made *ex-post*, when created R&D unit will come out with their innovation and solutions.

Tab. 3. Financing characteristics of measure 4.2 projects with regard to types of innovation

Types of innovation	No. of projects	Total value of projects budgets [thous. of zł]	Total value of EU funding [thous. of zł]	Mean value of a project [thous. of zł]	Mean value of EU funding per project [thous. of zł]
direct eco-innovation projects	8	62 836,8	27 815,3	7 854,6	3 476,9
eco-innovation supporting projects	6	17 543,3	7 463,7	2 923,9	1 243,9
non-ecologically oriented innovation	154	1 443 151,5	524 453,5	9 371,1	3 405,5

The measure 4.3 Technological credit is the most different one from the other 4<sup>th</sup> priority axis measures. The measure offers access to technological credit on the preferential terms instead of direct financial support. These features effect in the following characteristics of its projects: they are very diversified. Another difference comes from the necessity of engaging financial institution, namely Bank Gospodarstwa Krajowego, in the measure implementation procedure.

Fig. 3 presents the share of eco-innovation oriented projects and eco-innovation supporting projects within the whole population of projects within measure 4.3. The results should be more or less similar to the results of measure 4.1 but the share of eco-innovation oriented projects is little less here. The share amounts to 10% for direct eco-innovation projects and 4% for indirect eco-innovation projects. Especially this second value is evidently smaller than it could be expected on the basis of measure 4.1 observation.

In Tab. 4 the financial structure of eco-innovation projects within measure 4.3 is presented. Again, the observations from measure 4.1 are not confirmed for total budget share of eco-innovation projects (it is smaller here than it should be on the basis of the number of eco-innovation projects). And again, the share of EU funding is relatively high for eco-innovation oriented projects in comparison to overall mean EU funding. The reasoning behind these differences is related to the unwillingness of spending of own capital on non-direct profit promising investments as eco-innovation is regarded in Polish business sector so far.

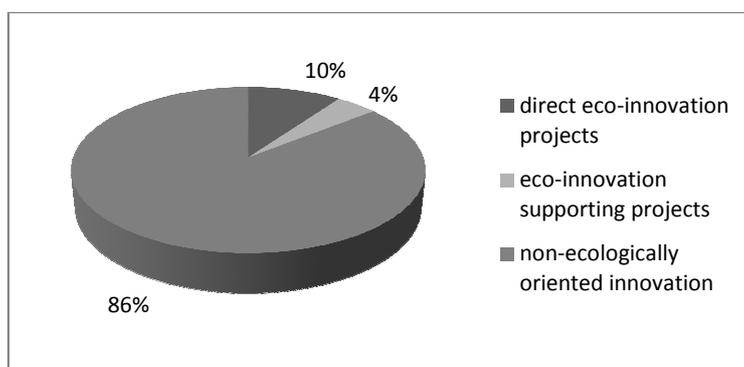


Fig. 3. The share of types of innovation resulting from measure 4.3 projects

The abovementioned finding is justified from another one specific feature of 4.3 measure only. Namely, it is meant for SMEs only. That joins these results with SME sector specificity. And one of SME sector specific characteristics is its rather short-term orientation and profit dominance while innovation engagement motivation is concerned. That would explain swiftly all the observations made for measure 4.3 as far as eco-innovation together with bank-operated crediting procedure are in the area of interests.

Tab. 4. Financing characteristics of measure 4.3 projects with regard to types of innovation

Types of innovation	No. of projects	Total value of projects budgets [thous. of zł]	Total value of EU funding [thous. of zł]	Mean value of a project [thous. of zł]	Mean value of EU funding per project [thous. of zł]
direct eco-innovation projects	9	33 318,7	13 963,2	3 702,1	1 551,5
eco-innovation supporting projects	4	22 273,7	8 864,2	5 568,4	2 216,0
non-ecologically oriented innovation	78	373 346,0	143 860,1	4 786,5	1 844,4

The companies interested in using financial aid of measure 4.4 New investments of high innovative potential need to be up to date with worldwide innovation (the requirement of implementing of innovation no older than 3 years). Additionally, the focus is on the investments that use to be a problem for Polish companies that prefer to accumulate or spent than to invest.

Fig. 4 shows the share of direct and indirect eco-innovation in the whole population of projects within measure 4.4. The share is 10% for projects directly oriented on eco-innovation and 5% for eco-innovation supporting projects. The result for direct eco-innovation is quite high concerning all the other 4<sup>th</sup> priority axis measures (the share is smaller only to the share of measure 4.1 which is 13% and equal to this of measure 4.3).

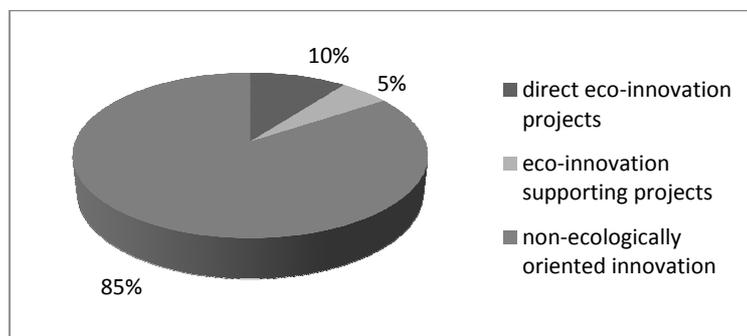


Fig. 4. The share of types of innovation resulting from measure 4.4 projects

Concerning the financial structure measure 4.4 seems to be fully predictable. The financial structure of measure 4.4 results is presented in Tab. 5. Its share in number of projects is reflected in its share in total budget as well as in total amount of costs refunded by EU. These results also confirm that eco-innovation are more expensive and its mean costs are higher than the regular innovation.

Tab. 5. Financing characteristics of measure 4.4 projects with regard to types of innovation

Types of innovation	No. of projects	Total value of projects budgets [thous. of zł]	Total value of EU funding [thous. of zł]	Mean value of a project [thous. of zł]	Mean value of EU funding per project [thous. of zł]
direct eco-innovation projects	37	1 403 169,6	570 469,3	37 923,5	15 418,1
eco-innovation supporting projects	19	638 819,5	237 382,9	33 622,1	12 493,8
non-ecologically oriented innovation	302	10 604 423,6	3 724 730,8	35 114,0	12 333,5

Measure 4.5 Support for investments of high importance to the economy is designed in a way to support number of economic issues, such as investment rate, innovation and employment, in the biggest possible scale. The support is for the projects that could affect economy on local, regional or even national level. 4.5 measure consists of two sub-measures: 4.5.1 Support for investments in the production sector and 4.5.2 Support for investments in the sector of modern services. Therefore, the innovativeness becomes minor criterion for second type of project qualification in comparison to investment and employment criteria. Second type of projects are oriented also on creating R&D services oriented units. Therefore, the potential effect in producing innovation is delayed.

The results presented on Fig. 5 concerning the share of direct and indirect eco-innovation in measure 4.5 projects bring no surprise. There are only a few, namely 4, projects that are oriented on eco-innovation, with another 1 project with eco-innovation as a supporting effect.

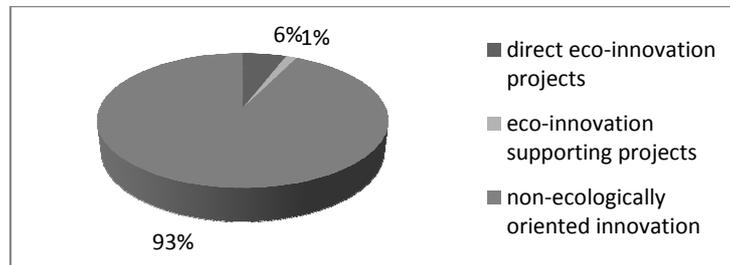


Fig. 5. The share of types of innovation resulting from measure 4.5 projects

As shown in Tab. 6 the financial structure of measure 4.5 reflects its numerical structure. The difference between this measure and all the other 4<sup>th</sup> priority axis measure is the lowest level of EU funding. This is due to the high costs of these types of undertakings and strict limitations of EU share in their financing.

Tab. 6. Financing characteristics of measure 4.5 projects with regard to types of innovation

Types of innovation	No. of projects	Total value of projects budgets [thous. of zł]	Total value of EU funding [thous. of zł]	Mean value of a project [thous. of zł]	Mean value of EU funding per project [thous. of zł]
direct eco-innovation projects	4	458 742,0	99 873,6	114 685,5	24 968,4
eco-innovation supporting projects	1	6 174,4	2 571,1	6 174,4	2 571,1
non-ecologically oriented innovation	64	7 618 344,6	1 424 546,8	119 036,6	22 258,5

## 6. Conclusions

To conclude assessment one more issue will be brought. Formerly presented analysis results did not include the sector diversification of eco-innovating companies. Summing up all the 4<sup>th</sup> priority axis measures the biggest number of projects implementing eco-innovation comes from electricity and heat production sector. It is no surprise, since this sector includes also renewable energy sources that all are classified as eco-innovations. Heat and energy production sector project involves also conventional technologies that are up to some improvement to decrease their environmental impact. Due to high involvement of energy sector also fuel production sector is highly engaged in eco-innovation (5<sup>th</sup> place in the ranking of the most eco-innovative sectors). Most of the fuels and fuel technologies are related to biomass and its potential use and therefore are classified as eco-innovation.

The 2<sup>nd</sup> spot in the ranking of the most eco-innovative sectors is taken by construction sector which should be regarded as a surprise. The types of eco-innovation projects are many and very diversified. Starting from passive buildings, new construction technologies, new materials and coming to new finishing options and devices construction sector is developing very fast in this field. The 3<sup>rd</sup> place is taken by waste management sector that is obviously one of the sectors with highest eco-innovation potential, especially in Poland, where recycling, re-use or reverse logistics are only starting to develop [8].

The overall conclusion is that the sectors with high eco-innovation potential (like heat and energy production or waste management) are using it, but not only because of their good will but also they are forced to do so because of legislation. The other sectors are not developing very fast, maybe except construction sector, their eco-innovation capacity and

do not fully use their chance that 4<sup>th</sup> priority axis offered to them. Maybe, the reason behind that is not only related to companies and their strategies but also to their customers, who are not putting big enough attention to environmental issues. For sure OP IE and its all measures have no chance to change it because it needs time, publicity, possible increase of wealth and consciousness. It also needs some stronger driving force from the national and local authorities that could direct the raising awareness actions.

Overall assessment of implementation of OP IE 4<sup>th</sup> priority axis measures gives a positive view of companies and their projects included in the funding scheme. Many companies use their chance to develop innovation also in the direction of decreasing environmental impacts and improving energy or material efficiency. Perhaps, the scale of eco-innovation could be a bit bigger, especially when environmental criteria are also used in qualification procedure, but the overall share of eco-innovation within the whole population of innovation is satisfactory. Finally, it must be underlined, that some of the projects will produce their effects in a nearest future and the assessment should be repeated in 3-5 years in order to investigate the actual share of eco-innovation in 4<sup>th</sup> priority measures.

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