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INTRODUCTION

In recent years, negative changes in the natural environment have been observed more and more often. These changes have a significant impact on the safety and quality of life of the society, as well as on its economic activity. Some of these changes are caused by nature, but the functioning of households and business units is undoubtedly responsible for a large part of changes occurring in the environment. The society is increasingly aware that through its daily activities and decisions regarding the choice of products it affects the state of the natural environment. However, the product's environmental impact throughout the life cycle is rarely taken into account when making purchasing decisions. The situation is similar for companies which due to numerous legal acts in the field of environmental protection, control their direct impact on the environment, but rarely take into account the impact of manufactured products throughout its life cycle. For this reason, it is necessary to introduce initiatives that will widen the responsibility of producers for the whole life cycle, as well as change the consumer's approach to purchasing decisions.

One of such initiative is an ambitious 'Circular Economy Package' adopted by EU in 2015 (European Commission, 2015). This package includes an EU Action Plan for the circular economy, which establishes a concrete program of actions defining measures that cover the whole product life cycle: from production and consumption to waste management and the secondary raw materials market. The aim of the circular economy is to maintain the value of products, materials and resources for as long as possible by returning it to the product cycle at the end of their use, while minimizing the waste generation. The proposed actions should contribute to 'closing the loop' of product life cycles through fostering more recycling and re-use and it should bring the benefits to both, the environment and the economy.

The transition from the linear loop of material flow ("Take-Make-Dispose") to the circular loop ("Take-Make-Re-use") is not an easy task. This requires continuous monitoring of the effects of actions taken to keep track of the progress made and evaluate the effectiveness of their actions. Therefore, the European Commission in 2018 sets a new indicator framework (European Commission, 2018) to monitor progress towards a circular economy. The developed indicators mainly use data

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which is already collected. These indicators relate only to measuring the effects achieved at the national level, so there is still a need to define such indicators for companies.

In accordance with legal requirements, companies are obliged to collect and report data on environmental protection. One such report is an environmental statement prepared by enterprises that voluntarily participate in the Community Eco-Management and Audit Scheme (EMAS). EMAS is a management instrument developed by the European Commission for companies and other organizations to evaluate, report, and improve their environmental performance. Within the framework of system, each organization shall report annually on its performance relating to the significant direct and indirect environmental aspects and impacts that are related to its core business activities, that are measurable and verifiable, and that are not covered already by the core indicators (EC no 1221/2009). The purpose of this article is to determine to what extent of the information and indicators currently presented in EMAS environmental statement allow the assessment of the circular economy principles application by companies and to indicate which information should be included in EMAS environmental statement in the future.

FRAMEWORK OF MONITORING PROGRESS IN TRANSITION FROM LINEAR TO CIRCULAR ECONOMY

The circular economy concept has become popular in recent years as a potential way to increase the well-being of society, while reducing dependence on natural resources and energy and reducing the amount of waste in the product's life cycle. The aim of the circular economy concept is keeping resources in use for as long as possible, extracting the maximum value from it whilst in use, then recovering and reusing products and materials (Morgan and Mitchell, 2015). This requires implementation of the eight main circular economy processes that can be classified into three categories (Rizos et al., 2017):

- processes allowing to use less primary resources: (1) recycling, (2) efficient use of resources, (3) utilization of renewable energy sources,
- processes allowing to maintain the highest value of materials and products: (4) product life extension and (5) remanufacturing, refurbishment and re-use of products and components,
- processes changing the product utilization patterns and allowing to reduce the amount of products disposed of in landfills after their use: (6) product as service, (7) sharing models and (8) shift in consumption patterns.

The implementation of the above-mentioned processes causes that a circular economy has the following key characteristics (European Environment Agency, 2016):

1. Lower input and use of natural resources as a result of: a). minimizing and optimizing the exploitation of raw materials by providing more value from fewer materials b). maximizing the use of secondary resources c). effective use of all natural resources, d). minimization of total energy and water usage.
2. Increased share of renewable and recyclable resources and energy by: a). reducing the consumption of non-renewable resources and replacing it by renewable resources b). increasing the share of recyclable and recycled materials that can replace the use of virgin materials.
3. Reduced emissions throughout the material cycle.

4. Fewer material losses/residuals thanks to: a). minimizing the waste production and b). limiting to minimum waste incineration and landfill.
5. Keeping the value of products, components and materials in the economy by: a). extension of product lifetime and b). reuse of components.

Implementation of the circular economy models brings benefits both to the economy and the environment. However, it should be remembered, that the transition from linear to circular economy is not an easy task and an effective implementation of circular economy requires the ability to track and measure the effects of the circularity activities implemented by companies (Janik & Ryszko, 2017). For that reason, in 2018 the European Commission set up a monitoring framework on progress towards a circular economy at EU and national level (European Commission, 2018). It consists of 10 indicators, which are divided into four thematic areas. Their list is presented in Table 1. It should be noted, that the developed indicators use mainly data that is already collected.

Table 1
Circular economy monitoring framework

	Indicator	Description
Production and consumption	EU self-sufficiency for raw materials	The share of selection of key materials, including critical raw material, used in the EU that are produced within the EU
	Green public procurement	The share of major public procurements in the EU that include environmental requirements
	Waste generation	Generation of municipal waste per capita, total waste generation per GDP unit and in relation to domestic material consumption
	Food waste	Amount of food waste generated
Waste management	Overall recycling rates	Recycling rate of municipal waste of all waste except major mineral waste
	Recycling rates for a specific waste streams	Recycling rate of for example packaging waste, plastic, WEEE, etc.
Secondary raw materials	Contribution of recycled materials to raw materials demand	Secondary raw materials' share of overall materials demand – for specific materials and for the whole economy
	Trade of recyclable raw materials between the EU Member and the rest of the world	Import and export of selected recyclable raw materials
Competitiveness and innovation	Private investments, jobs and gross value added	Private investments, number of person employed and gross value added in the circular economy sectors
	Patents related to recycling and secondary raw materials	Number of patents related to waste management and recycling

Source: European Commission, 2018.

As mentioned above, these frameworks have been developed to monitor the progress of circular economy implementation at EU and national level. Unfortunately, there is no specific set of indicators on the basis of which companies could assess the level of implementation of the circular economy principles. Over last years, many tools and indicators have been developed to measure circularity of companies (their list can be found e.g. in: Saidani et al., 2019). However, none of them have so far been indicated by the EU to monitor the effects of the transition to the circular economy at company level.

EMAS AS AN INSTRUMENT SUPPORTING ORGANIZATION IN THE TRANSITION TO A CIRCULAR ECONOMY

One of the main EU instruments that support organizations in the transition to a circular economy is EMAS (Eco-Management and Audit Scheme). EMAS is based on legal and institutional requirements. It was introduced in 1993 and changed significantly its requirements twice – in 2001 and 2009. Now the system functions under Regulation (EC) no 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organizations in a Community eco-management and audit scheme (EMAS) (EC no 1221/2009). Beside this, the system is additionally governed in Poland by:

- Act of 15 July 2011 on the National Eco-Management and Audit Scheme (EMAS) System (Journal of Laws of 2011, no 178, item 1060, as amended),
- Regulation of the Minister of the Environment of 23 March 2012 on the factors differentiating the amount of the registration fee for entry into the register of organizations registered in the national eco-management and audit scheme (EMAS) system (Journal of Laws of 2012, no 0, item 341),
- Regulation of the Minister of the Environment of 1 February 2012 on the model application for registration of an organization in the EMAS register (Journal of Laws of 2012, item 166).

The last amendments (in 2017 and January 2019) concerned the content of the annexes to the EMAS regulation and resulted from the necessity to take into account changes in the new ISO 14001:2015 standard and update of EMAS core indicators. In general, EMAS standard is the management system instrument designed for the organizations to ensure their performance, credibility and transparency. EMAS organization are obliged to evaluate, report and improve their environmental performance. It supports application of suitable tools for improving environmental performance and provides publicly available information through the environmental statements which are obligatory (Szafraniec, 2018; Molenda & Ratman-Kłosińska, 2018). Recently, the European Commission has led to the integration of the circular economy concepts with the Best Available Techniques Reference Documents (BREFs). Aspects of proper waste management have become a part of the mentioned documents. In 2017, the Commission reviewed EMAS in the context of the need and the possibility of highlighting the importance of circular economy in this system. As a result, modifications were made to the annexes of the EMAS Regulation so now EMAS stimulates organizations in the transition to a circular economy. The obligatory application of the following five principles make this two tools complementary and propelling one another (EU 2017):

- Assessment of resource efficiency – it is an obligatory tool to measure resource efficiency. EMAS organizations need to report on six core indicators: energy efficiency, material efficiency, water, waste, biodiversity and emissions that are mostly also an issue of circular economy;
- Continuous improvement – EMAS organization are obliged to continuous improvement which fosters eco-innovation. Innovation in the design of product or services are also desirable in circular economy concept;
- Involvement of employees – implementation of the circular economy principles is a very complex and difficult initiative requiring the involvement of many

organizational resources. Employee engagement is a very important factor for the success of any organizational change;

- Step ahead on legislation – EMAS organizations have to be a step ahead on legislation. They have to be in compliance with all regulations and report a continual improvement. Finding the possibilities to increase material efficiency, or decrease waste generation is always possible and can be achieved in many ways. There is always a possibility to improve material or energy efficiency;
- Transparent information – EMAS organizations have to develop and public the environmental statements. In these documents the top management has to report several indicators including resource consumption and waste generation. It gives the authorities an information on the organization's achievements and possibilities of reduction in resource consumption and in waste generation. The specific issues of environmental statements are addressed in more details in the next chapter.

POSSIBILITIES OF REPORTING CIRCULAR ECONOMY PERFORMANCE AND ENGAGEMENT IN EMAS ORGANIZATIONS

One of the requirements of EMAS and the core reporting tool for the EMAS organizations is the environmental statement. It contains the following comprehensive information to the public and other interested parties regarding an organization's (EC no 1221/2009):

- structure and activities;
- environmental policy and environmental management system;
- environmental aspects and impacts;
- environmental program, objectives and targets;
- environmental performance and compliance with applicable legal obligations relating to the environment.

Information contained in the environmental statement is verified by the environmental verifier who checks its reliability, credibility and compliance with the requirements of regulation. The environmental statement should be prepared in accordance with Annex IV and sectoral reference documents, where applicable. In case of substantial changes the environmental statement has to be modified accordingly. It has to be validated at intervals not exceeding 12 months.

An amended Annex IV of the EMAS regulation is in place since January 9th 2019 (EU Commission Regulation EU 2018/2026). It contains an update of EMAS' core indicators. According to this annex the environmental statement shall contain several information which can concern the scope of circular economy. This information comprises (based on EU 2018/2026 and ISO 14004:2016):

- environmental policy, and the structure of environmental management system of the organization – the environmental policy gives information about strategic principles of functioning or intentions and directions that organizations take into account when making decisions about the maintenance or improvements. This can also concern direct or indirect circular economy aspects;
- a register of direct and indirect environmental aspects and description of the approach that is used to determine it – the organization has to build a base of elements of activities or products or services that interact or can interact with the environment. It can also concern the direct circular economy elements (e.g.

- consumption of material) or indirect (e.g. supervision of the suppliers or training of the staff);
- a description of the environmental objectives and targets in relation to the significant environmental aspects and impacts, or actions implemented and planned to improve environmental performance, to achieve the objectives and targets and to ensure compliance with legal requirements related to the environment – EMAS organizations have to set objectives (strategic, tactical or operational) consistent with environmental policy for planning the improvements whose achievement should be verified during audits. This information can concern circular economy elements, (e.g. there can be listed planned actions of minimizing the waste production or consumption of the resources, energy etc.);
 - a summary of the data available on the environmental performance of the organization with respect to its significant environmental aspects. Reporting shall be on both the core environmental performance indicators and the specific environmental performance indicators. Where environmental objectives and targets exist, the respective data shall be reported. The core performance indicators should focus on the following environmental issues: energy, material, water, waste, land use with regard to biodiversity, emission therefore they can or even should concern also circular economy elements;
 - every organization should also report annually on its performance relating to the significant direct and indirect environmental aspects and impacts that are related to its core business activities, measurable and verifiable, and are not covered already by the core indicators – these indicators can also concern circular economy elements. Especially the indirect actions, like: life thinking actions or supporting the environmental performance in other entities which can have circular economy character effects typical for specific EMAS organizations.

RESEARCH RESULTS AND DISCUSSION

The review and assessment of environmental statements in the scope of inclusion of circular economy issues were conducted for all 66 organizations participating in Polish EMAS Register. These organizations have obligation to publish annually the environmental statement. Most of them are from the administration sector and waste management industry. The structure of organizations registered in the Polish EMAS system is shown in Figure 1. It should be noted that an organization can be registered as single organization or as a number of sites i.e. a distinct geographic location under the management control of an organization, so Figure 2 presents structure of sites of EMAS organizations in Poland.

The research process was organized as follow. In the first step of research, each organization's environmental statement was pre-reviewed to determine what circular economy elements it contains. Unfortunately, the Polish EMAS register does not contain up-to-date environmental statements and statements from different years are placed there. Therefore, the most current environmental statement were searched on the websites of the relevant organizations. The initial review has shown that the EMAS environmental statements contain references to the following circular economy characteristics: (1) energy efficiency (2) material efficiency (3) water consumption (4) waste generation (5) life cycle thinking.

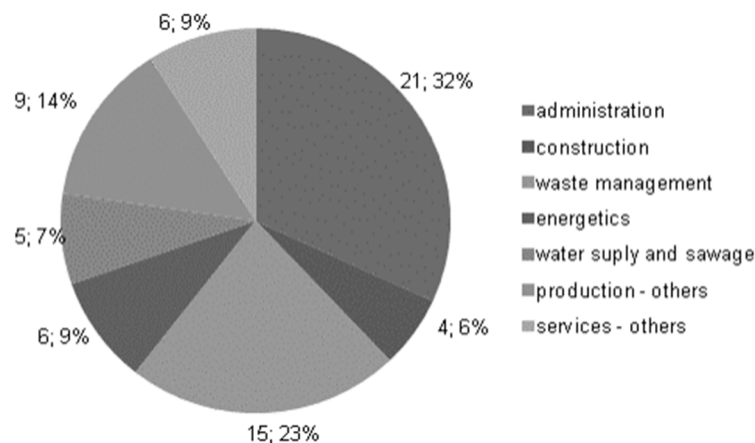


Fig. 1 Structure of EMAS organizations in Poland

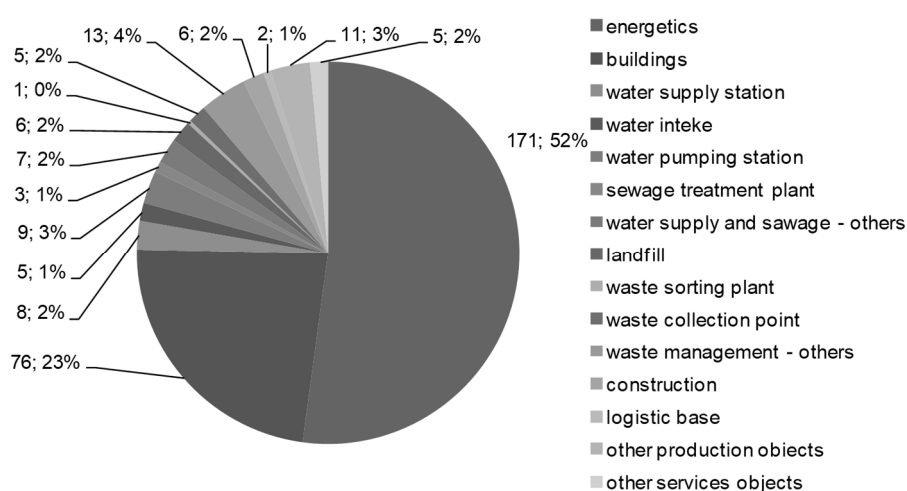


Fig. 2 Structure of sites of EMAS organizations in Poland

It was also decided to distinguish the "supporting stakeholders" as a separate characteristic, due to the fact that almost all organizations in the administration sector defined this issue as an environmental aspect and this aspect may cause various activities in the supported entities, also concerning circular economy.

In the second step of research, a detailed review of the following content included in the environmental statement was made: (1) environmental policy, (2) register of environmental aspects and (3) environmental significant aspects. It was assumed that both: direct and indirect occurrence of circular economy elements in the analyzed documents will be taken into account. For the presentation of the results of the conducted analyzes, the organizations participating in the EMAS system were divided into following sectors:

- Industry and construction (this group contains the organizations with NACE code: C, D, E, F without E38)
- Waste management (NACE code E38 – this group was separated due to the fact that these organizations treat waste as a product)
- Service (NACE code: G, H, J, L)
- Administration (NACE code: O)

The results of the analyzes are presented in Tables 2, 3 and 4 respectively.

Table 2
Main circular economy elements included in environmental policy of EMAS organizations in Poland by sector

CE elements\type	Industry and construction			Waste management			Service			Administration			Total
	dir.	indir.	total	dir.	indir.	total	dir.	indir.	total	dir.	indir.	total	
energy efficiency	12	10	92%	2	10	80%	4	1	100%	4	17	100%	91%
material efficiency	18	5	96%	5	9	93%	3	1	80%	10	11	100%	94%
water consumption	4	5	38%	2	8	67%	1	2	60%	2	18	95%	62%
waste generation	13	8	88%	11	4	100%	4	1	100%	4	17	100%	94%
life cycle thinking	3	0	13%	5	0	33%	1	0	20%	1	0	5%	11%
supporting stakeholder's	0	0	0%	0	0	0%	0	0	0%	18	0	86%	55%

Table 3
Main circular economy elements included in the register of identified environmental aspects of EMAS organizations in Poland by sector

CE elements \ type	Industry and construction			Waste management			Service			Administration			Total
	dir.	indir.	total	dir.	indir.	total	dir.	indir.	total	dir.	indir.	total	
energy efficiency	20	1	88%	8	0	53%	6	0	100%	20	0	95%	83%
material efficiency	19	1	83%	14	0	93%	6	0	100%	21	0	100%	92%
water consumption	9	1	42%	8	0	53%	5	1	100%	20	0	95%	67%
waste generation	22	1	96%	15	0	100%	6	0	100%	21	0	100%	98%
life cycle thinking	8	1	38%	10	0	67%	2	0	33%	0	0	0%	32%
supporting stakeholder's	0	0	0%	0	0	0%	0	0	0%	17	0	81%	26%

Table 4
Main circular economy elements included in the register of identified environmental significant aspects of EMAS organizations in Poland by sector

CE elements	Industry and construction		Waste management		Service		Administration		Total
energy efficiency	13	54%	1	7%	3	50%	1	5%	27%
material efficiency	15	63%	3	20%	2	33%	0	0%	30%
water consumption	5	21%	2	13%	3	50%	0	0%	15%
waste generation	16	67%	10	67%	4	67%	1	5%	47%
life cycle thinking	3	13%	2	13%	1	17%	0	0%	9%
supporting stakeholder's	0	0%	0	0%	0	0%	15	71%	23%

The research results show that circular economy elements are more often included in environmental policy or register of environmental aspects. The circular economy elements are often formulated indirectly, which results from the fact that the environmental policy should be a relatively short document, which implicates the need for general wording. There are big differences in terms of including circular economy issues in the organization depending on the economic sectors. The results show that:

- organizations from the "industry and construction" sector both in the environmental policy and the register of environmental aspects include the commitment to increase the energy and material efficiency. It is also important for them to reduce the waste generation. Only 38% of these companies look at their products in terms of their life cycle;
- for the organizations from the "waste management" sector, the most important is waste and material use minimization. These organizations also pay attention to the water consumption and environmental performance of suppliers and customers which is in accordance with the life cycle thinking;

- organizations from the “service” sector focus often on waste generation and media consumption at an operational level;
- administrative units are very unusual in this analysis. They focus on all the direct environmental aspects (except thinking about the life cycle) in environmental policy. Almost all of these organizations considered supporting stakeholders in their environmental activities as a significant environmental aspect.

In the third step of research, a detailed analysis of the environmental program, objectives and targets that companies planned to achieve in the coming years was carried out. The analysis was conducted taking into account the key characteristic of the circular economy listed in Chapter 2. The results of the analysis are presented in Table 5.

Table 5
Main circular economy elements included in environmental programs, objectives and targets of EMAS organizations in Poland by sector

Key elements of CE	Industry and construction	Waste management	Services	Administration	Total
1. Less input and use of natural resources:					
Minimizing and optimizing the exploitation of raw materials by providing more value from fewer materials	14 (58%)	2 (13%)	2 (33%)	3 (14%)	21 (32%)
Maximizing usage of secondary sources	5 (21%)	-	-	-	5 (8%)
Efficient usage of all-natural resources	1 (4%)	6 (40%)	3 (50%)	2(10%)	12 (18%)
1.4. Minimizing overall energy and water usage	19 (79%)	3 (20%)	4 (67%)	5 (24%)	31 (47%)
2. Increasing the share of renewable and recyclable resources and energy:					
2.1. Reducing the consumption of non-renewable resources and replacing them by renewable resources	7 (29%)	1 (7%)	-	1 (5%)	9 (14%)
2.2. Increasing the share of recyclable and recycled materials that can replace the use of virgin materials	5 (21%)	-	-	1 (5%)	6 (9%)
2.3. Closing of material loops	2 (8%)	15 (100%)	2 (33%)	1 (5%)	20 (30%)
3. Reducing emissions:					
3.1. Reducing emissions throughout the material cycle	3 (13%)	-	-	-	3 (5%)
4. Fewer material losses/residuals					
4.1. Minimizing the waste production	8 (33%)	15 (100%)	6 (100%)	4 (19%)	33 (50%)
4.2. Limitation to minimal incineration and landfilling	4 (17%)	15 (100%)	-	-	19 (29%)
5. Keeping the value of products, components and materials in the economy					
5.1 Extending the product lifetime	-	-	2 (33%)	-	2 (3%)
5.2. Reuse of components	-	-	-	-	-

Based on the data presented in Table 5, it can be concluded that environmental objectives and programs refer to specific circular economy characteristic to a greater or lesser degree. Only 32% of all organizations registered in the EMAS system in

Poland intend to optimize the exploitation of raw materials and only 21% of the organization from the "Industry and construction" sector plan to increase the use of secondary raw materials. The most organizations (47%) plan to improve the efficiency of energy and water consumption. Few organizations plan to increase the share of renewable and recyclable resources, 50% of all organizations plan to reduce material losses and 100% of organization in "Waste management" will aim to close the material loop by using open-loop recycling. The environmental objectives and programs do not take into account extending the life cycle of a product.

In the last step of the research, indicators which companies use to report their environmental effects were reviewed. To achieve this, each indicator used by an organization was assigned to one of the key characteristics of a circular economy. The results of the analyzes are presented in Table 6.

Table 6
Main CE elements included in the list of reported indicators of EMAS organizations in Poland by sector

		Industry and construction		Waste management		Service		Administration		Total
CE elements	energy efficiency	24	100%	11	73%	6	100%	14	67%	83%
	material efficiency	23	96%	9	60%	5	83%	11	52%	73%
	water consumption	11	46%	9	60%	6	100%	8	38%	52%
	waste generation	23	96%	14	93%	6	100%	20	95%	95%
	life cycle thinking	1	4%	3	20%	0	0%	0	0%	6%
	supporting stakeholder's	0	0%	0	0%	0	0%	18	86%	27%

The information presented in Table 6 shows that organizations from the "Industry and construction" section use indicators that assess most of the characteristics of circular economy. There are only missing indicators showing the inclusion of the life cycle thinking. Organizations from the "Waste management" and "Service" sections the most often use indicators regarding waste production, energy and material efficiency and water consumption. Organizations from the "Administration" sector the most often use indicators regarding waste, in particular hazardous waste. A significant part of the used indicators shows the amount of a given environmental impact only in relation to a unit of time (e.g. the amount of energy consumed per year, the amount of waste generated in a given year). This does not allow to determine the effects of the transition to a circular economy, because even if the organization shows a reduction in energy consumption, it cannot be accepted as realization of the circular economy principles due to the fact that this decrease could be a result of a decrease in production volume. However, there are some examples of organizations reporting circular economy indicators in accordance with the new Annex IV of EMAS regulation and these organizations refer their environmental performance in relation to reference value representing the activity of the organization.

CONCLUSION

The analysis of the background issues related to the circular economy concept and the EMAS allowed to determine the synergistic potential of these two key EU environmental frameworks that can be used in transition from the linear to the circular model. This means that the EMAS can be used to accelerate the implementation,

dissemination and evaluation of the circular economy principles at the organizational level. This is important due to the lack of available solutions for framework of monitoring progress to transition to circular economy at micro levels. The article points out the shortcomings of the current practices in EMAS reporting system and proposes changes to unify this system as a circular economy monitoring framework at the company level. The conducted analysis indicated that EMAS organizations currently use various indicators related to the main elements of the circular economy. Sometimes these organizations use incorrect indicators, e.g.: the size of the environmental impact (waste production, energy consumption) without reference to the annual production volume or the indicators have different units which makes it impossible to compare progress in the implementation of circular economy principles of two or more organization. For this reason, there is a need for further research that would allow the development of circular economy monitoring framework at micro level. However, it should be remembered to select such indicators, whose calculations will not necessitate a collection of new data.

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Abstract. The transition from the linear model to the circular economy (CE) model is not an easy task and it requires constant monitoring of the achieved effects. Taking this fact into consideration, in January 2018 the European Union (EU) set 10 indicators to monitor and evaluate the main elements of the circular economy in the EU and its Member States. The list of indicators is short and it is based on the use of current available data. The monitoring results are intended to constitute the basis for setting new priorities towards the long-term goal of the circular economy. In case of companies there is still no framework for monitoring the effects of circular economy at micro level. In practice, various indicators for circularity assessment at micro level are available, but each of the indicators evaluates the complexity of circular economy to different extent. For this reason, there is a need to create a framework for monitoring the circular economy at company level, which would also be based on information already collected by the companies for the preparation of various environmental reports. Therefore, this article presents the results of review 66 environmental statements, which are prepared and updated annually by organizations participating in the Eco-Management and Audit Scheme (EMAS) system in Poland. On this basis, it was determined what circular economy information are already collected and reported by the companies and which information can be included in the framework of circular economy monitoring at company level in the future.

Keywords: EMAS, environmental statement, circular economy