

TOOLS OF ENVIRONMENTAL MANAGEMENT AND EU CIRCULAR ECONOMY

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Among the priority areas of European Union environmental policy is to create a legal, technical and financial conditions to stimulate the effective use of resources and moving towards zero waste. To achieve these objectives, the European Commission is preparing measures in the form of the EU Action Plan for Circular economy. In the circular economy, most products, that would have been disposed in the linear model, are re-used e.g. as a raw material. Thus the value of raw materials is kept within the system for the longest possible time. A certain element of linearity will continue to be preserved in the economy. Enterprises will have to adopt measures to meet the requirements arising from the new legislation. In center interest of managers, researchers, designers and project engineers should be the application of tools of environmental management, such as eco- efficiency of products, ecodesign of products and environmental management systems certification.

KEYWORDS:

environmental management systems, ecodesign, requirements, tools

1 INTRODUCTION

One of the preferred areas of environmental policy of European union in 7th Environmental action programme (7.EAP) is to create legal, technical and financial conditions for stimulation of effective usage of sources and move in a direction of zero waste. Among nine preferred targets of Programme Just in the finish line 2, it is planned to create low-carbon, ecological and competitive economy, effectively using resources. To achieve this target, European Commission (EC) prepared measures in Action plan of EU for circular economy with appropriate name 'Coming full circle', which was presented to European Parliament, European Council, European economic and social committee and to Committee of the regions with the aim of its approval, and of adoption of mandate of EU for the support of the moving to circular economy.

The key reasons for creating of these new ambitious aims of EU are mainly ongoing negative environmental trends, and they are:

- insufficient application of existing legal instructions of Union regarding environment and their uneven effectivity in EU countries
- using of resources is still significantly ineffective and untenable,
- waste is still not dealt with in appropriate way,
- also from this reason companies in EU lose significant opportunities, that offer effective using of resources, from the point of competition, decreasing of costs,

increasing of productivity and securing of material supply.

Among preferred targets of Action plan for circular economy, that should be done until 2020, Committee proposed:

- to keep the value of products, materials and resources in economy processes as long as possible,
- to minimise the creation of waste (only to residual waste, which cannot be used anymore),
- to provide new and maintainable competitive advantages for Europe, including the increase of job opportunities,
- to use Action plan as a tool for achieving targets of UN Programme for sustainable development till year 2030 (mainly target 12 - to provide sustainable models of consumption and production, adopted as a part of UN Conference RIO+20) and Programme G7 for effective use of resources.

2 PRINCIPLES OF CIRCULAR ECONOMY AND KEY MEASURES

In the circular economy, most products, that would have been disposed in the linear model, are re-used e.g. as a raw material. Thus the value of raw materials is kept within the system for the longest possible time. Of course, it is not possible to achieve full recycling of all materials. A certain element of linearity will continue to be preserved in the economy. From the perspective of the EC the circular economy represents a change from the current linear model (*take - make - use - dispose*) to the circular model (Fig.1), [Reichel 2016] in which potential waste is returned to the economic process and closes the cycle in a circle (*closing the loop*).

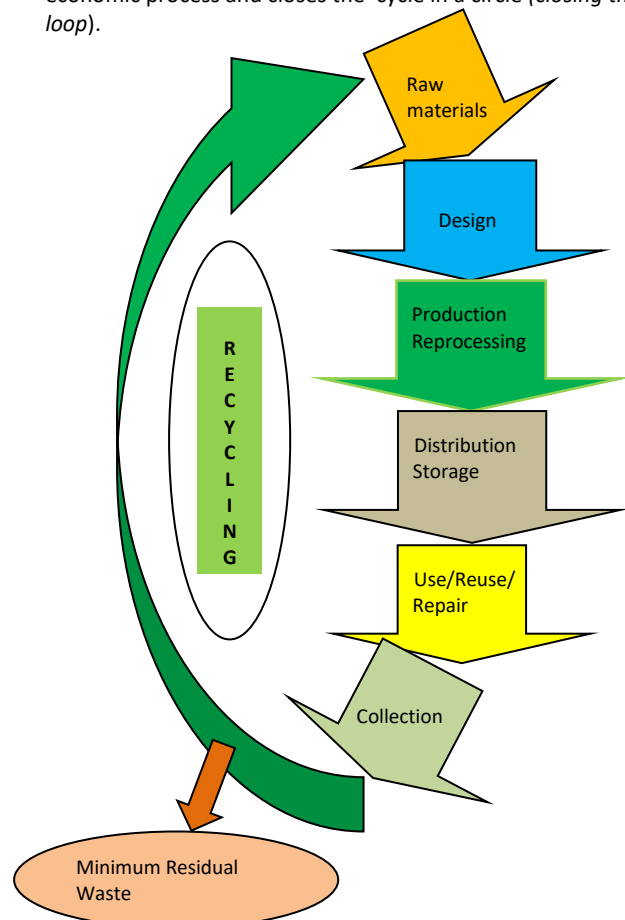


Figure 1. Product life cycle in connection with processes of circular economy

Among the key measures of AP CE for the processes of the product life cycle, there are measures regarding production processes, consumption of products, and processes connected with dealing with waste.

2.1 Key measures for production processes

It is important to insist design and development, and significant will be what rules will be adopted for consequent environmental qualities of produced products. EC will inspect regulation about ecodesign 2009/125/ES, which is valid nowadays, at which:

- mandatory product requirements should extend in terms of durability, possibility to repair and modernize, identification of certain materials or contents of product for consumer's information, for elaborators of recycling processes and re-users of secondary materials from recycling, and
- to design requirements for ecodesign for electronic displays including their safer disassembly, re-use and recycling.

The result of the review of regulation about ecodesign should be extending of mandatory requirements for other environmentally significant products, so not only products using power. Conformity mark CE, and this is a part of these measures, should also describe environmental effectivity of product, together with its safety parameters.

As a part of production phase, it is important to take into consideration the following aspects and to adopt relevant measures:

- To decrease the risks resulting from coming from the threat of inaccessibility of raw materials of processes including in the global level, and to create opportunities for their sustainability.
- Producers should dedicate their attention to environmental and social aspects of their production in EU and in the third countries, so these are requirements for managing environmental and social aspects of processes, products and services of economic activities throughout the whole value chain, practically it means the attitude, based on Life Cycle Assessment (LCA)
- To spread BAT technologies in different industries including recycling of extractive waste.
- To support small and medium sized enterprises when implementing innovative technologies should be having a priority.
- To set up an European centre of excellence for effective usage of resources would ease the development of innovative technologies – for example waste as by-product from one industry could be a raw material in different industry. When considering waste the priority area seems to be plastic waste, food waste, construction and demolition waste, bioproducts, biomass. Expensive metals, rare earth elements and phosphorus are becoming the key raw materials. When using by-products we should adopt measures ensuring the same interpretation of regulations about by-products.
- To improve the effectivity and to use environmental management and audit scheme (EMAS) in companies – as an EU tool for improving of environmental productivity of companies, should bring benefits to companies.
- Using of Environmental management systems – as a market tool for improving of environmental effectivity of companies should bring them benefits.
- Using of EU Programme for verifying of environmental technologies (ETV) - should bring benefits to companies.

2.2 Key measures for processes regarding consumption

Product consumption is an important step in a value chain in connection with achieving required success of results of circulation processes, mainly from consumer's point of view. This can have positive or negative environmental effect on different levels and locations. Functioning of tools that strengthen positive level of consumers and product users, is necessary. These can be ensured by authorities but also by businessmen themselves, who introduce their products on market and who are responsible for them in all stages of their life cycles. There are these tools:

- Reinforcing of protection of consumers by the inspection of misleading advertisement by inspection body.
- Starting the application 'Environmental product footprint' – method within EU will include measuring of environmental features of products and announcing the results of measuring to public.
- Increasing the effectivity of environmental brand of EU – it is a EU tool, which should significantly and effectively influence consumers and their environmental tendencies when choosing a product to buy on the market.
- To streamline the system of energy labelling of appliances and to extend this labelling also about environmental features including durability of product
- To encourage the member states to apply tax incentives and tools for prize creation, reflecting environmental costs in the whole life cycle of the product, so also including costs connected with dealing with product after ending of its durability (LCC).
- Supporting the innovative forms of consumption through common usage of products and services.
- Strengthening of support of green public procurement (GPP) performed by public authorities that contributes 20% of Gross domestic product of EU and implementing of requirements for durability and reparability in GPP criterias.

2.3 Pressure on corporations coming from AP CE measures

New attitude coming from circular economy will affect corporations mainly by forcing them to change thinking from traditional Technologies with traditional inputs to creative processes using new forms of material inputs. Notable pressure on strategic innovations in companies will be caused mainly by:

- new regulatory measures connected with mandatory requirements and provisions about eco- design of chosen products, such as period of use, reparability, repeated re-use of parts of products recyclability and use of created waste and usage of secondary materials,
- requirements for handling of environmental risks connected with decreasing or total elimination of chemical hazardous substances in products and in waste, because they should be a source of re-use as a secondary materials,
- requirements for informing about a wider scale of environmental parameters of products, secondary outputs and waste – so companies will be driven into a value chain as its inseparable part in supplier's and customer's relations as in circulation processes,
- increase of higher openness to customers, processors, consumers and to relevant interested parties, because increased interest in ecological product track is expected.

Because new expectations coming from requirements for securing circular economy will probably affect financial costs, for companies it will be necessary to change the

system from conventional accounting to environmentally focused accounting based on watching of all material flows in all life cycles of produced products. This approach will be inevitable, because regulation authorities will have to solve the situation with not used actually nonutilisable waste by appropriate economic tools. Pressure from authorities, pressure on innovations and market conditions created as a result of processes of material circulation will in time influence prizes of inputs, outputs and environmental services.

Another inevitability, which a company will have to take in a consideration from a point of view of economic sustainability, is strategic direction, including strategic environmental planning and environmental managing of processes, products and services. One of the most effective solutions for companies, managers researchers, and designers is using of appropriate tools of environmental management, as there are Environmental management systems (EMS) and EMAS, evaluating of environmental performance by chosen environmental indicators, environmental effectivity of product, announcing of environmental news, environmental labelling of products, environmental verification of technologies etc., that can help to solve new environmental challenges and requirements [Bodova, 2015].

3 ENVIRONMENTAL MANAGEMENT SYSTEMS AND ENVIRONMENTAL INNOVATIONS

Based on 7. EAP of EU the environmental management systems are one of the key elements of innovative processes in industrial companies. This claim had been researched as hypothesis even before adopting 7.EAP as a part of surveys in german companies registered in EMAS, taking in consideration its effect on technical environmental innovations and economic performance thanks to their different characteristics and mainly to those, that depend of specific implementation on researched workplaces [Rennings 2006, Ziegler 2009].

These differences can be caused by forwardness of particular EMS, strategic targets as a part of implementation of EMAS or by organisation aspects, for example an attendance of different hierarchy levels and organisation schemes in company. In the study authors were based on OECD documents, that differ technical and organisational innovations, while technical innovations are divided in process and product innovations. Currently the process environmental innovations are still used in 'end of pipe' technologies and in integrated technologies as a part of innovative mechanisms: modification – for processes of pollution management and their optimising; re-design – for the processes of cleaner production and improving of their environmental product effectiveness by using of environmental strategies (using of EMS) and targeted monitoring; alternatives – for the processes connected with thinking in terms of life cycles and through the practices of extended environmental and social responsibility, and managing of green supply chain; creativity – from production processes in loop and as a part of processes in industrial ecology to practices of reclassification of production procedures and integration of production systems with the aim to minimize or eliminate the using of non-renewable resources, environmental partnership in research and development of participating partners and building of industrial eco-parks [OECD, 2009].

Finally environmental and organisational innovations include re-organisation of processes and responsibilities within the company with aim to decrease negative environmental influences [OECD, 2009]. System tools of environmental management (EMS, EMAS) are the typical example of these organisational decisions. Environmental organisation innovations contribute to technological opportunities of companies and can create a supportive environment for technical environmental innovations.

Next studies in the field of using tools of environmental management in eco – innovative processes basically confirmed, that EMAS has positive effect on environmental process innovations in most companies [Rehfeld, 2007], and we can emphasize positive influence on environmental innovations of products through researching of existing technological processes, as a requirement of EMS with aim to find an improvement of environmental qualities and technological processes of product. But EMS plays its role of supporting of innovation only at the time, when it is not implemented only formally to impress clients [Wagner, 2008].

EMAS is one of the important tools applicable in the process of development of environmental organisational innovations in any type of organisation [Marazza, 2010]. Profound designing of EMAS scheme is determinative for the set up of environmental attitude but also for economic performance in particular company. The positive influence of implementing EMS on productivity is confirmed in research in japanese companies [Nishitami, 2012], and this increases mostly indirectly because a bad state of environment is considered as a sign of ineffective production process. Results of EMAS research should be relevant also for the worldwide respected standard ISO 14001, because more than 55 % respondents, when researching these evaluated companies registered in EMAS also implemented EMS by ISO 14001, a but only EMS itself should be complex, highly developed and reliable [Darnall, 2008].

3.1 Situation in using of environmental management systems in world and European Union

International Organization for Standardization (ISO) annually monitors the status of EMS certification according to ISO 14004 in all countries of the world. From 2015 onwards monitors ISO also certification operational sites of certified organizations [ISO, 2016].

Through data certification aggregation of individual EU member states, provided the ISO, be able to obtain the level of use of EMS under ISO 14001 within the EU. Whereas the European Commission created a system for registering organizations and also their individual sites, in which member countries regularly update this register [EUROPEAN COMMISSION, 2016], it is possible to compare the use of EMS and EMAS throughout the EU countries.

Certification/ registration	Countries	
	Total world	European Union
Number of certificates EMS by ISO 14004:2004	318 337	107 162
Number of certified sites of organizations by ISO 14001:2004	237 890	115 140
Number of registered organizations by EMAS	There are not registration	3 928

Number of registered sites of organizations by EMAS	There are not registration	8 908
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Table 1. Comparison of EMS certification according to ISO 14001: 2004 and EMAS registrations per year 2015 in the world and in the EU

As seen from Table 1, registration of organizations under EMAS within EU level EMS certifications to ISO 14001, despite the fact that EMAS is one of the most advanced instruments for improving environmental performance, compliance with laws and external communication with the public through environmental statement verified by an accredited environmental verifier. And data in this table show that fulfillment the requirements of EMAS requires greater openness over the competition, what the requirements of the EMS under ISO 14001 in 2004 to the extent not require.

Moreover, the current state of the environment and comparison increasing interest in EMS certification does not make clear opinion on whether the performance of certification meets the intent and purpose of the ISO 14001 standard from 2004 [Bodova 2016].

4 UTILISATION OF EMS BY ISO 14001:2015 IN COMPANIES IN CONNECTION WITH PRINCIPLES OF CIRCULAR ECONOMY

The new ISO 14001 standard from the year 2015 responds to these weaknesses and in the context of the general revision are built into the requirements of two important new approaches:

- management of environmental risks and their control through the opportunities and challenges

- consideration in the perspective of life cycle of the product.

Thus, it means that the organization must manage its environmental aspects to concentrate on all environmental risks and to all of its direct and indirect environmental aspects. This in practice means lifting the ground to the entire value chain all the entities in the business environment and thus in this way it is possible to comprehensively improve the environment on a global level. [Bodova, 2016]. However, it is necessary that in this process, strictly observe the requirements of the international accreditation standards.

The current model of ISO 14001 is approached by his concept of the scheme the EMAS by organisations must communicate with all of its stakeholders, at least in the area of the performance of regulations in the environment. EMS although it does not prescribe the reporting of mandatory environmental indicators as EMAS, which requires including the resource efficiency and waste, however, participation in the processes in the life cycle of the product, the EMS in addition to the EMAS become a tool supporting technical environmental innovation. Tab. 2 and 3 show examples in which way is possible to use the system tools of environmental management in the implementation of measures circular economy in practice [Bodova, 2013].

These examples confirm the conclusions of studies on the importance of appropriate selection of environmental performance indicators within the EMS application [Campos 2015, Comoglio 2012] and their meaning in the application for environmental innovation and entrepreneurship contributions [Zorpas 2010, Amores-Salvado 2015]. Examples also correspond with recommendations for the management of significant environmental aspects and environmental risks in accordance with the instructions of the revised EN ISO 14004 [ISO 2016].

Type of process/ Environmental considerations	Indicator of environmental performance (by EMAS scheme)	Expected economic benefits and benefits in connection with compliance with law and socially responsible entrepreneurship
Exploitation of resources: Decreasing of environmental pressure by limiting of non renewable resources and by limiting of new exploits	Total usage of direct energy (GJ). Total renewable energy use (%). Annual weight flow of used materials (t). Land use (m ²)	Thinking of using renewable and secondary resources. Exploitation effectivity. Compliance with a new legislation. Improving the reputation
Production: - Waste and emissions: What type of emissions and waste and what quantity is produced?	Total annual emission of greenhouse gasses (t). Total annual waste production (t). Land use (m ²). Annual flow of used materials (t).	Decreasing of the costs for regulation and process management. Decreasing of material, transport, storing and landfill. Creating the image. Contribution for keeping competitiveness.
Production: - Material and energy productivity Which material and energy are direct ? (Come from production technical and administration facilities of company ?) Which material and energy are indirect ? (mining, external distribution, the phase of using of product and its disposal). Can a company waste become a secondary material (internally end a externally)? Can we use a waste from area in company? What types and quantity of materials and energy are used in life cycles of product? What decision is possible to do to decrease input of materials, energy, water and other resources in relation	Annual weight flow of used materials (t). Total usage of direct energy (GJ). Total renewable energy use (%). Annual water consumption (m ³). Land use (m ²). Total annual waste production (t). Total annual emission of greenhouse gasses (t).	Saving of material and energy resources. Significant decreasing of the costs. Contribution to maintain competitiveness. Contribution to fulfilling of state adopted target Europe 2020 strategy.

to that technology or to financial possibilities or market requirements? Can we use alternative resources in processes or products?		
Supply chain: What is the company position in global supply chain? What are the aspects of increased added value of product in supply chain? As can be beneficial cooperation with partners in relation to the improvement? Where can we apply practices of sustainability? (For example purchasing, own packing, a way from storing to transporting, from using to recycling of product .) What are the risks and opportunities of implementation of sustainable supply chain?	For example : Total annual emission of greenhouse gasses (t). Total annual waste production (t). Total renewable energy use (%). Annual weight flow of used materials (t). Land use (m²). Indicators of TOP-management environmental performance.	Opportunity for mapping of resources, risks and opportunities as a way of systematic comparing on the market and including setting the improvement indicators Opportunity for organisational changes Opportunities for creating an environment for applying for GPP Improving internal and external communication with users and participating sides. As a final effect increasing of profit and improving of a good name as a supplier.

Table 2. An example of eco - innovation opportunities in companies, focused on processes

Product phase /Environmental considerations	Indicator of environmental behaviour (by EMAS scheme)	Expected economic benefits, opportunities for company
Research and development : Does a company have possibilities, time and skills for relevant research and development? Who has got research and technical experience to understand eco-innovative research and development ? Does the internal staff need education for creating eco-innovative capacity? Does the company have the system for monitoring of eco-	Indicators of environmental performance can be used as improvement targets. All and specific environmental indicators. Indicators of TOP-management performance.	Analysis of market requirements and trends stimulating eco – innovations and underlying search of key managers and designers. Mapping of environmental impacts of life cycle of products. Identification of critical places and opportunities for improving of resource productivity.

innovative trends connected with key business activity? Can the company create strategy research and development by integrating environmental considerations with the aim of improving the eco-profile of product?		Introducing with new technologies, materials and processes connected with requirements of internal and external interested parties. Creation of channels for filtering information about newly created technologies, which could, if implemented, be beneficial for company and environment.
Design: Is there a potential for extending the durability of product including repeated re-use, repair, recycling, or its part? Are parts of product separable? Can we use the decrease, or less types of material or alternative substitutions (for ex. recycled materials or materials possible to recycle) for decreasing of environmental impact? Can an energy or water be reduced in the phase of using of the product or replaced with aim of decreasing of environmental impact? Which data and tools are accessible for LCA and quantification of environmental impacts ? Are these tools accessible? What future product designs or users information will be needed in connection with decreasing of the environmental impact? Are materials and recycling technologies available on market?	All indicators are relevant including specific indicators regarding environmental and health risks Indicators of TOP-management performance.	Improving of environmental profile of products by →reducing of weight →increasing the energy effectiveness → decreasing covers →increasing recyclability →replacement of hazardous materials →increasing the cleanness →decreasing pollution →biodiversity impact →decreasing the impact on the land →increasing the protection of farmland. Adapting to requirements of → market →consumers →tightening the environmental standards. Potential of getting a patent or design. Economic benefits. Contribution to maintain competitiveness.
Marketing: How is the market	For example:	Feedback from

<p>research mapped through users groups significant for environmental awareness, understanding and offer an opportunity for improvement? Who are targeted users groups, retailers and government interests?</p> <p>How to combine interests of these interested parties?</p> <p>How to secure visible participation in competitions? What is the market potential in connection with ability to pay? How can environmental added value influence product prize, user's costs when using it and how can interested parties be evaluated ?</p>	<p>Specific indicators of management performance.</p> <p>Quantity and type of received environmental labels.</p> <p>Quantity and type of certificates and registration in EMAS.</p> <p>Number of GPP contracts.</p> <p>Quantity of different awards.</p> <p>Publishing of environmental studies and information.</p>	<p>market research and communication with interested parties and consumers can identify new opportunities for improving and further innovation promotion based on visible and verified true information and environmental claim about product improves internal and external communication (ecolabel, product carbon footprint, product water footprint).</p> <p>Good identification of feedback of environmental aspects and profile of product can improve reputation of company and widen the lead to competitors positive environmental profile can increase the level of sustainable consumption and production on regional and international level.</p> <p>Better resistance and confidence against the pressure from environmental pressure can enable new, better quality and more qualified communication.</p>
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Table 3. Examples of eco - innovation in companies focused on products

5 CONCLUSION

EU created an action plan for implementation of activities leading to increasing the material process effectivity and services for economy area in Europe. Implementation of environmental targets will require the creation of conditions in EU member states on macro level for integrated coordination of sectoral policies in connection with economic activities. Among the key challenges mainly in industry belong innovative activities of companies leading to active decreasing of waste production by implementing of prevention during individual phases of life cycle of product. Material effectivity will focus on maximizing of the evaluation of waste for the purpose of its usage as input in processes. Regarding 7.EAP the EMS were highlighted as effective market tools for innovative activities of companies. ISO 14001:2015 requirements are compatible with expectations Action plan for circular economy of EU. European authorities should create better legal and supportive environment for using of certification, registration and other tools of conformity, supporting

environmental innovations and increasing credibility and level of environmental attitude of companies.

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