

Case Report

Environmental Innovation and Green Growth in the Repair and Maintenance of Cars—Case Study

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Abstract: The current phase of the sustainable development of production is primarily focused on innovation and environmental products and services, and on greening the economy through the implementation of standardized tools (according to ISO). The paper presents the application of results of ongoing research through case studies under particular conditions. We have expanded our previously proposed business model as an input/output transformation system, presented in our previous research that was published at the 18th International Scientific Conference “Globalization and Its Socio-Economic Consequences” in Zilina and supported by the fact that we are co-creators of STN EN ISO standards 14051:2012 (839051) and STN EN ISO 14045:2013 (839045). Here, it is supplemented by the proposal of a procedure for selecting an instrument for greening the economy according to the area of economic activities (NACE coding). The methodological principles and the proposed procedure are applied through a case study in a small car repair company.

Keywords: car repair; business; process innovation; green growth; waste recovery



Citation: Majerník, M.; Daneshjo, N.; Malega, P.; Rudy, V.; Al-Rabeei, S.A.S. Environmental Innovation and Green Growth in the Repair and Maintenance of Cars—Case Study. *Sustainability* **2021**, *13*, 12853. <https://doi.org/10.3390/su132212853>

Academic Editors: Baojie He, Ayyoob Sharifi, Chi Feng and Jun Yang

Received: 8 October 2021

Accepted: 15 November 2021

Published: 20 November 2021

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1. Introduction

Sustainable production, green growth and a green business economy represent a new way of doing business and creating value while improving the quality of environmental components and improving the quality of society in a globalized sense. Sustainability and greening of production are possible in principle when understood and defined as the creation of products and services through using such materials, technology, energy and procedures that minimize and eliminate the environmental aspects, impacts and risks of operations, save energy and natural resources, and are safe for both employees and consumers, making them economically and environmentally sound.

Industry 4.0, as a trend of today's production, is based on characteristics that have already been focused on: “lean and green” concepts. The goal of the article is to move from resource consumption, pollutant emissions, and more extensive manufacturing towards environmentally responsible manufacturing (ERM) [1].

Based on these facts in the context of real business practice, it is necessary to encourage investment and innovation activities, and to examine those aspects of production as a basis for sustainable growth, increasing competitiveness and green business administration. The global strategy of green social and economic growth must be reflected through regional action plans at the local corporate level, regardless of the location, size and scope of the economic activities of the organization [2]. To change the current unsustainable developmental direction of the global ecosystem, the major opinion-forming institutions are proposing a revolutionary economic reform. They believe that the new concept of the reform should be based on ecological factors, such as green growth and green economy [3].

“Green Growth, OECD green growth strategies, is a way of supporting economic growth and development while protecting natural resources so that we can continue to enjoy the resources and environmental services on which our prosperity depends. It is therefore necessary to support investment and innovation that will be the basis for sustainable growth and allow the emergence of new economic opportunities”.

By the term green growth, we mean balanced growth with environmental protection focused on quality. It represents a low-carbon and energy-efficient growth with a focus on value creation through “clean” technologies, natural infrastructure, and innovation in the market environment, the driving force of economic growth [4]. The focus of environmental growth strategies should be to overcome the constant cyclical deterioration of the environment, unsustainable economic growth, and poverty, and to replace these with a cycle of quality growth, environmental improvement and social inclusion.

Greening the economy and sustainable green growth cannot be applied in the same way everywhere. It is important to realize that needs vary in terms of different cultural, environmental, political, and economic conditions. Therefore, countries, regions, businesses, and, where appropriate, local communities should develop their own strategies for sustainable and green growth [5].

Awareness of achieving sustainable development through a green economy is increasing and is becoming a major topic of discussion for politicians, agencies, and research programs. Their efforts are starting to focus on signalling the changes that are necessary to ensure sustainable trade and investment leading to global developments [6]. These changes will subsidize legal structures supporting trade, investment, and general ideas about a new understanding of globalization national forces [7].

Currently, environmental management and responsible behavior in the corporate environment offer an opportunity for a business to differentiate from competitors and to provide its customers and shareholders greater value, which is based on the expected environmentalization. Greening can be defined simply as “not to be wasteful”, and emphasizes appropriate technology, operational efficiency, and optimal use of resources. It is necessary that the organization have sufficient resources to meet demand without the degradation of the environment and natural resources [8].

A green business is an organization that is involved in ecological and environmentally friendly activities, not only to ensure continued profitability, but also to ensure that all business and manufacturing activities and outputs adequately address current environmental problems [9].

Research has provided a more exact methodology for the green public procurement of goods and services based on connectivity to the worldwide standardized indicators of sustainable socio-economic development [10].

The essence of green business is to adequately meet the needs of today’s society without interfering with and threatening the social needs of the next generation. A green business is concerned with the design process of products, which assesses the capacity for the sustainable operation of the product in the current environmental situation and given the ongoing availability of natural resources [11]. The essence of green energy is that renewable resources in particular participate as much as possible, with the involvement of biomass, water and wind energy, but also geothermal and solar energy [12].

Eco-innovation is a relatively recent construct in the literature, which nowadays more and more researchers and academics consider as one of the strategies that generates a higher level of sustainable and business performance. However, little is known about the influence of eco-innovation practices on sustainable performance and business performance, particularly in the automotive and auto-parts industries. Therefore, the research carried out by Maldonado-Guzmán aims to fill this knowledge gap and explore the aforementioned interdependence [13].

The study of Morrone confirmed that green marketing strategies implemented by car manufacturers successfully raised the awareness of consumers on sustainability issues.

However, the gap separating recognition of the issue from the enactment of environmentally friendly consumption is still to be filled [14].

In order to meet great environmental challenges such as climate change, much attention has been paid to innovation as a way to develop sustainable solutions. Industry and policy makers increasingly adopt the concepts of eco-innovation as a way to facilitate more radical improvements in production processes and products, and also in corporate environmental performance. Eco-innovation can be understood in terms of its target, mechanism and impact [15].

For the sustainable development of the manufacturing industry, it is important to obtain a further understanding of green growth efficiency evaluation in the manufacturing industry [16]. The focus of the paper by Nunes is on investigating and benchmarking green operation initiatives in the automotive industry, documented in the environmental reports of selected companies. The investigation lays out the main environmental initiatives taken by the world's three major car manufacturers, and benchmarks them against each other. The categorization of green operation initiatives that is provided in the paper can also help companies in other sectors to evaluate their green practices [17].

The paper by Sarkar performs a holistic and strategic review of how the eco-innovations and their specific promotional and developmental efforts are stimulating the sustainable development of eco-industries and enhancing green growth by setting up demonstrable eco-industrial models in multi-sectoral areas in Europe and other parts of the world [18]. The article by Yucheng takes a sustainable development perspective, and sets up an index system based on a Sustainability Balanced Scorecard, including the main factors of Financial, Internal Process, Customer, Learning and Growth and Social, and a sub-index comprising 28 factors to evaluate the green manufacturing of the automotive industry. Based on the index system, an evaluation model integrated by a back-propagation artificial neural network and genetic algorithm was introduced [19].

Research performed by Lyytimäki presented and evaluated the process of attempting to build a set of policy-relevant key indicators of green growth for a particular country. The more important results of this research are that we face many challenges in green growth, such as data availability, the right balance between different indicator selection criteria, a systemic understanding of the relationships between indicators, and the variable usage contexts of the indicators [20].

Vukovic's study outlined the main principles and methodology of criteria evaluation for a regional green economy. This paper can be a suitable tool for everyone who needs to evaluate the current state and level of a regional green economy's development, determine the efficiency of environmental and economic programs, optimize finance structure, perform environmental monitoring, and develop state plans [21].

Increasing pressures, such as stricter regulations, increased community and consumer pressures, and the developing country's aim to enter the WTO, have caused automotive supply chain managers to consider and to implement green supply chain management practices so as to improve both their economic and environmental performances. The result of this paper present practical guidance for managers in performing green supply chain management practices by ranking green supply chain management practices according to their importance, which leads to improving green supply chain management performance [22]. The work of Dieguez presented a study on the current main vehicle motorization technologies, namely, internal combustion engines, electric motors, electric-hybrid vehicles and vehicle fuel cells, without considering technology diffusion. The main objective of this study was to point out the best model to help reduce the amount of pollutant gas emission, as well as contribute to public policy decision-making [23].

The study conducted by Drohomieretski aimed to identify how green supply chain management practices are adopted, and to pinpoint the main motivations and barriers to their implementation in the automotive supply chain. The result is that the transference of environmental practices carried out by suppliers has a greater impact when combined with actions for reducing the costs of supplier operations [24].

Green growth is considered a new growth mode to achieve sustainable development worldwide. The research performed by Guo develops a system dynamics model integrated with five subsystems, including economy, population, resources, environment, and policy, to investigate pathways towards green growth in a traditional Chinese industrial region [25].

The purpose of the study performed by Ismail was to unveil the influence of a new business model, namely, STOF, on the performance of the green economy automotive industry. In this fast-emerging arena, one of the most crucial components of the automotive industry is service innovation. The success of green economy depends on the success of service innovation in the companies and the mediating effect of core competencies in the relationship between the STOF model and green economy [26].

The research that was conducted by Lüthje analyzes the changes in production and innovation networks in the automobile industry in China resulting from the transition to new energy vehicles and digital driving technologies [27].

2. Materials and Methods

Our current research builds on our previous research in this area, which has been developed through the application of less formalized environmental policy and greening tools.

The methodology that is used in the paper has been developed previously by the members of our author team—specifically, the usage of less formalized tools of environmental policy design and the greening of the economy. We applied this methodology to the model of the transformation system (input–transformation–output). We did not cite these publications because we wanted to avoid the problem of self-citation.

The aim of the paper is to propose a procedure for the implementation of less formalized greening tools through a case study, and to verify it on specific conditions, in a small car repair company.

2.1. Methodological Aspects of Choosing a Green Economy Tool

The European Union is promoting various voluntary environmental policy instruments to introduce sustainable development into companies and to fulfill its principles and goals. Companies introduce these tools into their activities. In general, these tools are applied in the companies via the introduction of standardized forms of environmental management.

Environmental management in the company represents a complex of strategies related to the usage of green economy tools. The company's management has responsibility for the selection and application of these tools within the various stages of the production process. The selection depends primarily on legislative regulations, but also considers the necessities of the company and market requirements.

The company as an input–output system with the assignment of tools for green growth and the development of green economy is illustrated in Figure 1. Recently identified and briefly analyzed voluntary tools for improving the environmental performance of companies are now almost ubiquitous within the countries of the European Union. It is not simple to select and develop one optimal tool for a particular company due to its activity and size. Table 1 shows recommendations for the selection and implementation of individual voluntary instruments according to the economic activities of companies.

The areas of individual economic activities are specified according to the standardly used NACE codes in the certification of managerial systems. According to the conceptual recommendation, it is clear that some tools, such as EMAS, EMS, EIA or eco-innovation, are suitable to use in any company regardless of their focus. Other tools, such as ecolabelling, LCA or eco-design, are specific to some of the areas marked above. The recommendation to use voluntary tools is based on the experience already gained via the implementation and application of these tools in foreign companies. At the same time, however, these tools may be different, and adapted to specific conditions related to the ongoing formation of the Slovak economy in relation to the European Economic Area.

2.2. Procedure for the Selection of the Green Economy Tools According to the Area of Economic Activities

The methodical procedure of the selection of a suitable green economy tool includes the following steps:

1. Characteristics of the selected company and its activities—We will assign the selected company to a suitable area of economic activities and describe its activities and processes;
2. Level of impacts of business activities—According to the assignment of business activities to a suitable area of economic activities according to NACE codes, the intensity of their impacts on the environment will be determined. The correct determination of the level of impacts on the environment is described in Table 2;
3. Identification of existing and possible problems in the company—After the characterization and assignment of the company's activities into a suitable area, it is necessary to analyze the course of partial business processes and identify existing or threatening problems that affect the smooth operation;
4. Selection of the focus phase of green economy tools—According to the identified problems that influence the company, the phase in which the problem occurs is assigned. The individual phases represent the inputs of production, the transformational input–output process, and the outputs of the production for the customer;
5. Selection of the specific tool of the green economy—Following the identification of the issue, a suitable tool will be determined that is adequate for the phase wherein the mentioned issue occurs. The choice of the tool will also be made on the basis of the classification of the company's activities into the areas of economic activity, according to the proposed concept in Table 2;
6. Application of the chosen tool to the business activity—After the selection of a suitable tool, it is necessary to simulate the procedure and course of implementation of the given tool in the company, as well as its processes and activities;
7. Evaluation of the impact and benefits of the tool's implementation for the company—Finally, we determine the effects of the applied tool on business activity, and evaluate the changes and the level of the positive impact that would occur after implementation.

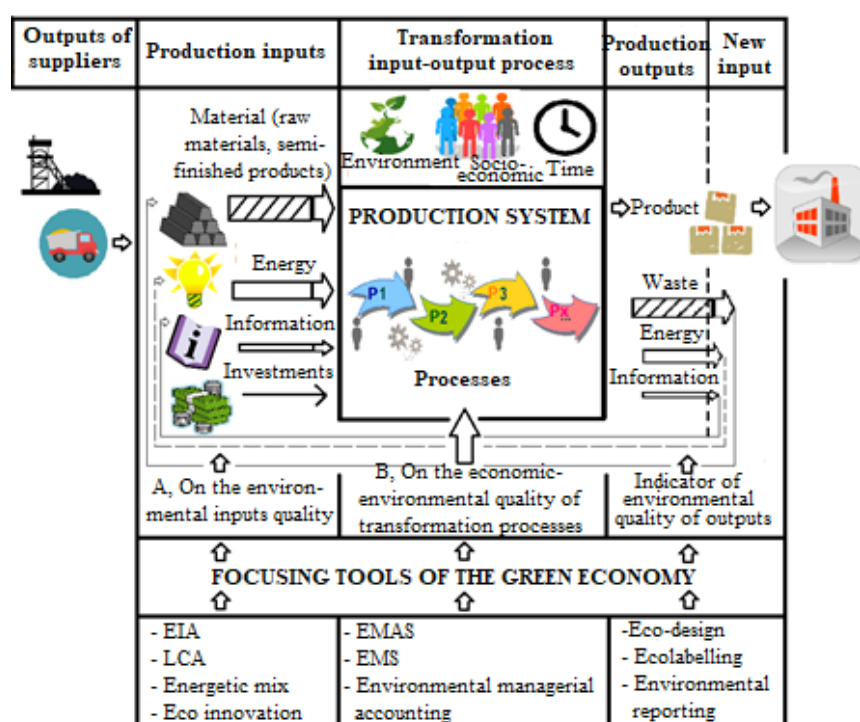


Figure 1. The company as an input–output system with the assignment of tools for green growth and the development of the green economy.

Table 1. Possibilities of using the tools of green growth and the green economy in individual areas of economic activities.

	Agriculture, Forestry and Fishing	Mining and Quarrying	Manufacturing	Electricity, Gas, Steam and Air Conditioning Supply	Water Supply; Sewerage, Waste Management and Remediation Activities	Construction	Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	Transportation and Storage	Accommodation and Food Service Activities	Information and Communication	Financial and Insurance Activities	Real Estate Activities	Professional, Scientific and Technical Activities	Administrative and Support Service Activities	Public Administration and Defence; Compulsory Social Security	Education	Human Health and Social Work Activities	Arts, Entertainment and Recreation	Other Service Activities
Level of environmental aspects and impacts	ML	HL	HL	ML	ML	ML	ML	LL	LL	LiL	LiL	ML	LL	LiL	SC	LiL	ML	SC	SC
EMAS	●	●	●	●	●	●	●	●	◇	○	◇	○	◇	●	●	◇	○	●	●
EMS	●	●	●	●	●	●	●	●	◇	○	◇	○	◇	◇	◇	◇	○	◇	●
EIA	○	●	○	○	○	●	○	○	○	○	●	○	○	○	○	○	○	○	●
EMA	◇	◇	●	◇	●	●	◇	●	◇	◇	◇	○	○	○	◇	●	●	○	○
Environmental reporting	●	●	●	●	●	●	◇	●	○	◇	○	◇	◇	●	◇	○	●	●	◇
Ecolabelling	●	○	●	●	○	○	◇	◇	◇	○	○	○	○	◇	◇	○	○	○	◇
LCA	○	○	◇	◇	◇	●	◇	◇	○	○	○	◇	○	○	○	○	○	○	◇
Eco-design	○	◇	●	○	○	●	○	◇	◇	◇	◇	●	○	○	◇	◇	○	○	○
Energetic mix	●	●	●	◇	◇	●	○	●	◇	●	◇	●	◇	●	●	○	◇	○	●
Eco-innovation	◇	◇	●	●	◇	●	◇	●	◇	○	○	◇	○	◇	●	●	◇	○	●

Legend: HL—high level of environmental aspects and impacts, ML—middle level of environmental aspects, LL—low level of environmental aspects and impacts, LiL—limited level of environmental aspects and impacts, SC—special case of environmental aspects and impacts; ●—A tool that is very suitable for the given area, ○—Inapplicable tool, only secondarily applicable in the given area; ◇—Exploitable tool with restrictions.

Table 2. Level of environmental aspects and impacts of individual areas of economic activity.

Level of Environmental Aspects and Impacts	Area of Economic Activity According to NACE Codes
High	<ul style="list-style-type: none"> • Mining and Quarrying • Manufacturing
Middle	<ul style="list-style-type: none"> • Agriculture, Forestry and Fishing • Electricity, Gas, Steam and Air Conditioning Supply • Water Supply; Sewerage, Waste Management and Remediation Activities • Construction • Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles • Real Estate Activities • Human Health and Social Work Activities
Low	<ul style="list-style-type: none"> • Transportation and Storage • Accommodation and Food Service Activities • Professional, Scientific and Technical Activities
Limited	<ul style="list-style-type: none"> • Information and Communication • Financial and Insurance Activities • Administrative and Support Service Activities • Education
Special case	<ul style="list-style-type: none"> • Public Administration and Defense; Compulsory Social Security • Arts, Entertainment and Recreation • Other Service Activities

3. Results

The assessed car repair company meets the conditions and holds the certificate of a functional quality management system according to the standard STN EN ISO 9001:2015. The quality management system is applicable to all products and activities that the company provides:

- Car service inspections;
- Tire service for cars, SUVs and trucks up to 3.5 t;
- Cleaning and filling of air conditioning equipment;
- Engine and transmission oil change;
- Comprehensive inspection of the vehicle before MOT and emission control;
- Brake system service;
- Adjustment of lights;
- Maintenance and replacement of batteries;
- Body repair and painting;
- Replacement of windscreens;
- Measuring and adjusting the geometry of the 3D vehicle.

Their environmental performance is assessed through indicators in accordance with ISO 14031, and the company is preparing for certification of environmental management according to the current ISO 14001 standard.

The research was performed on a specific company—Ekol, Ltd. (Kosice, Slovakia)—at universities in the Slovak Republic focused on environmental innovation and green growth in the engineering industry.

The inputs into the company are primarily basic energies, such as water, gas, and electricity, which are used for routine hygiene and cleanliness, heating, and the lighting of

the premises. Furthermore, it also takes in information and investments, which include the knowledge and experience of employees and investments made to procure the current technologies and software needed for the activity. It also takes in the technologies and devices needed for each activity.

Its competitive advantages include the usage of diagnostic programs and software by employees, which are purchased directly from the producers of selected car brands and are also regularly updated, which facilitates the diagnosis of errors and speeds up the actual repair of cars. The company whose activities were the subject of our research could, from the point of view of greening, similar to all companies, be defined as an input–output system consisting of inputs, the transformation processes of inputs to outputs (technologies), and required outputs (see Figure 2).

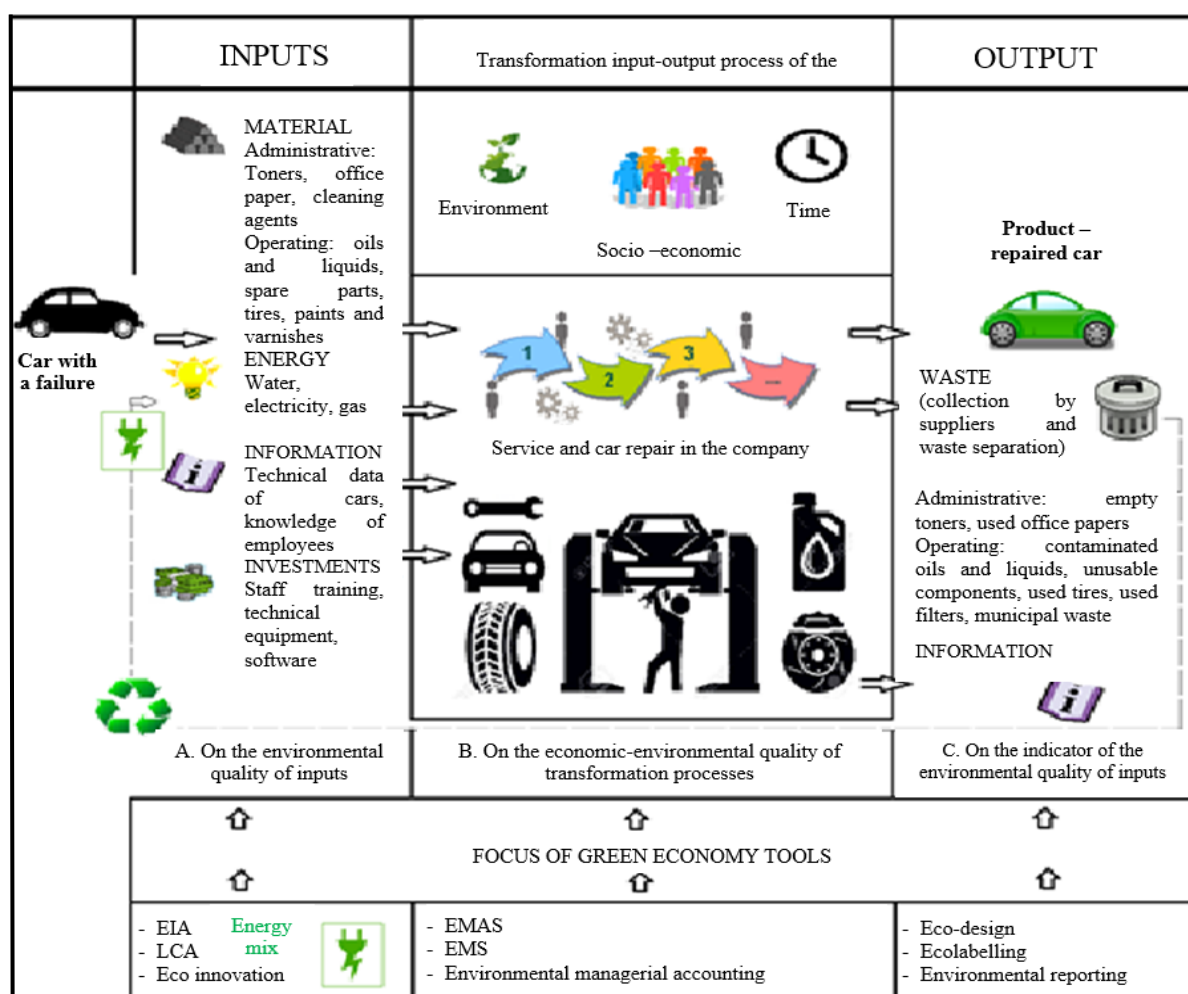


Figure 2. Car repair company as an input–output system.

Other inputs include materials in the form of spare car parts, oils, various operating fluids, tires, and the like. These materials and technologies directly enter the transformation process and are part of the individual activities that the company performs. During the transformation process, not only the final product—the repaired car—but also various by-products, particularly wasted materials and energy in the form of waste, are produced. Wastes as outputs are made up of used oils and coolants generated during replacement, and also include damaged or unusable car parts and used tires.

Oils and liquids are then divided, according to type, consistency, and level of pollution according to statutory rules and standards, into special packaging designed for this purpose. The covers are clearly marked so that workers can correctly categorize the various waste

liquids. The authorized company Ekol, Ltd. then weighs the separated oils and liquids as part of their contract covering the collection of hazardous waste. Ekol deals with the filtration, processing, and subsequent disposal of oil and liquid, as well as the sale of modified oils for further use. Ekol, Ltd. also collects other wastes from the company, such as substances and cloths soaked in oils and liquids, sorbents for extracting various types of liquids, and selected types of plastics that form part of the bodywork.

The produced waste and scrap also includes unusable components and parts from cars. These are directly exported for collection and are not recycled or reused by the company. Waste in the form of used tires is weighed and processed by the authorized companies that supplied the tires initially. The primary business pays a fee at the time of purchase to fund the recycling company to evaluate the tires at the end of their useful life.

Environmental and health records are kept in the form of controlled documentation, and they include confirmation of their acceptance and confiscation. This is due to the fact that the company is obliged to regularly send these records to the Ministry of Environment, and must be able to produce them during the regular inspections of the operation and storage of waste by the environmental inspection authorities and other concerned entities.

The activity of the researched company in the sense of NACE codes can be classified and characterized as the service and repair of cars. According to our proposed methodological concept in the field of economic activities, according to NACE codes [28], we classify business activities into the field of “Wholesale and retail trade, repair of motor vehicles and motorcycles”. The level of impact of the activities of the examined company is determined according to the model for the levels of impacts of activities [28]. According to the proposed concept, this company has a medium level of environmental impacts, which can also have a serious impact on environmental components, but also health, in their selecting of environmentally unsuitable inputs, technologies, and procedures during the transformation process, or the inappropriate or insufficient processing of undesirable output activities.

According to our proposed concept for areas of economic activity [28], after assignment to a suitable area, tools were identified whose application and use are best suited to the surveyed company, and which focus its activities in terms of improving environmental behavior according to potential usability, as specified in Table 3.

Table 3. Suitable tools for green growth for a car repair company.

Tools Green Growth and Green Economy	Exploitability of Tools According to our Research
EMAS III—Environmental Management and Audit	●—A tool very suitable for the given area
EMS According to ISO 14001	●—A tool very suitable for the given area
EIA—Environmental impact assessment	○—Not applicable tool, only secondarily applicable in the given area
EMA	◇—Exploitable tool with restrictions
Environmental reporting	◇—Exploitable tool with restrictions
Eco-labeling	○—Not applicable tool, only secondarily applicable in the given area
LCA—Life cycle analysis	◇—Exploitable tool with restrictions
Eco-design	○—Not applicable tool, only secondarily applicable in the given area
Energy mix	●—A tool very suitable for the given area
Eco-innovation	◇—Exploitable tool with restrictions

Footer: ●—A tool very suitable for the given area, ○—Not applicable tool, only secondarily applicable in the given area, ◇—Exploitable tool with restrictions.

After consistent analysis of the processes in the transformation input–output system, the input phase and the output phase were identified as the most environmentally significant areas. There is a lot of waste at the output phase, including hazardous waste, the collection and disposal of which the company funds heavily. The largest waste is waste oils and operating fluids generated during oil changes, oil pumps and tank repairs in automobiles. An authorized company disposes of waste oils in a sorted but not filtered

form. These services represent the highest financial costs, with the paying of high fees for hazardous waste treatment. In the reuse and recycling of these waste oils into the entry phase, we see potential for the company to save costs and simultaneously reuse waste oils; for example, for heating the used premises and the operation of hydraulic equipment. From the identified and analyzed tools, the use of green economy and green growth to solve the above problems appears to be very effective—in particular, the use of an energy mix in combination with the internal recycling of the unwanted outputs of production.

Before the actual implementation of the green instrument in the company's activities, it is necessary to identify and quantify inputs, especially material ones (Table 4).

Table 4. Material inputs into the car repair company.

Material	Brand	Price Per Package (EUR)	Quantity Per Year	Annual Costs (EUR)
Administrative:				
Toners	HP	26	7	182
	ORING	29	5	145
Office paper	COPY	3.37	20	67.4
	XEROX	4.21	20	84.2
Cleaning products	Soap FA	0.59	70	41.3
Operating:				
Motor oil	SHELL	11	4000	44,000
Gear oil	SHELL	15	150	2250
Coolant	G12	8.5	200	1700
Brake fluid	CASTROL	4.5	20	90
Air filter	BOSCH	10.5	1000	10,500
Pollen filter	BOSCH	8.5	600	5100
Oil filter	BOSCH	10	1000	10,000
Paint box filter	STANDOX	12.5	280	3500
	SIKENS	12.5	320	4000
Base color	DUPONT	15	150	2250
Colour standard	DUPONT	35	200	7000
Pearl color	DUPONT	50	450	22,500
TOTAL COSTS				113,409.9

Although corporate environmental awareness is on the rise, the results suggest that the application of specific tools to improve environmental behavior is rather stagnant in small and micro enterprises. After obtaining a certification of the quality management system according to STN EN ISO 9001: 2015, the researched company set itself the goal of not only maintaining its green behavior, but also advancing, taking the necessary steps and introducing other necessary voluntary environmental policy tools for the continuous improvement of green environmental behavior in the Deming cycle P-D-C-A.

For continuous improvement, we propose to focus the management's attention on input materials and their environmental suitability. The company buys products necessary for its operation and activities (shown in Table 4). However, if it wants to reduce its "environmental footprint", it should focus on whether the products meet the criteria of an environmentally sound product when selecting the materials to be purchased.

Identifying these products will be a helpful eco-labeling tool. The demand for such labeled products indicates that the consumer is interested in environmental issues, is active in this regard, and seeks to reduce their negative impact and thus contribute to the protection of their immediate surroundings and the wider environment. The signs that indicate suitable products include, for example, the Flower, which applies within the European Community, as well as the Blue Angel, which refers mainly to products of German origin, but also environmentally friendly Slovakian products or eco-friendly products used in the Czech Republic and elsewhere. Not all products can receive the mentioned designations. These are mainly dangerous products and products produced by processes that are dangerous, whether for human health or the environment.

Based on this tool, we suggest input materials that are marked with one of the mentioned brands, or are a more suitable or more environmentally friendly replacement for the environment (Table 5).

Table 5. Design of environmentally friendly material inputs for a car repair company.

Material	Brand	Price Per Package (EUR)	Quantity Per Year	Annual Costs (EUR)
Administrative:				
Toners	HP	26	7	182
	ORING	29	5	145
Office paper	COPY	3.37	20	67.4
	XEROX	4.21	20	84.2
Cleaning products	Soap Marseille	1.75	50	87.5
Operating:				
Motor oil	CASTROL EDGE	15.10	4000	60,400
	BIO-SYNTHETIC			
Gear oil	TOTAL BIOTRANS FX	19.90	150	2985
Coolant	SHELL Glycocool G30	3	160	480
Brake fluid	Silicone DOT 5	9	20	180
Air filter	BOSCH	10.5	1000	10,500
Pollen filter	BOSCH	8.5	600	5100
Oil filter	BOSCH	10	1000	10,000
Paint box filter	STANDOX	12.5	280	3500
	SIKENS	12.5	320	4000
Base color	MIPA PRIMER	22	150	3300
Colour standard	MIPA	39	200	7800
Pearl color	MIPA PEARL	57	450	25,650
TOTAL COSTS				134,461.1

As administrative materials we used brand toner and office paper because the company recently acquired a new printer in which it is advisable to use only specific types. Under the green thinking requirements, it would be uneconomical to buy new printers that are more environmentally friendly. We proposed to the company the establishment of cooperation with Cart4future, Ltd. (Jalubi, Czech Republic), which deals with the collection and recycling of used toners, cartridges, and paper. The company will provide a collection box made of recycled cardboard, where the used administrative material is collected, and after it is filled, the company will pick up the collection box and provide another empty box for collection. With active participation in the program and proper waste sorting, it is even possible to obtain various rewards in the form of office supplies and aids. With this step, the company can not only reduce the amount of hazardous waste generated, but can also reduce the cost of administrative materials (especially office paper) with the correct sorting of waste.

For operating materials, we have proposed a change of engine oil to the Castrol Edge biosynthetic brand, which contains 25% plant-based oil. We opted for the Total Biotrans FX gear oil for better biodegradability. We chose Shell Glycocool G30 for the coolant. This guarantees that the liquid does not contain nitrites, amines, borates, or phosphates. It is made based on ethylene glycol and is diluted with water before use, thanks to which a smaller amount can be consumed than with the type of coolant used previously. We replaced the brake fluid with the Silicone Dot5 brand, which is composed of faster-degradable silicones.

In the case of filters, we will focus mainly on their recycling or disposal, as the filters themselves are not so harmful to the environment. Only their subsequent pollution by substances that absorb and filter poses a danger to human health and the environment. Both in the disposal of waste oils and in the disposal of used filters, the company Autoop has agreed to cooperate with the company Ekol, Ltd.

The colors used for painting cars have been replaced with the brand Mipa. This brand offers base, basic, but also pearlescent paints, which the company uses, but at the same

time they are not composed of dangerous halogens and phenols, do not contain heavy metals, are water-soluble, and use components that are biodegradable, unlike the currently used Dupont brand. Although they are not labeled as environmentally friendly products, they meet the criteria required in this product group for labeling.

The execution of the proposed changes in purchased products would have brought the company several benefits related to green behavior:

- Strengthening pollution prevention at the expense of remediation, as prevention is generally more cost-effective than remediation;
- Support for the production and consumption of selected products with a lower negative impact on the environment and meeting the criteria of environmental suitability;
- Raising awareness of the environmental performance of products, their objectives, and benefits;
- Supporting the decline in the use of limited reserves of non-renewable resources in nature;
- Contributing to the creation and protection of environmental and public health components, and promoting waste minimization as a contribution to the circular economy.

Environmental problems include that the company generates a large amount of waste at the output. In particular are the used filters, impaired liquids, and oils, which are then shipped away and disposed of by an authorized, company Ekol, Ltd. Therefore, in the output stage, we propose to change the approach to waste management and recycling, with the intention of re-utilization within the application of a progressive green instrument—energy mix.

The implementation of the energy mix in the company involves several phases and processes. The first phase is the recycling of waste oils with further usability for heating purposes. The company classifies degraded oils in marked containers according to the type. Subsequently, the company uses Ekol, Ltd. for their removal and disposal. The company Ekol, Ltd., however, filters some types of oils, and then sells them to other companies for combustion and space heating. The company pays for the “liquidation” service expenses listed in Table 6.

Table 6. Expenditures on waste disposal by Ekol, Ltd.

Consumables—Waste	Disposal Costs (EUR)	Amount Consumed	Total Costs of the Disposal (EUR)
Oil filters	0.27/pcs.	1000	270
Motor oil	0.20/1l	4000	800
Gear oil	0.22/1l	150	33
Total costs			1103

Based on the quantified expenses paid by Ekol, Ltd., we can state that the largest share of these costs is due to the fees paid for the disposal of motor oil, which can be used further. Therefore, we propose to the company to purchase space-heating equipment powered by the combustion of filtered waste oils, which would not only reduce the total annual waste disposal costs by UER 800, but also reduce the costs of water heating and space heating during the winter months. The best choice would be to install an oil–solar hybrid heating system. This system is able to accumulate renewable energy from solar radiation and thus reduce not only the cost of heating and hot water, but also the consumption of waste oil. The hybrid heating system consists of the following parts:

- Heating equipment;
- Reservoir oil;
- System supplying air and at the same time discharging flue gases;
- Oil condensing boiler;
- Hot water draw-off point.

Hybrid technology is not only a time-tested, affordable and compact solution, but also above all an efficient way of heating, as it can use up to 98% of the fuel thanks to

the combustion effect. The system uses heat recovery from the flue gas, which in the case of other systems is unused and discharged through the chimney. An intelligent hybrid heating control system can combine the use of multiple energy sources, the level of costs and, based on this, use the most environmentally friendly and economical combination of sources for space heating and water heating. The device must be placed at least 5 cm from the wall, and along the remaining sides it is necessary to keep a distance from other objects and walls of at least 40 cm. The oil reservoir should be at least 1 m away from the device, and a radiation-protecting sheet metal material should separate it; it should be placed in a watertight, usually brick bath.

However, the implementation of this system requires certain conditions be met. The heating system includes an oil reservoir. If this tank stores more than 5000 L of oil, the device system must be located in a separate room. The surveyed company produces approximately 4000 L per year of waste oil, which allows the equipment to be located within the work area. Another condition for the storage room is the need to have a self-closing door. The room with the installed system must not be in the roof area, near the staircase, or in a transition room. It is essential that these areas and their entrances comply with fire protection requirements.

We see this type of solution with multiple sources of energy as the most appropriate in connection with the fact that the amount of waste oil as an output of the business process is not sufficient to heat the premises via hot water throughout the year.

To ensure the energy mix in the company requires only waste material. Following the original process of introducing the selected green tool, we propose as a next step the introduction of a photovoltaic system on the roof of the company building. If the energy is obtained through photovoltaic devices, it brings not only reduced heating costs via the hybrid system, but also reduces expenditure on energy usage.

The photovoltaic system generates electricity with the help of solar radiation. Solar energy is transformed into electricity via the photoelectric effect, which is due to the irradiation of light from the surface of semiconductors, and metals emitting electrons. Photovoltaic equipment is most often placed on the roofs of buildings and consists of modules and a current converter, which converts direct current into an alternating current usable for business purposes. Following on from hybrid heating and savings on electricity costs, the photovoltaic system must also be equipped with an electricity accumulator. The purpose of the accumulator is to store the energy obtained from solar radiation and to facilitate the possibility of pumping it even if the solar radiation is not sufficient and it thus is not possible to produce electricity using the photovoltaic system. The accumulator prevents the loss of excess energy during the time when the conditions for its production are suitable, and it collects energy with the possibility of later use. When purchasing and installing a photovoltaic system, the following parts must be procured:

- Photovoltaic panels;
- Energy accumulator;
- Skeleton;
- Current converter;
- Charge controller;
- Regulator of energy transmission into the system;
- Control device;
- Electrical installation material;
- Mounting material.

4. Discussion

We here discuss the area of corporate environmental management (environmental sciences) in the context of the economic and social pillars of sustainable production and consumption (environmental economics), as well as in selected technical sciences, which are directly related to this area.

After the successful installation and connection of the system, it is necessary to perform certain tests and revisions. Only after their successful implementation it is possible to put the system into operation. To design a suitable photovoltaic system, it is first necessary to examine the company's energy consumption. For the purposes of our proposal, we took into account the usage of electricity during the period of 2018 and 2019, looking at individual months (Table 7).

Table 7. Electricity consumption in the company Ekol, Ltd.

Month	Energy Consumption		Energy Costs (EUR)	
	2018	2019	2018	2019
January	718.2 kWh	678.2 kWh	135.74	128.18
February	615.8 kWh	630.4 kWh	116.39	119.15
March	764.9 kWh	714.6 kWh	144.57	135.06
April	660.4 kWh	599 kWh	124.82	113.21
May	702.7 kWh	693.8 kWh	132.81	131.13
June	680.6 kWh	708.1 kWh	128.63	133.83
July	612.3 kWh	615.9 kWh	115.72	116.41
August	700.2 kWh	679 kWh	132.34	128.33
September	593.8 kWh	571.8 kWh	112.23	108.07
October	690.6 kWh	645.7 kWh	130.52	122.04
November	643.2 kWh	699.1 kWh	121.56	132.13
December	580 kWh	546.8 kWh	109.62	103.35
Total values	7962.7 kWh	7782.4 kWh	1504.95	1470.87

From the table, we infer that the electricity consumption is mostly constant, and can reach up to 8000 kWh consumed per year. As a solution, we created a system assembly that would be suitable for the needs of the company. The data of the prepared set are given in Table 8.

Table 8. The project of corporate photovoltaic system.

Design of a Photovoltaic System Assembly					
Executive Board	Connection method	Approximate annual electricity production	Number of photovoltaic panels	Price of delivery and installation of the system	Price after deduction of the subsidy
8.215 kWp	3-Phase	8480 kWh	32	EUR 12,839.58	EUR 10,289.58

We concluded that from a business point of view, the most suitable would be the arrangement of thirty-two pieces of photovoltaic panels with a total output of 8480 kWh. This performance slightly exceeds the current values of the company's consumption, but in the calculation, we took into account several factors.

The first factor is a hybrid heating device, which will slightly increase electricity consumption, and therefore it is desirable for the photovoltaic system to produce energy at higher values than previously measured. Another reason is the possible growing trend in electricity consumption, which may occur during the modernization or expansion of the company in the future. Last but not least is the fact that the production of panels is only approximate, and therefore it is more reasonable to use more panels with a higher estimated production than is necessary, as this can capture more sunlight even in bad weather conditions, and meet the required amount of produced energy.

Figure 3 shows the dimensions of the roof spaces and their division, in relation to the activities performed, into the administrative and operational parts of the building.

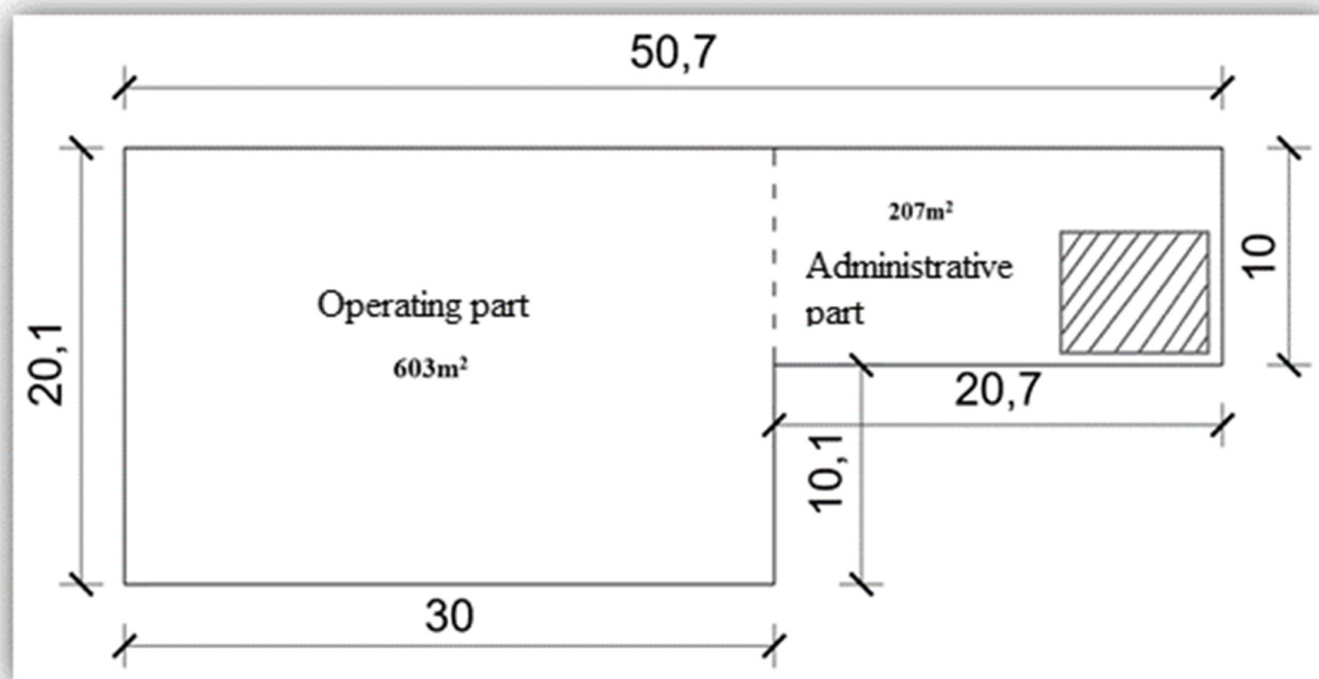


Figure 3. Dimensions of the corporate roof space.

The roof space of the administrative part is 207 m^2 , while the operating part is almost three times larger, with the dimensions of 603 m^2 . Together, the roof has an area of 810 square meters, which is enough space for the implementation of the proposed photovoltaic system.

The standard design of photovoltaic panels is $100 \times 120 \text{ cm}$, which would offer 38.4 m^2 for the proposed 32 pieces. The space that the photovoltaic panels would cover with the given assembly is indicated in Figure 2 by hatching. The panels are oriented towards the southeast to obtain as much sunlight as possible. The company has enough space for the possible additional expansion of the system.

The design of a complete photovoltaic system by the company Ekosolution, Ltd. (Presov-Nizna Sebastova, Slovakia) has not only panels, but also the electronic elements and material necessary for the installation of the system. The price offer also includes assembly work. However, the resulting amount is only a rough estimate, as the price depends on other factors depending on the requirements and needs of the customer. The company also has the opportunity to reduce the resulting amount by applying for a subsidy of renewable energy sources, which supports the use of renewable energy sources.

The subsidy is provided not only for photovoltaic systems, but also for heat pumps and biomass boilers, so the company can apply for it when purchasing a hybrid heating system.

The final amount required for the acquisition of a photovoltaic system, in the form of approved subsidies, is EUR 10,289.58. This investment for small business can initially seem high; therefore, using the data obtained, we calculated the estimated time of return.

The return on investment in a photovoltaic system has been estimated at about seven years. However, for environmental projects, such a payback period is generally acceptable.

Another part of the energy mix, which is an important part of business processes, is water. Water is an irreplaceable natural resource that is exhaustible, and it is therefore essential that the behavior of companies in this area is economical and environmentally friendly. The amount of this energy that enters the company and is used in business processes is also large, and therefore we have been looking for alternative solutions and proposals for this type of energy, considering how to save not only on heating but also

on the high consumption and related costs. The cost of heating water by way of these measures should fall significantly.

According to Table 9, we can conclude that the actual water consumption is similar to the electricity consumption of an average constant evolution. However, the total cost is about 7 times higher than the cost of electricity. Therefore, we are not focused on designing solutions only to reduce costs, but also to reduce overall consumption by recycling water.

Table 9. Consumption and costs of water.

Year	Water Consumption		Total Water Consumption	Costs (EUR)		Total Costs (EUR)
	Cold Water	Hot Water		Cold Water	Hot Water	
2018	1637 m ³	1035 m ³	2672 m ³	4714.25	3175.55	7889.8
2019	1575.72 m ³	978.33 m ³	2554.05 m ³	4357.44	2959.7	7317.14

Water consumption involves one of the largest energy costs that a company has to spend in relation to the activity it carries out. After servicing and repairing the vehicle, the company automatically provides the service of washing and cleaning the exteriors of all cars that have been serviced. This service is free of charge, introduced as one of the competitive advantages in an effort to get more clients. Customers appreciate and evaluate this service positively, but high water consumption also represents uncovered costs for the company.

Therefore, in order to help the company maintain the provision of this service and maintain an advantage over competing companies, we propose that the company install a collection container under the floor of the washroom that will accumulate and purify the water used to clean cars.

Application proposals for green growth in the implementation of most of the energy mix in corporate practice for saving costs are roughly quantified in Table 10.

Table 10. Calculation of the average annual costs of a car repair company.

Type of Costs	Average Value of Costs Per Year (EUR)
Waste oil disposal	800
Electricity consumption	1487.91
Water consumption (hot + cold)	7603.47
Total costs saved	9891.38

5. Conclusions

Through verifying the developed theoretical and methodological principles of less formalized instruments of environmental policy and greening through a case study of the specific conditions of a small car repair company, our selection model in relation to economic activity according to NACE codes was confirmed. This was especially pertinent in the field of the environmentalization of business inputs (material, information, working equipment, working items, etc.) and the energy mix.

The research can be extended to the issue of wastewater, which is currently solved by interconnection with a wastewater treatment plant in the industrial zone of the small car repair company.

As part of the greening of the production, more environmentally friendly materials were selected as inputs into the company, and an energy mix with the usage of photovoltaic panels was also designed for use in the transformation process.

Even from the point of view of the elaboration of tools and the specifics of environmentalization, such projects usually do not bring immediate economic effects, but do significantly contribute to the greening of economic growth.

Environmentally innovative proposals would bring the company slightly increased costs associated with the procurement of the proposed equipment in the first few years, but it would also gain almost complete self-sufficiency in consumer energy procurement,

as well as competitive advantages, and more responsible and environmentally sound operations and sustainable green growth.

In the calculations that were made in this paper, we used the average costs obtained from the company for the period 2018–2019. The total saved costs of EUR 9891.38 represent the approximate costs that the company pays for the use of energy and the disposal of hazardous waste.

Author Contributions: M.M. and N.D. drafted the theoretical problem according to environmental innovation and green growth in the repair and maintenance of cars. P.M. and V.R. wrote article. S.A.S.A.-R. lead the discussion. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by KEGA 002TUKE-4/2020, KEGA 032EU-4/2020, APVV-19-0418.

Institutional Review Board Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

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