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TRANSFORMATION TOWARDS A CIRCULAR ECONOMY IN THE POLISH ARMED FORCES

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ABSTRACT: This paper is an analysis of the existing economic situation, referred to as the circular economy, of the armed forces during peacetime. This economic approach is often indicated as the target model in civilian areas and activities within the "European Defence Action Plan." The analyses carried out in this study demonstrate that some European armed forces, including the Polish one, actually realise circular economic requirements, namely creation of closed loops of material flow, slowing resources flow and using fewer materials. Some of these economic principles are typical for the military sector, such as "outdated" ammunition in civilian use. The above findings demonstrate the transformation towards a circular economy in the armed forces during peacetime.

KEY WORDS: circular economy; sustainable development; defence sectors

Introduction

During peacetime, economies of the armed forces (AF) of the Republic of Poland, NATO members, and other EU states, are currently not required to definitively base their actions on circular economy guidelines. They are, however, gradually leaving the linear economy model. For this reason, the aim of the paper is to examine the existing state of the circular economy in the armed forces. Furthermore, the necessity of this study and analyses directly stems from the *Strategy for Responsible Development*, adopted by the Polish government in 2016, and the *Priorytetowe Kierunki Badań w Resorcie Obrony Narodowej na lata 2013-2022* project (Priority Research Directions in the Ministry of National Defence for 2013-2022). This study also aims at fulfilling the goals of the European Commission as listed in "The European Defence Action Plan" (EDAP), the objectives of the European Defence Agency (EDA) and the *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Region* (COM(2015) 614 final).

Circular economy

"Circular economy is a concept aimed at rational use of resources and limiting the negative environmental impact of manufactured products, which – just as materials and raw materials – should be used in the economy for as long as possible and the production of waste should be minimised as far as possible" (https://www.gov.pl/web/srodowisko/goz, 31-07-2019). This definition has been uploaded to the website of the (Polish) Ministry of Environment. The essence of the circular economy lies in treating a product at each subsequent stage of its life as secondary raw material and not as a waste product (Kirchherr, Reike, Hekkert, 2017). The above statement is not ground-breaking, as it has been stated and published previously (Janikowski, 1999). Currently, system-based thinking is living through its renaissance (Janikowski, 2017a, 2017b). However, it has appeared before date (as illustrated by, e.g. Polski Ruch Czystszej Produkcji (The Polish Cleaner Production Movement Society), Rozszerzona Odpowiedzialność Producenta (Extended Producer Liability), Społeczna Odpowiedzialność Biznesu (Corporate Social Responsibility). However, the form used to be largely dispersed substance-wise and applied to various fields, also military (Soufani et al., 2018a; Soufani et al., 2018), as retardation, circular flow of treated post-industrial wastewater, remediation, and recultivation, etc. (Janikowski, 2013).

It is crucial to state that the basic concept of a circular economy, also in the armed forces, must be founded on the following rules:

- creating closed loops of material flow,
- slowing down the flow of materials,
- limiting the amount of materials in the flow.

The economy in the armed forces

Abandoning the linear economy model in the armed forces is a slow process. Thus, it is essential to follow the rules and mechanisms that would accelerate it. Concerning the circular economy in the armed forces (CEAF), the first phase of implementing this idea has to focus on closing the loop of material flow. The linear model, "take-make-dispose", is based on large quantities of (economically) cheap and easily accessible raw materials and energy (Degórski, 2018). It stands in contradiction with the general economic rules at the present state of civilisation development. Management of this sector of the economy (armed forces during peacetime) should also follow the trail of other sectors of the Polish national economy. An equally important stimulant of economic changes, especially in military areas, is the deepening cooperation with NATO forces and the emerging global deficit of raw materials, both being of paramount importance for the military. These are, among others, lanthanides, tungsten, lithium and cobalt, so resources essential for high-level IT technologies (e.g., hard drives) and specialist steel used for military purposes (e.g., cannon barrels) or batteries (e.g., propulsion for drones).

In the fourth industrial revolution, securing permanent and continuous access to these mineral resources (both energy and non-energy) (Pavel, Tzimas, 2016) is a fundamental developmental factor for the military, armament and equipment (MAE). This is commonly outlined in planning documentation in the EU and Poland, and in the Ministries of Defence of the USA and Russian Federation. Many mineral resources are concentrated in only one area of the globe (e.g. China) with minimal options of substitution. For this reason, the European Commission is preparing and updating a list of resources (non-energy) which are of high-risk delivery stability and of significant economic importance. The constant and unlimited access to these resources is essential for European industries. In September 2017, the EC published this list and highlighted that 27 out of 78 analysed raw materials are deemed critical; it means they are essential for the harmonious and sustainable economic development and technological progress of all EU countries (COM (2017) 490 final). Abandoning the open, linear economy and wide use of secondary materials is a reaction to limiting the availability of raw materials.

The case of electronic waste may serve as an example of the importance of this approach for the military sector. Electronic waste contains noble metals (gold, silver, platinum), although in trace amounts, and – what is more important and valuable – metals known as *Rare Earth Elements* (REE) (Grasso, 2013) and tungsten. Improved communication, information and military technologies generate greater technological significance for these elements and rapidly increases their demand (Grasso, 2013). China holds a monopoly on obtaining and producing REE. The Chinese authorities noticed this fact and used it as a strategical weapon in geopolitics.

Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030) (SRD) formulates rules, goals and detailed activities of the new state development policy. It is directed at promoting structural changes on Poland's competitiveness factors and ensuring participation in the growth and increasing the quality of life for all Polish citizens. It is explicitly associated with engaging the Polish armed forces in the modern civilisation trend of shaping their development. As with other sectors of the national economy, the military sector during peacetime has to conform with the rules laid out in Article 5 of the Constitution: "The Republic of Poland shall safeguard the independence and integrity of its territory and ensure the freedoms and rights of persons and citizens, the security of the citizens, safeguard the national heritage and shall ensure the protection of the natural environment pursuant to the principles of sustainable development."

The concept of sustainable growth clearly points to a change from a linear to a circular economic model. This is also reflected in the *Polish Raw Material Policy*, especially in its second pillar, based on the activities listed below, namely "obtaining raw materials from waste, raw material substitution along with recultivation and remediation (...).

2.1.2. Identification and classification of raw materials obtained from waste, along with directing their use.

2.2. Development of obtaining raw materials from waste:

2.2.1. Support for preparing and implementing technological solutions that reduce the amount of raw material required and waste products as well as technologies for processing waste;

2.2.2. Defining the category of critical raw materials to support selective waste collection that may provide raw materials;

2.2.3. Other activities related to recovering raw materials from waste, including the development of processing technologies;

2.2.4. Implementing the system of mandatory collection of waste containing valuable raw materials (especially strategic and critical) (in relation to Pillar 3 tasks)" (Polish Raw Material Policy, 2018).

The Subpillar 2.2.4 should be strictly followed by (Polish) armed forces in all military units. In other words, it is analogous to a "green military office", e.g., recycling toners, cartridges, paper, light sources and using a professional shredder (norm DIN 66399), satisfying the *General Data Protection Regulation* provisions. While the documents are shredded, a specific type of waste is accumulated, which is actually beneficial for further processing.

Another item/resource that should abide by the rules of CEAF is the real estates occupied by military training areas/units. After their use and optional degradation (*brownfields)* by the AF, they should not be left to fallow, but rather recycled by proper recultivation and restoring to their natural state (*greenfields*).

Poland shows a tendency to abandon current military properties and grant civilians access to them for further "green" use. The programme entitled *Recultivation for environmental purposes of degraded, post-military and post-military training areas managed by PGL State Forests* (Table 1) may serve as an example. "The primary goal of the endeavour was to eliminate the threat to human health and life in areas managed by State Forests. Therefore, the first activities within the project involved exploration and demining, which required the use of over 60% of the total costs of the project (underlined by author). The remaining amounts were assigned to completing recultivating projects submitted by forest inspectorates" (http://www.ckps.lasy.gov.pl/skala-przedsiewziecia#.XUmYAHvgo2w, 31-07-2019).

The above statements are in line with the theoretical assumptions (Janikowski, 2013), so a system in which three basic categories of land use are outlined:

A – strongly subject to anthropogenic factors,
L – half-natural (forest, agricultural),
N – strongly subject to natural factors,
and the total finite area equals to:

$$S = A + L + N,$$

the following rules have to be followed:

$$\rho, \varpi \rightarrow 1, \tag{1}$$

$$\alpha, \beta \rightarrow 1, \tag{2}$$

$$\delta, \gamma \rightarrow 0, \tag{3}$$

$$\xi = 0, \tag{4}$$

where:
$\rho = x^A/A$, $\varpi = x^L/L$ – size of the recoverable area, used again within A and L categories (land recycling),
$\alpha = x^A/A$, $\beta = x^L/L$ – size of the area obtained from categories A and L, respectively,
$\delta = x^L/L$, $\gamma = x^N/N$ – size of the area obtained from categories L and N, respectively,
$\xi = x^N/N$ – size of the area obtained from category N,
x^k – size of the area obtained from a specific category k = {A, L, N}.

Table 1. Recultivation for environmental purposes of degraded, post-military and post-military training areas managed by PGL State Forests

No.	Forest inspectorate	No.	Forest inspectorate	No.	Forest inspectorate
1	Drygały	20	Jedwabno	39	Czarnobór
2	Choczewo	21	Przasnysz	40	Bydgoszcz
3	Elbląg	22	Spychowo	41	Gniewkowo
4	Kolbudy	23	Strzałowo	42	Solec Kujawski
5	Chrzanów	24	Wipsowo	43	Włocławek
6	Kłobuck	25	Okonek	44	Żołędowo
7	Koszęcin	26	Wałcz	45	Chojnów
8	Rudziniec	27	Łopuchówko	46	Chocianów
9	Siewierz	28	Piaski	47	Jawor
10	Tułowice	29	Stąporków	48	Kamienna Góra
11	Lubaczów	30	Włoszczowa	49	Przemków
12	Mielec	31	Barlinek	50	Świętoszów
13	Tuszyma	32	Chojna	51	Złotoryja
14	Brzeziny	33	Kliniska	52	Gubin
15	Grotniki	34	Międzychód	53	Lubsko
16	Opoczno	35	Międzyzdroje	54	Sulechów
17	Radziwiłłów	36	Resko	55	Świebodzin
18	Skierniewice	37	Skwierzyna	56	Wolsztyn
19	Spała	38	Borne Sulinowo	57	Wymiarki

Source: http://www.ckps.lasy.gov.pl/rekultywacja-poligonow#.XUGfCXvgo2w [31-07-2019].

"Infinite" reusing

Ammunition, just like many other items/products, has a particular expiry date, prior to which it can be used in an effective and efficient manner (Ferreira et al., 2019). After that date, it was usually "destroyed." However, current CEAF regulations have changed the end-use of ammunition, from its original military application to civilian usage (mining, building, demolition, etc.) To do so, proper methods of regaining the explosive materials have to be applied. A similar approach has to be assumed towards military food rations past their expiry date.

Textile waste

Each soldier has a legal right to a proper uniform assortment (Regulation of the Minister of National Defence of 31 October 2014 on uniforms and equipment of active-duty soldiers and candidate soldiers (Journal of Laws of 2014, item 615 – annex no. XXX). In Poland, each year, this generates 100 thousand sets of uniforms. This number fluctuates and is closely tied to the number of active-duty soldiers in Poland (in the next two decades, it may reach 200 thousand soldiers). There are also normative periods of wear, after which the uniform and equipment (according to the law) become the soldier's property. It means that the administration of the AF is not responsible for the fate of this textile waste. It also entails that textile waste around military units becomes spatially dispersed.

From several perspectives, transferring the ownership of uniforms to their current user is inappropriate and should be forbidden. This addresses several perspectives on the flow of waste, particularly:

- Sustainability (sustainable growth) (EC 2016), where in the life cycle of a product the waste stage is also important, {where in the context of a specific (basic) need the product becomes unusable}; however, it is possible to still successfully use it on the next stage (secondary raw material).
- Spatio-environmental, on the quantitative spatial concentration of a homogenous secondary raw material. Satisfying this requirement prevents disorganised and chaotic landfills (concentrated waste) in any location.
- Circular economy, which ensures that the generated waste returns to the economic flow for further use (Pardo, Schweitzer, 2018).
- Resource perspectives, which make sure that the environmental resources will be used in an economic cycle once obtained.

- Homogenous waste flow, which entails that the emerging sub-streams of waste will not be mixed together; on the contrary, homogenous waste flows will be permanently outlined.
- Raw materials, where all waste is a source of secondary raw materials, so conditions should be created to make use of this material.
- National security – in the light of current experience with methods of various terrorist groups, it is not inconceivable to assume that those uniforms might be used to clothe the terrorist formations and their soldiers would be mistakenly treated as soldiers of the Polish AF.
- Costs of obtaining waste/secondary raw materials, where minimising the costs of obtaining secondary raw materials results from concentrating the material and its homogeneity.

Standing in contrast to the transfer of uniform ownership to the soldier, collecting this type of waste at military units concentrates the textile secondary raw material for recirculation. Initially, it may appear as unprofitable for the functioning of each military unit. It generates costs of gathering and storing waste, along with disposal costs as quoted by companies specialising in this area. At the end of 2019, this cost reaches 200 PLN/Mg. Furthermore, appropriate consents from environmental and governmental authorities for waste collection need to be obtained. Bearing in mind the significance of the above argumentation, a simple and only possible solution comes to the fore. Collecting, storing and disposing of textile waste should be taken over by specialised internal military teams.

Conclusions

First signs of the transformation of the AF into a circular economy may be observed. It is confirmed by the number of scientific publications and reports on the applied practical solutions. At the same time, analyses point to the fact that implementing the rules of the circular economy, namely *creating closed loops of material flow, slowing down the flow of materials and lowering the number of materials in the flow* requires their in-depth understanding for the application processes. It is crucial to include the trailing effects co-creating the links in the cause-and-effect chain, include its non-linearity and economic efficiency. Simultaneously, it is paramount to use social sensitivity towards shaping sustainable growth and responsibility for the quality of life of later generations at this current initial stage. Thus, the claim "take-make-dispose" should quickly become obsolete in the military sector during peacetime, just as in other state economy sectors.

References

COM(2015) 614 final, 2015. Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions. Closing the loop – An EU action plan for the Circular Economy.

COM(2017) 490 final, 2017. Komunikat Komisji do Parlamentu Europejskiego, Rady, Europejskiego Komitetu Ekonomiczno-Społecznego i Komitetu Regionów w sprawie wykazu surowców krytycznych dla UE 2017.

Degórski, M., 2018. Gospodarka o obiegu zamkniętym. Circular economy – nowe podejście w rozumieniu relacji człowiek-środowisko. Studia KPZF, t. 183.

European Commission, 2016. Next steps for a sustainable European future – European action for sustainability. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions COM(2016) 739 final, Strasbourg.

Ferreira, C. et al., 2018. Circular Economy Approach to Military Munitions: Valorization of Energetic Material from Ammunition Disposal through Incorporation in Civil Explosives. Sustainability, 11, 255-261, DOI: 10.3390/su11010255.

Grasso, V.B., 2013. Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress, Congressional Research Service, 7-5700.

Janikowski, R., 1999. Zarządzanie ekologiczne. Akademicka Oficyna Wydawnicza PLJ, Warszawa.

Janikowski, R., 2010, The Dimensions of Sustainable Development. Wydawnictwo Wyższej Szkoły Bankowej, Wrocław.

Janikowski, R., 2013. Retardacja jako element konceptualizacji rozwoju zrównoważonego. Inżynieria Ekologiczna, 34, 5-16.

Janikowski, R., 2017a, Środowiskowe aspekty czwartej rewolucji przemysłowej. Studia i Prace WNEIZ US, 47/2 201, 67-76, DOI: 10.18276/SIP.2017.47/2-06.

Janikowski, R., 2017b, Dilemmas of environmental programming in the context of sustainable development. Ekonomia i Środowisko, 1(60), 49-59.

Kirchherr, J., Reike, D., Hekkert, M., 2017. Conceptualizing the circular economy: An analysis of 114 definitions. Conservation and Recycling, 127, 221-232, https://doi.org/10.1016/j.resconrec.2017.09.005.

Pardo, R., Schweitzer, J.P., 2018. A long-term strategy for a European circular economy – setting the course for success. Policy Paper produced for the Think 2030 project, Brussels.

Pavel, C., Tzimas, E., 2016. Raw materials in the European defence industry, European Commission, Joint Research Centre, Directorate for Energy, Transport & Climate, Knowledge for Energy Union Unit, doi:10.2790/0444.

Polityka Surowcowa Państwa, Projekt, 2018. Ministerstwo Środowiska, Warszawa.

Regulation of the Minister of National Defence of 31 October 2014 on uniforms and equipment of active-duty soldiers and candidate soldiers (Journal of Laws of 2014, item 615 – annex no. XXX).

Soufani, K. et al., 2018a. A roadmap to circular economy in EU defence inspired by the case of the Dutch Ministry of Defence. The European Financial Review.

Soufani, K., et al., 2018b. Bridging the circular economy and social enterprise: the Dutch Ministry of Defence and Biga Groep. European Business Review.