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Supporting Environmentally Conscious Consumer Sales Law by Life-cycle Thinking

Katarzyna Klimkiewicz¹ , Anna Dubel² , and Katarzyna Południak-Gierz³ 

ABSTRACT

The circular economy is a core approach driving innovative economic solutions. Although the legal system should support the development of such an economy, scientific methods to assess the environmental impact of legal rules are lacking. Legislators and scholars have highlighted consumer law as an area requiring ecologically efficient solutions. This research aims to design a method to calculate environmental costs related to the exercise of remedies for nonconforming goods under a consumer sales contract.

Various environmental impact assessment approaches are reviewed to identify those which can be used when designing a method for calculating the environmental impact of legislative provisions. The Life Cycle Thinking is applied and the Life Cycle Assessment method is chosen and used to compare different remedy-scenarios, that is, when the consumer chooses repair, replacement, price reduction or termination. A formula is devised to determine which remedies should be prioritized and whether it is possible to design an eco-friendly hierarchy of remedies in consumer sales law. Though it proved impossible to design a rigid hierarchy of remedies, which would be optimal in every scenario from the perspective of environmental costs generated as a result of the consumer exercising the rights for non-conforming goods, the environmental costs of exercising each of the rights under the remedies available to the consumer can be assessed not only *in concreto* but also *in abstracto* allowing for formulation of specific recommendations for legislator.

KEY WORDS:

circular economy, life cycle assessment, consumer sales law, legislation process, remedies for non-conformity.

JEL Classification: D62, K12, Q51, Q56, Q58.

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1. Introduction

Circular economy and sustainable development are the core concepts driving development of innovative markets and economies. Economic activity impacts on society and environment by producing so-called externalities, namely costs or benefits that are imposed on a third party without their consent. A distinction may be drawn between positive and negative externalities: external benefits and external costs, respectively (Folmer & Gabel, 2001). Whereas environmental and so-

cial impacts occur as a result of economic activity across the value chain, in this paper we focus on the environmental impacts during the entire life cycle of the good, starting from the process of material extraction and processing, manufacture, packaging and distribution to a consumer, to the use of the good until its end of life. Following the end of its life, the good can be reused, recycled or delivered to the landfill for treatment or disposal. All of these processes across the value chain impact upon the environment, yet it is their design that determines the scale of such impact (Andalib Ardakani

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& Soltanmohammadi, 2019; Dmuchowski, 2021). For many years, strong institutional pressure (Majid et al., 2020) has encouraged companies to respond to the growing stakeholder expectations in the field of environmental impact disclosure. In this respect, Non-Financial Reporting Directive (2014/95/EU) is one of the most influential examples of coercive pressure in recent years, but we can also observe mimetic pressures through the growing interest in ecolabelling (Wojnarowska et al., 2021). From the regulatory perspective, however, ecolabelling cannot be considered a universal tool to improve environmental quality (Yokessa & Murette, 2019). Despite the efforts for encouraging development of environmental strategies (e.g. innovations in core technologies, product design or revenue models) there remains the need for socio-institutional change: on the one hand, companies and customers need to look at their purchasing decisions through the lens of the environmental effects arising during the entire life cycle (Organisation for Economic Co-operation and Development [OECD], 2017; Potting et al., 2017; Slavikova, 2013) of the product and on the other hand, the law should strive towards achieving goals related to sustainable development.

Consumer law is one of the regulatory areas that is claimed to have a substantial influence over the degree of adverse environmental impact by commerce (Keirsbilck & Rousseau, 2019; Keirsbilck et al., 2020; Micklitz, 2019; Šajn, 2020). Whereas rules may be designed to protect consumers against particular risks, they also have the potential to incite unsustainable consumer behavior. Moreover, these rules might also hinder development of general eco-friendly strategies in B2C relations due to their inflexibility. Where goods are concerned, the most interesting example is the hierarchy of remedies provided under EU law – Art. 13 Sale of Goods Directive (2019/771) – with regard to goods that are not in conformity with the sales contract. In such instances, the consumer is entitled in a first step to have the good brought into conformity by repair or replacement. The consumer is only entitled to the second level remedies of price reduction or to terminate the contract if the seller has not brought the good into conformity within a reasonable time and without significant inconvenience for the consumer, or the lack of conformity is of such

a serious nature as to justify an immediate price reduction or termination (Art. 13[4] Sale of Goods Directive). The question is whether this design of the remedial system corresponds with those principles of sustainability and circularity which aim to lower the use of resources and energy, and the aforementioned negative externalities.

This matter has not been thoroughly investigated during the legislative procedure. EU impact assessments including the assessment of the environmental impact (European Commission, 2021) are carried out for initiatives expected to have significant economic, social or environmental impacts, inter alia legislative proposals¹. Conclusions stemming from such assessments are published in reports with proposals for legislation. However, although in general the need to enhance the circular economy and reduce environmental costs of human activities by appropriately designing legal frameworks has already been recognized, the impact assessment reports made for legislative proposals do not always provide a sufficient overview of the environmental consequences of proposed solutions (European Commission, 2017a; European Commission, 2017b). This is especially true for legislation that does not focus on solving environmental matters. For instance, during the assessment of the environmental consequences of the proposal of Sale of Goods Directive, only general remarks were made concerning the environmental costs:

Fully harmonised rules across the EU will boost online sales of goods. This could in turn increase the use of transport for delivery purposes, leading to an increase in CO₂ and other vehicle emissions. However, more online purchases could also limit the number of buyers actually using their vehicles to make their purchases, and thus counterbalance the increase in CO₂ emissions. (European Commission, 2015)

As an actual assessment of the environmental impact of application of individual norms of the proposed act was lacking, the environmental impact of the legislation is not clear. It is crucial therefore to provide the European legislator with a tool to assess the environmental consequences of introducing legal norms of a particular content. Such an instrument is unavailable at this time and it is still uncertain

whether it is possible to design it at all. This article serves a humbler purpose: to design a method for assessment of the environmental consequences of exercising remedies under EU law for lack of conformity of the goods with the contract, namely repair, replacement, price reduction and termination of the contract.

The need for such an instrument is already readily apparent: though the ecological efficiency of particular remedies for lack of conformity is discussed, the conclusions tend to be based on general assumptions and anecdotal evidence. By establishing a method to compare the environmental impact of the rules on seller's liability for the good's lack of conformity with the contract, it becomes possible to determine solutions that are the most adequate from the perspective of sustainable development and circular economy – they are related to the lowest possible environmental impact or even a zero environmental impact.

This method should not be viewed, however, merely as a specific tool for impact assessment. More importantly, it is a proof of concept that designing a method of calculating environmental externalities of application of private law norms is possible. Both the result of calculation performed as well as the conclusions, which can be derived from the design of the formula (especially the scope and character of the variables included), should be considered during the legislative process.

Despite the rigidity of the hierarchy of remedies under Sale of Goods Directive, its four remedies are assessed as if no hierarchy of remedies existed. The proposed method corresponds with the variables that influence the amount of the environmental costs generated by exercising the aforementioned remedies. Hereafter, this method could be re-adjusted, for instance to serve for shaping other norms governing the seller's liability regime in consumer sales law in such a way that it will minimise the environmental impacts and negative externalities related to natural environment quality and condition. This can contribute to facilitating the development of the environmentally effective sales law at the EU level. The applied Life Cycle Thinking constitutes a holistic approach that strives to consider environmental, social and economic impacts of a product within its entire life cycle, including all supply chain steps. Over the

years, Life Cycle Thinking has evolved, multiplying case study experiences and methodologies (Mazzi, 2020), including the Life Cycle Analysis (LCA). In the design of this assessment tool we conceptualize the analyses of environmental costs that can appear in the product life-cycle. We identify the areas of change in the product life-cycle inflicted by the defined remedies and focus on these areas in our further analysis, for which we review and analyse various environmental impact assessment approaches.

This paper is structured as follows. The first part presents a review of current literature and explains the regulatory context of the research issue. The second part considers and analyses various environmental impact assessment approaches to identify those that can be used to design a method of calculating the environmental impact of the remedies available to the consumer in case of lack of conformity of the goods. In the third part we adopt the perspective of the Life Cycle Thinking and utilize the Life Cycle Assessment method in order to compare the different remedies available under EU law when the goods sold do not conform with the contract (repair, replacement, price reduction, termination) as to identify the risk factors related to environmental impact of exercising each of the remedies. In this part of the analysis, typical factors influencing environmental costs related to exercising each of the remedies are determined and incorporated in the specific ecological efficiency test. The discussion presents the main reasons why a less complex approach would not be sufficient to achieve an optimal outcome from the perspective of environmental aims. Some of the key difficulties of developing an adequate method are illustrated, including those related to the practical use of the method by regulatory authorities. Finally, limitations of the effects of the application of the formula are underlined. In our conclusion we summarize our findings and indicate the direction of further research.

2. Regulatory Context of the Research Question

EU policies already clearly indicate the drive to ensure that the legal framework contributes to sustainable consumption (Chiti, 2022). Typically, norms which aim at introducing ecology-related standards can be found in the public law sphere,

for example, Ecodesign Directive (2009/125/EC) and pursuant regulations; Eco-labelling regulations: (EC) 66/2010, (EU) 2018/848; waste framework, inter alia: directives on end-of-life vehicles, on batteries and accumulators and waste batteries and accumulators, on waste electrical and electronic equipment, on the landfill of waste, on waste, on packaging and packaging waste, on waste electrical and electronic equipment; RoHS Directive (2011/65/EU); Plastic Directive (2019/904). The same trends now appear in private law giving rise to the discussion on which areas of private law should be modernized (Keirsbilck & Rousseau, 2019; Micklitz, 2019). The main point of interest here is consumer sales law, especially the remedies available to the consumer in the event of nonconformity of the purchased good (Terry, 2019).

Consumer sales law has been identified as a highly important area (Zoll, 2021; European Commission, 2020), not least due to the sheer volume of consumer transactions. Here, even an improvement which seems negligible in the individual case can significantly decrease the amount of negative environmental externalities on the mass scale. Furthermore, the ecological consequences concerning previous legislative choices were mainly disregarded when designing this branch of law: the old Consumer Sales Directive (1999/44/EC) centered on ensuring a uniform minimum level of consumer protection in the context of the internal market (Zoll, 2021). In contrast, the new Sale of Goods Directive (Rec. 32) also aims at achieving more sustainable consumption patterns and a circular economy (Zoll et al., 2020).

However, the current wording of Sale of Goods Directive does not fully align with the said objective and a possibility of amending the Sale of Goods Directive is already discussed (European Law Institute 2022; Zoll et al. 2022). Though current SGD responds to the phenomenon of planned obsolescence by requiring goods to have certain durability in order to be in conformity with the contract, the ecological concerns seem to be reflected only in the provisions defining the requirements the good needs to meet in

order to be in conformity with the contract (Zoll et al., 2020). In contrast, the consumer remedies for a non-conforming good appear to be designed merely to balance economic interests of the parties, disregarding the potential environmental impact of exercising these remedies (Zoll, 2021). The main idea is that the contract should remain binding and its content should not be altered (Kryla-Cudna, 2020; Schulze & Zoll, 2021). As a result, if the good is not in conformity with the contract, the consumer is entitled to have the goods brought into conformity by requesting either repair or replacement (Art 13 sec. 2 Sale of Goods Directive). If the remedy chosen is impossible or, compared to the other remedy, imposes disproportionate costs on the seller or the seller did not bring the goods to conformity, the consumer is entitled to a proportionate price reduction or, unless the lack of conformity is only minor, he may terminate the contract (Art. 13 sec 4-5 Sale of Goods Directive).

Such design of the tiers of remedies is not optimal from the perspective of environmental costs. As repair is claimed to be the most ecologically efficient, it should be prioritized over other remedies (Mak & Lujinovic, 2019; Terry, 2019). Replacement could become a similarly sustainable remedy if the non-conforming goods could be replaced by refurbished or remanufactured goods⁴, a solution that is currently not accepted under EU law. Price reduction is also mentioned as an ecologically efficient remedy (Kryla-Cudna, 2020).

The main issue is that these conclusions tend to be based on general assumptions that lack sufficient justification (Michel, 2016; Terry, 2019; Zoll, 2021). It is claimed that repair can contribute to achieving a more circular economy without, however, comparing environmental costs associated with repair to environmental costs generated by other remedies. Instead some positive aspects of repair are listed (Terry, 2019). Kryla-Cudna (2020) also underlines that:

[repair] as a remedy for non-conformity of goods with the contract, can serve [to prolong the lifespan of goods in order to reduce waste] as it preserves the energy and materials used to manufacture the goods and enables the buyer to use the goods for a longer period rather than seeking new goods instead. (p. 1210)

However, legal scholars do not intend to verify these assumptions. Commonly, the justification behind pointing to repair or price reduction as the most ecologically efficient is that these two generate the least waste. These conclusions tend to be challenged by anecdotal evidence (Zoll, 2021; Zoll et al., 2020). Yet, provided that such assumptions could be the basis for re-designing a hierarchy of remedies applicable in case of non-conforming goods, they need to be based on solid data rather than premonitions or common intuitions.

Elaborating a method to enable the actual assessment of the environmental costs generated by each of the remedies requires a bridge between the research from different disciplines (Micklitz, 2019), namely law, environmental economics, and management. This determines the manner of conducting the research: once the research issue, stemming from the legal context, has been identified, the analysis moves towards designing an assessment method with the use of tools and interferences familiar to economics and environmental analysis.

3. Review of Environmental Impact Assessment Approaches Potentially Suitable for the Purpose of the Analysis

Assessment of environmental impacts is not an easy task due to the complex matter of the analysed issue, the stochastic dynamics of change embedded in the ecosystems and systemic feedbacks observed between the elements of the natural and manmade environments. Also, the analysis is complex and messy due to the variety of impact categories that need to be taken into account, including impacts on: water, air, soil and land use change, radiation, life on earth and biodiversity, noise and light pollution. There are a number of methods, methodologies, models, indicators for the identification, assessment and valuation of environmental impacts. Table 1 presents the above indicating their outcomes, several case studies of their use and a comparative analysis of selected features of these methods in relation to their usefulness for determining the environmental costs related to the exercise of remedies for nonconforming goods under a consumer sales contract.

The methods of environmental assessment concentrate on a single assessment of one causally related impact studying the dynamics of change between the cause and result or on an integrated assessment developing complex models depicting disordered problems. Solutions are characterized by two main parameters, namely: the effect they bring and the costs they cause. They are designed to fit a certain purpose (goal) which constitutes the main desired effect. However, due to the complex and disordered structure of the world and the systemic nature of the feedback loops the fit-for-purpose designed solutions bring various positive and/or negative effects. The latter are perceived as co-benefits and additional costs. If the solution (remedy) is environmentally effective it means it achieves its goal (e.g., zero environmental impacts). If the solution is environmentally efficient (eco-efficient) it means it achieves said goal at the minimum cost. Cost-Effectiveness Analysis compares the effects in natural units to the costs needed to achieve them. Cost-Benefit Analysis compares all the positive effects (benefits) related to the solution to all the costs of this solution in monetary terms to come up with a single measure (BCR: Benefit-Cost Ratio). It can also account for the dynamic changes in the value of money in time when the FNPV (Financial Net Present Value) and ENPV (Economic Net Present Value) are calculated. Financial analysis is concentrating on revenues flows compared to the investment costs (CAPEX) and operational costs (OPEX) and it does not take into account externalities, environmental impacts and other socio-economic aspects related to the society as a whole and the development of economy. So, it assesses the profitability of the solution. Economic analysis allows for considering all the aforementioned aspects, being the profitability together with externalities, environmental and socio-economic impacts. In this paper we focus on environmental impacts and we assess the remedies only from the point of view of minimizing the negative impacts on the environment.

The analysis lead to the conclusion that LCA is the most robust and adequate method to frame our further analysis, because it is taking into the holistic way all the supply chain activities, from raw material extraction to production and use, to the final management of waste.

Table 1

Comparative Analysis of Selected Features of the Methods Related to their Usefulness for Determining the Environmental Costs Related to the Exercise of Remedies for Non-conforming Goods Under a Consumer Sales Contract.

Methods	Outcomes	Examples	Selected features of the methods related to their usefulness for determining the environmental costs related to the exercise of remedies for non-conforming goods under a consumer sales contract			
			imbedded circular economy approach	comprehensive holistic approach vs casual approach	capturing cause and effect relationships	usefulness of a method for assessment of policies
Integrated Assessment Models (IAMs)	indicators defined according to the scope of the analysis	(Braunreiter et al., 2021; Duan & Wang, 2018; Pastor et al., 2020; Siebenhüner & Barth, 2005; Vasylykivska et al., 2021)	yes	holistic	yes	yes
Integrated Environmental Assessment Methods (IEAMs)	indicators defined according to the scope of the analysis	(Jeong et al., 2019; Nita et al., 2022; Ortiz & Climent-Gil, 2020; Rodriguez-Luna et al., 2021; Svensson et al., 2022)	yes	holistic	yes	yes
Environmental Assessment (ELA)	indicators defined according to the scope of the analysis, natural measures, e.g. CO ₂ emissions [Mg]	(Hu et al., 2021; Ogino et al., 2021)	yes	casual	yes	yes
General Equilibrium (CGE) Models	Common economic measure, such as GDP.	(Farajzadeh & Bakhshoodeh, 2015; Lee, 2020; Pradhan & Ghosh, 2019; Van Truong & Shimizu, 2017)	yes	holistic	yes	yes
Drivers-Pressures-Stare-Impact-Response Analysis (DPSIR)	Indicators for each of the D-P-S-I-R, e.g., CO ₂ emissions	(Ladi et al., 2022; Malmir et al., 2021; Moss et al., 2021; Zhao et al., 2021)	no	holistic	yes	yes
Cost-effectiveness analysis (CEA)	Costs in monetary values for the determined effect in natural values	(Akerboom et al., 2020; Blanco-Gutiérrez et al., 2011; Eslami & Nahani, 2021; Uwasu et al., 2013)	no	casual	no	yes
Cost-benefit analysis (economic efficiency with assessment of environmental and social impacts, CBA)	Costs and benefits presented in monetary values, indicators such as: NPV, IRR, ENPV	(Ayeleru et al., 2021; Lavee & Parsha, 2021; Sendzimir et al., 2013)	no	casual	no	yes
Ecological footprint analysis (footprint analysis, EFA)	Indicator approximating the impact of the analysed stressor	(Chen et al., 2021; Gao et al., 2021; Y. Yang et al., 2022)	yes	holistic	yes	yes
Environmental valuation methods: direct and indirect (cost, demand, WTP)	Value of the assessed non-market good, or an externality cost, based on peoples' perceptions or correlations with demand for market goods	(Braig & Edinger-Schons, 2020; Dubel, 2017; Hervani et al., 2022; Perni et al., 2021)	no	casual	no	no
Product Life-Cycle Analysis (LCA)	material and energy flows	(Kulczycka et al., 2008; Sala et al., 2021; Schaubroeck et al., 2020; Seidel, 2016)	yes	casual holistic	or yes	yes

The complexity of the method combined with the diversity of the goods, which are sold on the EU consumer market, may make it challenging to draw any general recommendations from the analysis of environmental costs of exercising remedies for nonconformity of the good under consumer sales law. The potential plethora of heterogeneous scenarios may discourage further analysis. Nevertheless, legally relevant conclusions can be drawn not solely from the final results of the application of the LCA method. Already the manner in which the formula for calculating the environmental costs of exercising a particular remedy (repair or replacement of good, price reduction, contract termination) is shaped may allow for formulating concrete regulatory recommendations. In this way, the postulate of applying Life Cycle Thinking for greening of consumer sales law can be implemented under the current law making process².

This conclusion can be supported by the fact that the Life Cycle Assessment is also suited for evaluation, management and monitoring of infrastructural projects (Kulczycka et al., 2008; Sala et al., 2021). LCA enables a holistic coverage of environmental dimensions and for the identification of hotspots, possible trade-offs, and burden shifting among life cycle stages or impact categories. In relation to IAMs, which the performed analysis also finds suitable, it is mentioned that the circular economy could be investigated with this kind of models, but it is largely unexplored within the IAMs examples (Braunreiter et al., 2021). More often it is utilized within the Environmental Impact Assessment (Hu et al., 2021) and the Integrated Environmental Impact Assessment studies dedicated to a specific environmental domain, such as study from Svensson et al. (2022), focused on assessment of management options for dredged sediment, where LCA of the climate impacts is combined with various other methods, such as: scoring of other environmental aspects and a cost evaluation. It can be observed that life-cycle-based assessment modelling to support EU policy making gains recognition due to the high number of application (Röck et al., 2021).

At the same time, the new methods for measuring sustainability performance, including environmental costs, such as: Product Environmental Footprint (PEF) (European Commission, 2012) and Organizational Environmental Footprint, are developed by the

European Commission. They are advanced in cooperation with companies and sustainability experts with the aim to improve the comparability of the environmental advantages of the companies. To achieve this the PEFs enable to determine relevant environmental and health impacts as well as resource-related burdens caused by products of a specific company. For the calculations, the entire life cycle of the products is considered, from raw material procurement to disposal, and dedicated software for visualization of material and energy flows as well as life-cycle assessment and resource efficiency are available for the companies to use (iPoint-Systems, n.d.). However, these methods are not directly suited to assessing the ecological effects of legal norms. They are specific to the conditions of the company and require case by case analysis. Hence, we are looking for a method that would enable the analysis of the effects throughout the life cycle of a product, allowing for a comprehensive and systemic comparison of the environmental impacts of the implemented consumer rights.

To know what effects of the application of a legal norm should be measured, it is also necessary to determine what are the most typical categories of externalities/environmental costs related to the products life-cycle: process of production, sales, usage and disposal of goods. These can be measured in natural units related to the identified impacts, such as energy consumption, pollution generated as CO₂ emissions, or/and finally valued in monetary terms. The differences in value between the countries is addressed by the differences in the purchasing power parity and these differences can be calculated with the application of Purchasing Power Standard (Eurostat, 2014).

4. Applied Method

Identifying the environmental impacts triggered by exercising each of the remedies (replacement, repair, termination, and price reduction) requires an examination of the entire value chain within the life-cycle of a good and consideration of the resource streams as well as emissions generated during specific processes.

In order to compare the different scenarios of possible remedies in the context of nonconforming goods, we view specific externalities that occur in the value chain depending on consumer's decision (Figure 1). The diagram shows the rationale for consumer deci-

sion making, which drives the remedies and their impacts within stages of the product life-cycle (manufacturing process, delivery, sales, usage and disposal).

The environmental impacts occurring in case of exercising each of the listed remedies are generated at each step of the supply chain. In our analysis we use categories that are taken into account when calculating environmental impacts under the LCA method (Hauschild, 2018). We propose to calculate the C_{ei} environmental cost occurring in each scenario per item (i) while taking into account following aspects:

$$C_{ei} = f(P, M, W, d),$$

where manufacturing process:

$$P_i = f(E_i, H_i, T_i, P_{mi}, S_{ti}, T_i)$$

H_i - Heat per item; E_i - Electricity per item; P_{mi} - Processing of materials per item; S_{ti} - Surface treatment per item; T_i - Transportation costs; M - material use, W - disposal, d -durability ratio.

While assessing the environmental impacts of con-

sumer's decision³ we propose to introduce in the model a specific measure – durability ratio⁴ – defined as the ratio of the estimated period in which the good remains usable to the period estimated by the producer in which the good should remain usable. In our model, the durability ratio represents the variable responsible for reflecting the environmental impacts occurring in time, which may shorten or extend the good's life cycle, resulting in more or less intense environmental degradation

If we take into account the fact that the analysed processes are stretched over time and the durability of the good plays an important role for the intensity of the production on the demand side, we need to provide a more complex perspective (1).

$$C_{ei}(t) = \{P_i + (P_i + T_i(s) + W_i) \text{ for } x \in (1, tn) \}$$

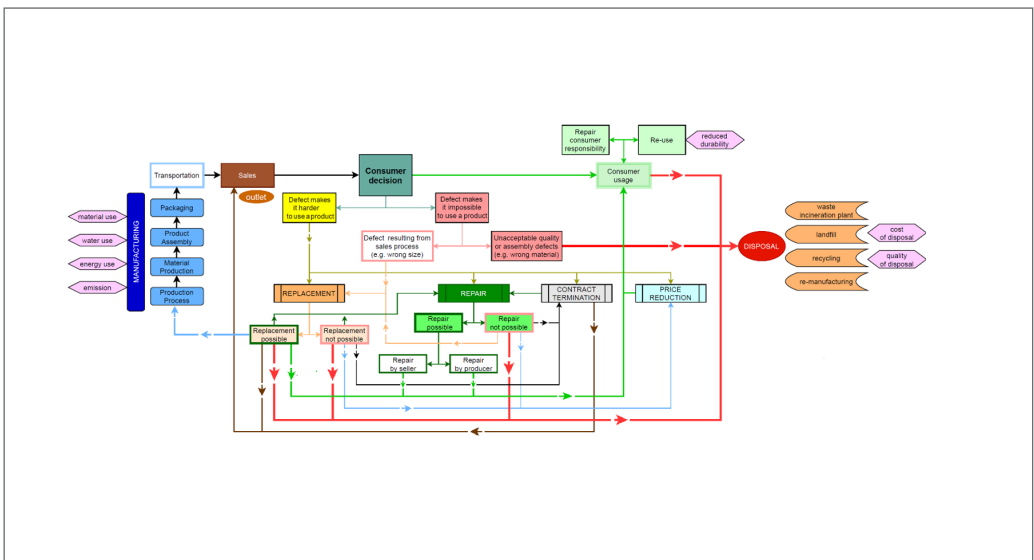
$$C_{ei}(t) = \{P_i + (P_i + T_i(s) + W_i) \times 2 \text{ for } x \in (2t, 2tn) \}$$

$$C_{ei}(t) = \{P_i + (P_i + T_i(s) + W_i) \times 3 \text{ for } x \in (2t, 3tn) \}$$

$$C_{ei}(t) = \{P_i + (P_i + T_i(s) + W_i) \times 4 \text{ for } x \in (3t, 4tn) \dots \}$$

where, tn - product life time; x _ number of periods for which we conduct the analysis

Figure 1
Conceptual Framework of the Analysis



In following we will present the analysis only for the period $x \in (1, t)$.

5. Analysis of Possible Scenarios

If the good bought by the consumer is not in conformity with the contract and he or she wants to exercise the rights under the seller's liability regime where the rights to repair, replacement, price reduction and termination of contract are provided as alternative (in contrast to Sale of Goods Directive where repair and replacement are the remedies of the first tier, and price reduction and termination of the second), there are basically four possible scenarios:

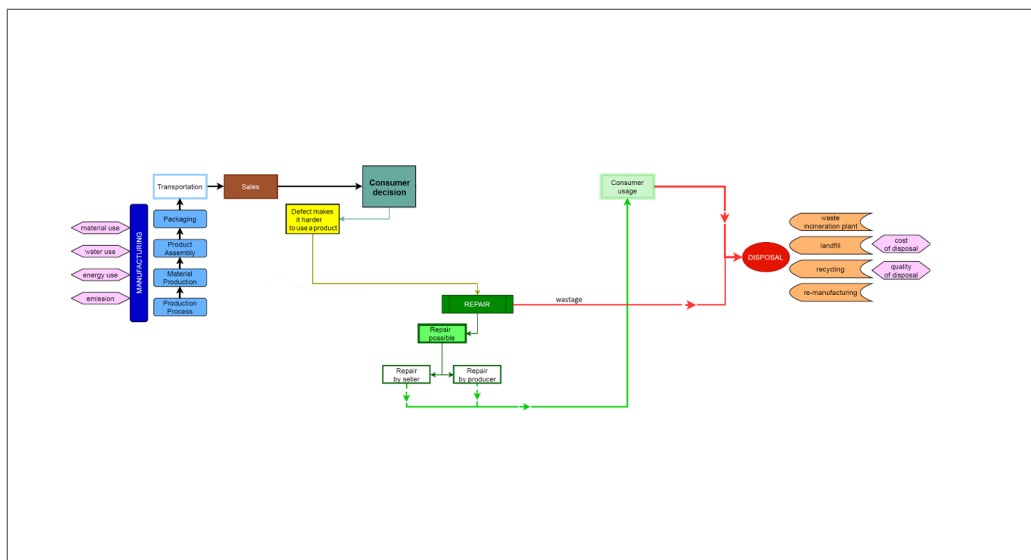
Scenario [1]. The consumer demands repair of the purchased good and the seller takes the responsibility for handling the process of repair (repair by the consumer oneself - self-repair - shall not be further investigated as not regulated by the Sale of Goods Directive as a remedy for nonconformity). Seller's decision on how to perform repair depends on the cost-benefit analysis, which may include cost categories such as: cost of improving reliability, cost of repairing a good which is not in conformity with the contract, cost of producing a spare unit, cost of transporting a functional good, cost of transporting a good which is not in conformity with the contract (Kim et al., 2017). The cost-benefit analysis often does

not take directly into account the environmental impacts, however the costs reported above help to identify the possible environmental externalities. Willingness to minimise economic costs may result either in decreasing the environmental externalities (e.g. looking for shortening the required transportation distance; minimising energy, material and water use) or in increasing environmental externalities (as result of usage of cheaper but less sustainable energy sources, ways of waste treatment or usage of cheaper materials/repair processes resulting with shorter durability ratio of the good after repair). This particular scenario is presented in the Figure 2. We propose the following formula for this case (2):

$$C_{e_i} = P_i + M_i + T(s) + \frac{1}{d} \times (P_{i-spare\ parts} + M_{i-spare\ parts} + T(s_{defect(i),s_{spare\ parts}(i)})) + W_{company(i-spare-parts)} + W_{retail(i)}$$

Scenario [2]. For the remedy of replacement, the customer returns a defective good and receives in return a good that is in conformity with the contract. In principle, under Sale of Goods Directive the consumer may freely choose between repair and replacement, unless replacement is impossible or (compared to repair) would create disproportionate costs. Consequently, this right may be exercised under different circumstances,

Figure 2
Framework for Scenario 1: Repair



for instance, if the lack of conformity is significant, if the repair is impossible or if the consumer wants to obtain a new good and not seek the repair of the good he or she has already used or tried. In this regard, from the perspective of the environment, the transportation costs and the external costs of the manufacturing process of the entire good (not only spare parts, as in the case of repair) are to be considered. Once replaced, it is not necessary to take into account the differences in durability, as the new good will be characterized by the same level of durability. In this case, however, the costs of disposal of the good which was not in conformity with the contract remains an important aspect generating costs for the environment (3). We present this case in the Figure 3, accordingly with the following formula:

$$Ce_i = 2 \times (P_i + M_i + T(s)) + T(S_{return}) + W_{company(i-replaced\ product)} + W_{retail(i-new)}$$

Scenario [3]. Price reduction in the case of price reduction related to the lack of conformity, the environmental costs related to providing a new good (as in case of replacement) may arise later, i.e. when a consumer decides to use the good for a shorter period of time than initially assumed. In contrast to case [1] (repair), in this scenario the consumer is responsible for eventual repair as well as the disposal of the good at

its end of life. The consumer decides how to proceed in case of repair (which repair shop to select, which influences the environmental impacts) and how to dispose of the good after usage. In case [3] (price reduction), frequently the general costs of transportation and repair are borne by the consumer, whereas in case [1] (repair), by the seller. Only in case when the customer refrains from repairing the good (e.g. in case of aesthetic defects) the parameter of additional environmental costs related to transportation of goods which are not in conformity with the contract and spare parts will be avoided (4). This scenario is presented in the Figure 4.

$$Ce_i = P_i + M_i + T(s) + \frac{1}{\alpha} \times (P_{i-spare\ parts} + M_{i-spare\ parts} + T(S_{defect(i),S_{spare\ parts}(i)})) + W_{retail(i-spare-parts)} + W_{retail(i)}$$

Scenario [4]. Termination of the contract the environmental costs of production remain at the same level as for case [1] (repair) lowered by the component of costs related to repair. However, if the seller decides to repair the returned good in order to re-sell it, the environmental costs in cases [1] and [4] will align. If not, for termination the environmental costs will be related only to the production, transportation and disposal of

Figure 3
Framework for Scenario 2: Replacement

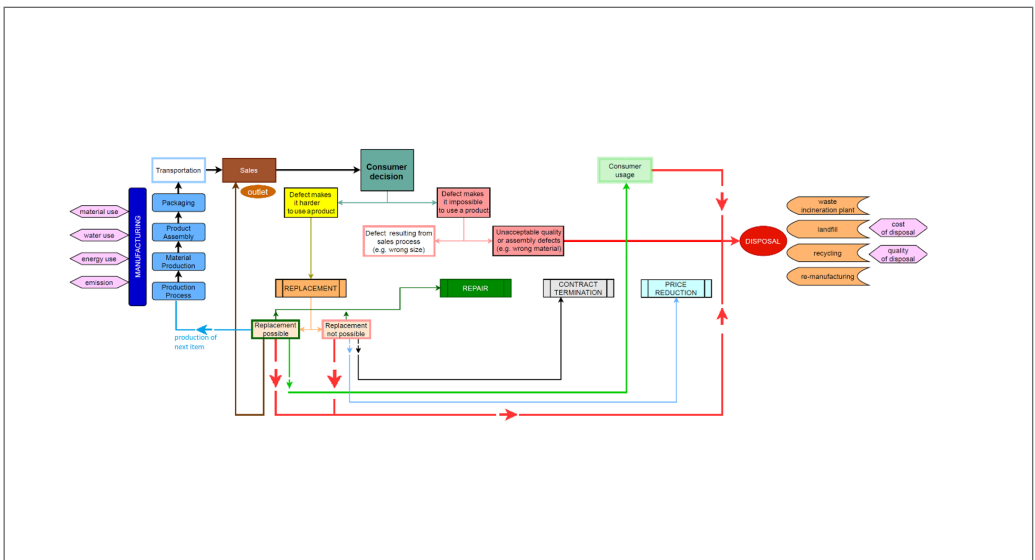
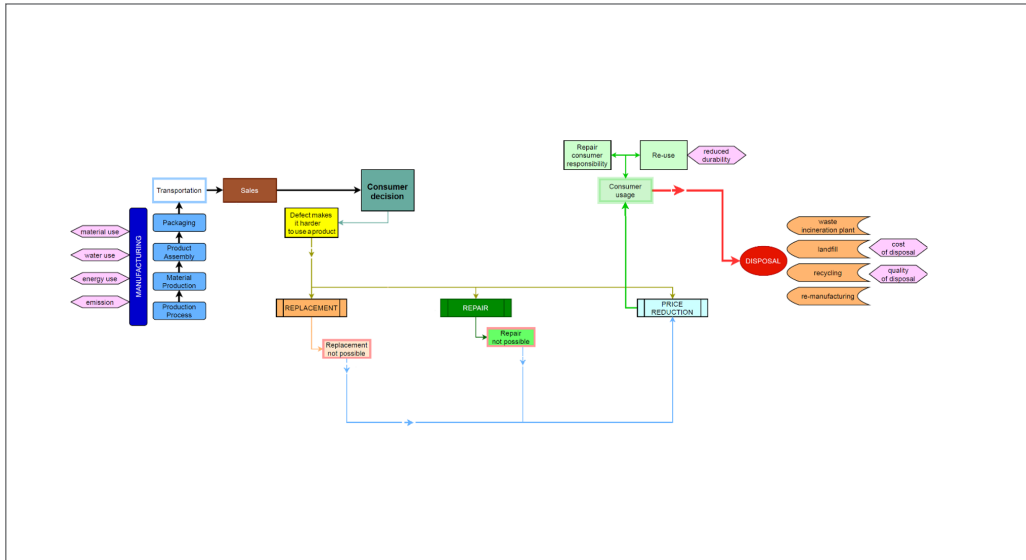


Figure 4
 Framework for Scenario 3: Price Reduction



the good. We need to recognize, however, that in this case the need the consumer wanted to satisfy with the purchase will still remain, therefore it is highly likely that the real environmental costs in case of termination of contract will be similar as in case [2] (replacement) after termination the consumer may buy such good elsewhere (Figure 5). The formulas will look as follows:

Where the seller decides to dispose of the good and the consumer decides not to buy a new one (5):

$$Ce_i = P_i + M_i + T(s) + Wcompany(i)$$

Where the seller decides to dispose of the good and customer decides to buy another one (6):

$$Ce_i = 2 \times (P_i + M_i + T(s)) + T(s_{return}) + Wcompany(i-replaced\ product) + Wretail(i-new)$$

Below in Table 2 we propose an overview of occurring factors which reflect the uncertainty related to occurring environmental costs for each scenario (described as “risk factor”).

In summary, it is possible to determine main factors that typically influence the amount of environmental costs of exercising a remedy in case of non-conformity of a good. However, not all listed factors will impact on

the amount of environmental costs in every scenario.

In the case of repair [1] among the core factors that influence the amount of environmental costs we can identify the production and material costs of one unit of the good, by production of the spare parts used for repair (including the material necessary for its production) as well as the effects of the technology applied in order to repair the good. The transportation costs in case of repair appear at the stage of item production and then again, during the process of repair. At the good's end of life we need to look at the environmental costs of disposal by the consumer and take into account the quality of repair as well as the consumer's preferences (how long he or she is likely to use the repaired good).

If replacement [2] is chosen, we can observe that there are twice as many resources needed because this scenario entails producing both the replaced good and the replacement. The disposal process will also be doubled in this scenario.

In the case of price reduction [3], the customer accepts the good that is not in conformity with the contract but he receives a reduction of price, thereby only the basic environmental impacts are generated (for one good). Yet, the impact of durability is of high importance (similar as in case of repair). If the defect de-

Figure 5
 Framework for Scenario 4: Termination

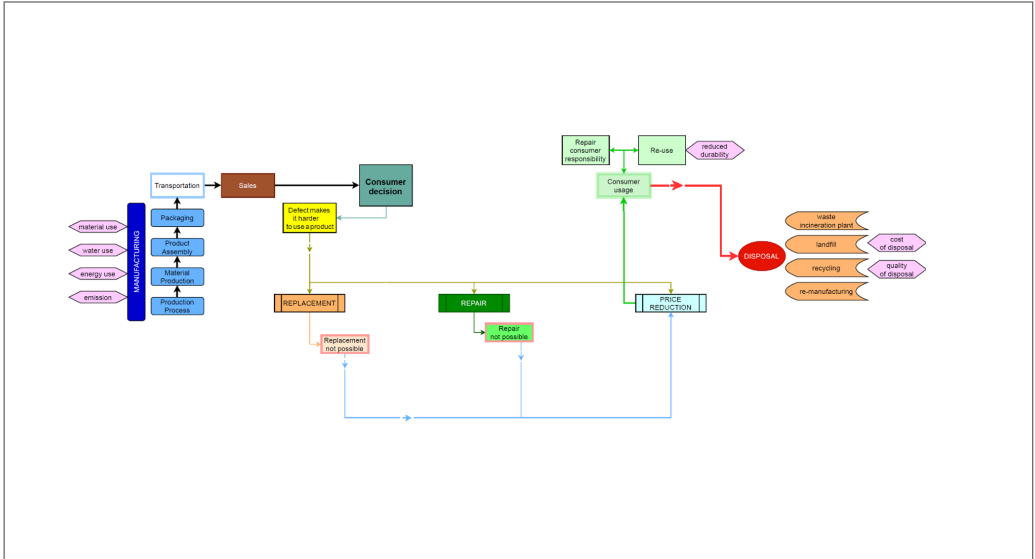


Table 2
 Number of Possible Factors Related to the Risk of Occurring Negative Environmental Effects Over the Entire Lifetime of the Good for the Case of Each Scenario

Core risk factors (RF) occurring for a lifetime of the good	Repair (company repair) RF= 6	Replacement RF=7	Price Reduction RF= 4-6	ABHAR Termination RF=3-7
Production and material costs per unit	1	2	1	1 or 2
Transportation related to manufacturing process	1	2	1	1 or 2
Disposal by consumer	1	1	1	0 or 1
Transportation related to replacement, return or repair (the good comes back to the seller)	1	1	0	1
Material, technologies and transportation used for preparing spare parts	1	0	0 or 1	0
Transportation related to possible individual repair	0	0	0 or 1	0

creases the durability ratio and the consumer is likely to dispose of this good and purchase a new one before the lapse of the standard time during which this type of good is used, the environmental effect will be similar to the situation of replacement: only the occurrence of some of the environmental costs will be delayed. In turn, when the consumer chooses price reduction, but decides to repair the good at his own risk and expense, the same environmental risk factors as in the case of repair are produced.

Finally, the environmental costs of termination of the contract [4] appear to be generated by the fewest factors. If not accompanied by the repurchase of another product, this remedy may seem to generate the lowest environmental costs. Yet, it does not allow the consumer to satisfy his or her needs. Thus, from the consumer's perspective, the effect is analogous as if the contract was not concluded at all, but the environmental costs associated with the production process, transportation to the client's premise and product's devolution will appear nevertheless. Satisfying the consumer's need would, in the majority of scenarios, mean buying such a good again, doubling the initial environmental costs. The attractiveness of this remedy from the perspective of the environmental costs is thus misleading. However, if we assume that the good returned to the seller is re-introduced onto the market, the environmental effects of this remedy differ compared to the case of immediate disposal: it once more increases the number for risk factors occurring in case of contract termination.

6. Discussion

6.1. *Imposing Information Obligations Upon the Seller as an Alternative*

The information asymmetry between businesses and consumers regarding environmental effects of certain decisions may lower the level of consumer's environmental ethics and lead to irresponsible customer behavior (Kulkarni, 2000). Imposing information obligations in regard to environmental costs related to repair or replacement of the good, price reduction and termination of the contract could steer consumers towards more ecologically efficient choices. However, this approach is based on the assumption that it is sufficient to inform consumers

about the environmental costs to make them choose an eco-efficient remedy in case of lack of conformity of goods (Ayres et al., 2013). Reservations and limitations to this approach (Terry, 2021) are already explored in the context of information obligations regarding the environmental costs of production process, use of goods, and disposal stage. Though informing the consumer about the environmental consequences of one's individual choices is strongly recommended, the actual impact of such disclosures is limited (Ben-Shahar & Schneidern, 2011; O'Rourke & Ringer, 2016).

6.2. *Tailoring the Remedies According to the Type of Good as an Alternative*

The reasonableness of the postulated method might be challenged by advocating that similar effects can be obtained by remedies tailored to the type of good. A categorization of goods could be proposed to simplify the process of calculating the optimal remedy in case of lack of conformity of the good sold. For example, in case of household appliances, repair is the best option in the majority of cases, whereas in case of stationary, termination tends to be most suitable from an environmental perspective. If that was the case, introducing a deeper differentiation of remedies would not be viable. However, it is not only the characteristics of the good that determine which remedy is optimal from an environmental costs perspective. There are various factors influencing the environmental costs of remedies, and though they include characteristics of the good such as: material and energy used, technology applied for its production, reparability, they are not limited to them. The transportation policies of the seller (e.g. disposal of the goods in a landfill), policies of the producer, technological innovation on the market are also relevant. In certain sectors, innovation decreases the amount of materials/energy used, which is therefore crucial from the environmental perspective. It may be counterproductive for particular types of goods to have a long lifespan. In conclusion, a "one size fits all" solution, even if limited to categories of items, is not optimal due to the divergences between scenarios and number of circumstances which need to be considered when assessing environmental costs of exercising remedies.

7. Potential Limitations

7.1. *Innovations and Durability Relativity of Seemingly Eco-friendly Solutions*

Durability is an important factor for encouraging sustainable consumption (Sun et al., 2021), but its impact varies depending on the product category (Cooper & Gutowski, 2017). For example in the case of white goods, which are perceived as “important investments”, consumers prefer to buy those which last longer. In contrast, when purchasing goods such as smartphones, televisions or clothing, many consumers declare that they prefer to buy these goods more frequently because of technological advancements or fashion (European Commission et al., 2018). If recommendations as to remedies like price reduction or repair are to be made (where durability represents an important risk factor), the specific category of goods should be taken into consideration. However, prolonging the stage when the goods are on the market by exercising repairs, and promoting resale or reuse, etc. is not always the most efficient scenario from the perspective of environmental costs. Sometimes, the environmental costs of repair, resale, and of related transportation mean that it is not cost effective to keep the goods on the market. Standardized, unpowered goods and components strategies aimed at repairing and reusing an item are less energy intensive than the production of new goods. Nevertheless, reusing a good does not always guarantee an environmental benefit because of the increase in the requirements related to energy use (the case of goods with a high use-phase energy requirements, which, from an environmental point of view, have low optimal lifespans). Consequently, promoting use of cheap, reused goods can help to minimize waste in the short term, but from a long term perspective it may increase consumption rather than benefit the environment (Cooper & Gutowski, 2017). It needs to be remembered when making recommendations that the objective is not to prolong a good’s life-cycle per se but to minimize the consumption of resources and environmental impact.

7.2. *Effects of Rebound Mechanisms Related to Incentivizing More Sustainable Options*

It might be observed that consumers declare interest in goods which support a circular economy. Nevertheless, their actual engagement is estimated as rather low. The majority of consumers prefer to purchase and keep goods for a long period of time (93%) and repair them if they break (64%), the minority (10-25%) is, however, more interested in leasing goods instead of purchasing them (European Commission et al., 2018). This stresses the importance of introducing regulative incentives that help to transform consumer behavior from being typical of the linear economy towards more circular alternatives. Suggesting a remedy (or a hierarchy of remedies) that decreases environmental impact may raise individuals’ awareness and influence customer behaviour.

Currently, the consumer can choose between repair or replacement with a new good; the leading factor seems to be the price-quality ratio of the both options. If the more sustainable option does not offer significant savings, the new goods are always preferred (European Commission et al., 2018). In addition, incentivizing more sustainable options by offering price discounts may cause additional negative effects for the environment. The first phenomenon related to the so-called imperfect substitution suggests the limited ability of “re-circulated” goods as a substitute for primary good (Zink & Geyer, 2017). The second phenomenon relates to the fact that when consumers make some savings when purchasing they are more willing to re-spend the money, which in turn also accelerates consumption (Makov & Vivanco, 2018).

7.3. *Accessibility of the Data*

It is not obvious whether application of such a method would, in fact, lead to the desired outcome due to the difficulties related to obtaining relevant and adequate data.

For the regulatory purposes, either data from individual cases or standardized data obtained in previous LCA assessments can be used. Yet, neither of these solutions is optimal. If the exemplary data were fed to the system calculating optimal regulatory response, the result would be a recommendation for one particular scenario only. Consequently, provided that the legislator seeks general recom-

recommendations, formulated to serve not in one case but in the majority of situations, it could be reasonable to use the standardized data on the environmental costs of typical processes available as a residue of already conducted LCA assessments (Myers et al., 2019). LCA includes statistical data regarding the environmental causes of certain processes, which on the one hand helps to promote the “cleanest” processes (as these generate less environmental negative costs), and, on the other hand, reflects the level of infrastructure developed especially in the case of quality of disposal. The issue is that data directly related to specific production processes is lacking, which increases the level of generalization. In consequence, monitoring the whole process can be hindered.

Another matter is the process of data collection itself: it should be continuous, unbiased and effective. Technology used and the processes themselves evolve over time which impacts their environmental costs. In addition, the method of obtaining data needs to be chosen carefully, having in mind the possible interests of entities involved in this process. If the data are, in principle, collected for some other purpose, there is a risk that some factors crucial from the perspective of the assessment of the environmental costs of exercising chosen legal norm are disregarded. If private entities are gathering or providing the data, then the risk of the conflict of interest arises, increasing the exposure to data manipulation and reducing credibility of final results of their processing. This majority of LCA analyses so far were ordered on behalf of producers, and historical reviews show that they tend to support the interest of their sponsors (Seidel, 2016). Currently, it is also one of the issues that hinder the effective incorporation of LCA in the process of policy development. If the data are obtained based on the public producer's declaration, for example, regarding the energy consumption of the good, declaring possibly low consumption, it is as a rule, in the best interests of that producer it may help him to build a reputation of an eco-friendly producer and ultimately increase his sales. Such producer is therefore likely to test the actual energy consumption under favorable but yet uncommon circumstances (Zachariadis, 2020). Such tendencies

influence the reliability of publicly available data. Finally, if the variables taken into account when calculating which remedy is the optimal from the environmental perspective are known, it is an incentive for the private entities to reshape their policies and strategies in case of exercising a right to repair, replacement, price reduction, and termination to make the option which is most cost-effective from the perspective of the business is also the most cost efficient from the perspective of environment. The issue is that this can be achieved not only by reducing the environmental costs of the option preferred by the business but also by unnecessarily increasing environmental costs of the other remedies.

7.4. Regionalization and Environmental Justice

In the proposed model, the manner of disposal is one of the factors which strongly influences the ecological effectiveness of each remedy. The quality of infrastructure used for disposal may significantly impact the results of the analyses of occurring environmental costs. For example, there are strict waste policies and effective waste incineration plants in developed countries, and the sellers there are obliged to fulfil legal requirements and their actual compliance can be closely monitored. In turn, proper legislation in this matter is lacking in developing countries, and so does the infrastructure for appropriate waste management or any framework for extended producer responsibility, ERP⁵ (Feronato & Torretta, 2019). The result is that waste treatment is more expensive in the developed countries, but it also produces lower environmental costs than in developing countries. There is an economic pressure to transfer waste disposal to countries with lower disposal costs, regardless of high environmental and social costs. For instance, the yearly amount of current waste electric and electronic equipment generated in developed countries tends to be illegally transferred to developing countries (it is estimated that it can be up to almost 50% of this type of waste) (Cucchiella et al., 2015).

For this reason, including the variable of “the quality of disposal infrastructure” in the equation for assessing ecological effectiveness may give rise to the question of environmental justice of the proposed solution, namely the question whether it may

it lead to geographical discrimination. By including this variable into the equation, we aim at promoting the value chains that generate the least negative effects for the environment. This solution may decrease the likelihood to dispose waste in regions where the infrastructure is underdeveloped, for instance, in developing countries. Instead of encouraging investments for modernization of disposal infrastructure, including this variable in the general equation may result in differentiation of company policies and diminish the possibilities for exercising the consumer rights in less developed countries. In order to prevent it, when increasing the pressure on disposing the waste in regions with a highly developed infrastructure, regulators should also increase the pressure on improving the quality of disposal infrastructure in less developed regions, so as not to discriminate against the regions, which require substantial support.

7.5. Growing Legal Uncertainty Undermining the Consumer Protection Mechanism

Another weakness of the proposal is that its implementation inevitably creates a new field of uncertainty which needs to be addressed. Provided that a rather complex method and a substantive amount of data are necessary to calculate which remedy is optimal in a given scenario, it might be highly problematic or even impossible for the consumer alone to establish what rights they have in relation to a non-conforming good. Without this knowledge, the buyer is not able to make an informed decision regarding the exercise of his or her rights. The need to incur higher than marginal costs (money, time, etc.) to learn what one's rights are is likely to discourage the consumer from demanding protection (European Commission et al., 2017; Grochowski, 2012). Thus, establishing remedies so that they correspond with peculiarities of individual cases with the use of the described method might reduce the effectiveness and practical utility of said remedies.

7.6. Need to Revise Fundamental Assumptions Behind the Design of Remedies for Lack of Conformity

Finally, the application of the proposed method may lead to the change of primary assumptions

anchored in the regime of remedies for non-conforming goods. Traditionally, the starting assumption is that the contract should remain binding without any changes as to its content (*pacta sunt servanda* principle). Consequently, the priority is given to remedies which allow the seller to bring the good into conformity with the contract (repair and replacement), which allow him to save the contractual bond in its original form. The application of this method may lead to results which are incompatible with the fundamental assumptions of the EU legislator behind the design of remedies for lack of conformity. Once the proposed method is applied, the seller might be deprived of the right to cure in instances where price reduction or contract termination would be better from the environmental perspective than bringing the goods into conformity. Thus, the interests of the third stakeholder, previously disregarded, would be given priority over the interests of the party to the contract, namely the seller.

Allowing for limitations as the *pacta sunt servanda* principle in consumer law in order to facilitate reaching common objectives has already been observed in EU law, for example, when the consumer's right to withdraw was praised as a tool to boost internal market development (Cohen, 2016; Schulze & Zoll, 2021). In the light of the eco-related EU policies, introducing further limitations of said principle could also be viewed as justified.

8. Conclusions and Further Research

It is not possible to design a rigid hierarchy of remedies, which would be optimal in every scenario from the perspective of environmental costs generated as a result of the consumer exercising the rights for non-conforming goods.

However, it proved possible to assess the environmental costs of exercising each of the rights under the remedies available to the consumer repair, replacement of the good, price reduction, contract termination and to compare them. The LCA analysis is one of the most frequently referred to methodologies in the area of policy development, but usually it is usually it is "addressed and cited only as a general concept and in a rather generic manner" (Sala et al., 2021, p. 2295). Above, the LCA analysis

was integrated into a method designed for assessment of the environmental costs of legal norms. It allowed for obtaining a general overview of ecological effectiveness of the remedies. It was observed how many times a certain process typically producing environmental costs is performed if a particular right is exercised. The cycle analysis suggests that as a rule price reduction (if not correlated with repair by the consumer or a chosen by third party) is the most effective remedy from the perspective of environmental costs. If the consumer reduces the price, but at the same time has the goods repaired, the associated environmental costs of price reduction and repair become similar. In contrast, replacement and termination of the contract tend to drive substantially more endeavor-generating processes, and, as a result, produce more environmental costs. Yet, it should not be neglected that prioritizing repair and price reduction may have an indirect impact on the frequency and length of good's life cycle a consumer who has a repaired or defective good might be more prone to quickly acquire a new one instead.

The method developed within this study could be referred to as a model for designing appropriate tools for eco-assessment of the other provisions, making it possible to more adequately assess environmental impact of regulatory proposals in the EU legislation process. Yet, from the perspective of the EU regulatory authorities, the analysis of the environmental costs related to exercising each one of the remedies is just the first of many questions that need to be answered in order to regulate in an eco-friendly manner the remedies of the consumer in case of lack of conformity of the goods sold with the contract. Under the current legal framework, it is possible that the repair of the good is intended, but it fails to bring it into conformity, and therefore the consumer terminates the contract (Art. 13(4) Sale of Goods Directive). Hence, the environmental costs may arise firstly during the repair process and then again, as a result of contract termination. Consequently, the issue which would need to be addressed in the future is whether the existence of a hierarchy of remedies in general is recommended or should this matter be solved differently. In particular, the proposed method could be used to design a flexible system of remedies, which would

adjust to the peculiarities of individual scenarios: the consumer could be granted only this(these) remedy(ies) which would be most reasonable from the perspective of the environmental costs.

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Footnotes

¹According to European Commission (2021) “Impact assessment is required when: impacts (economic, environmental or social) are significant AND the Commission has a choice between alternative policy options” whereas “significance depends on the expert judgment and should be decided after stakeholders consultations.” (p. 30).

²The actual effects of application of LCA method in individual scenarios could, in contrast, be used in future to fuel so-called personalized (granular) law, namely a legal system in which technological tools would be used to find the most adequate – form the perspective of protected values – legal solution for every individual, depending on their situation, traits, and preferences and to determine the legal response accordingly, that is produce individually tailored legal norm (Ben-Shahar, Porat 2021).

³We refrain from taking the “Sales phase” into consideration which would require an analysis of the environmental effects of the marketing activities and sales process per se. In our analysis, we focus only on the “Consumer’s decision” step and discuss the environmental effects that will arise from this decision. Commonly, in the decision-making process the price-quality ratio is the core variable based on which consumers take their decision. We assume that while facing the situation related to lack of conformity consumers also adopt this criterion, but they also take into account transactional costs of return or repair, as well as whether they are willing to accept the lack of conformity of this particular good. We do not include these criteria in the analysis, as we take an environmentalist perspective

and concentrate on the environmental effects that arise from the decision taken.

“There is a difference between the legal term “durability” which appears in the Sale of Goods Directive and the economic term “durability ratio”. The durability - understood as the ability of the goods to maintain their required functions and performance through normal use – is a required characteristic of a good. If the item remains functional for a shorter period of time than typically expected, it does not meet the durability requirement, hence it is not in conformity with the contract. Durability is a binary indicator. In contrast, the “durability ratio” indicator serves to determine the relation between the said durability and the time during which the product actually maintained its functionality and performance.

⁵Extended producer responsibility is defined as “environmental policy approach under which the responsibility of producers for their products and product packaging is extended to include the social costs of waste management, including the environmental impact of waste disposal” (European Commission, 2017b, p. 7).