Machine learning: a catalyst for green economy transformation, with implications for the Republic of Moldova

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To cite this article:

Hamuraru, M., Cojocaru, A. (2024). Machine learning: a catalyst for green economy transformation, with implications for the Republic of Moldova. Romanian Journal of Economics, 58(1), pp. 18 - 29

***Abstract. Objective**: The modern world is witnessing a remarkable surge in the adoption of machine learning (ML) techniques, driven by advancements in computational power and data availability. The aim of this article is to develop a conceptual model for transforming the economy of the Republic of Moldova into a green economy, using artificial intelligence (AI). This model aims to provide recommendations for the implementation of the National Development Strategy "European Moldova 2030" and the Energy Strategy of the Republic of Moldova until 2030 policies. In order to achieve the set goal, the following specific objectives are proposed: - Define machine learning (ML) algorithms to support the achievement of the objectives of the National Development Strategy "European Moldova 2030" and the Energy Strategy of the Republic of Moldova until 2030; - To exemplify how to apply the identified algorithms in order to facilitate the achievement of the strategic objectives in the following directions: energy efficiency, renewable energy, sustainable agriculture, waste management and smart transportation. **Method**: The techniques employed in this article include: logical-deductive reasoning, observation, analogy, comparative analysis, graphical and tabular methods, historical analysis, synthesis, modelling. **Results**: The result of the research entails the development of a conceptual model to facilitate the Republic of Moldova's transition to a green economy. It highlights opportunities for leveraging machine learning in pivotal domains, including energy, agriculture, waste, and transportation, in alignment with national development strategies. **Originality**: Our study presents an original approach to the integration of machine learning techniques in the context of the green economy of Moldova. While the application of machine learning in green economy initiatives has been explored in various contexts, our research focuses on its potential and relevance specifically in the Republic of Moldova.*

***Keywords**: green economy, artificial intelligence, machine learning, national strategy, model.*
***JEL classification**: O38, Q01, Q57*

1. Introduction

The development of artificial intelligence offers unprecedented opportunities to address pressing global challenges, including the need to develop a green economy. The Republic of Moldova, a country that suffered a lot of crises, including the severe energy crisis in 2022, has much to gain by

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harnessing the power of AI to build a sustainable future. Artificial intelligence is a broad field that refers to the use of technologies to create machines and computers that can mimic cognitive functions associated with human intelligence, such as seeing, understanding, and responding to spoken or written language, analysing data, making recommendations, and so on. Although artificial intelligence is frequently regarded as a system in and of itself, it is actually a collection of technologies applied in a system to enable it to reason, learn, and act in order to solve a complex problem.

2. Literature review

Burkov (2019) in his book explores the concept of machine learning and its types. In the research, Burkov's opinions were used for identifying the practical solutions offered by the machine learning algorithms to solve real-life problems. Taffese & Sistonen (2017) review the capability of machine learning in addressing the limitations of classical prediction models. Their findings were later used in our research to develop the conceptual model of transition to the green economy. Cios et al. (2007) introduce the concept of clustering, as an example of unsupervised learning, present the basic terminology, offer a commonly encountered taxonomy of clustering algorithms, and discuss in detail some representative algorithms. This information was used in the research to characterize and define the particularities of different learning types specific for the ML.

The energy strategy of the Republic of Moldova until 2030 was used to assess the energy situation at the country level, as well as the objectives set by the state to solve the identified problems and improve the situation in the energy field.

The National Development Strategy "Moldova 2030" served as a basis for identifying the priority actions needed to be implemented for ensuring the transition to the green economy and searching for the relevant ML algorithms which can be used.

3. Methodology and data

In this research quantitative and qualitative techniques have been used for elaboration of the conceptual model of transition to green economy in the Republic of Moldova. The paper includes statistical analysis of energy consumption, number of regenerable production units and consumption of electricity. The result has been reflected using logical-deductive methodology, observation, analogy, comparative analysis, graphical and tabular methods, historical analysis, synthesis and modelling.

4. Research results and comments

While AI and machine learning are not the same thing, they are closely related:

- AI is the broader concept of allowing a machine or system to sense, reason, act, or adapt in the same way that humans do.
- ML is an AI application that lets machines to extract information from data and learn on their own.

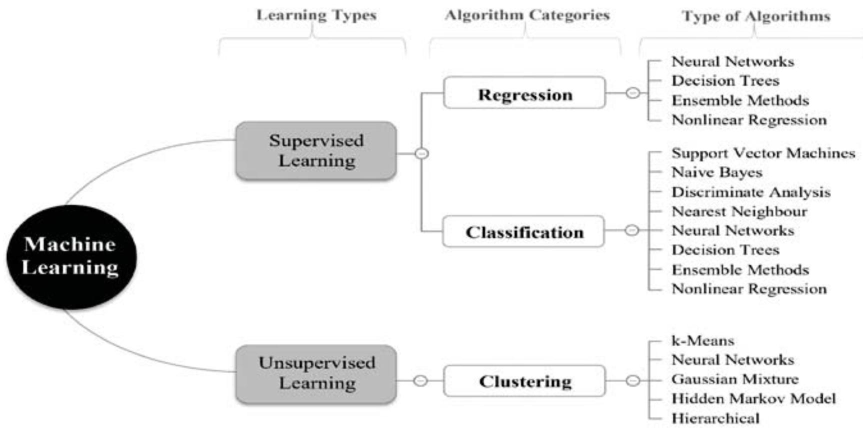
A helpful way to remember the difference between AI and ML is to imagine them as umbrella categories. Artificial intelligence is a broad word that encompasses a wide range of specialized methodologies and algorithms. Machine learning is included, but so are other significant subfields such as deep learning, robotics, expert systems, and natural language processing (*AI Vs. Machine Learning: How Do They Differ? |Google Cloud*, n.d.).

Building algorithms that rely on a set of examples of a phenomenon in order to be useful is the focus of the computer science subfield of machine learning. These illustrations may be taken from nature, created by hand by people, or produced by another algorithm. The method of solving a real-world problem by amassing a dataset and then algorithmically creating a statistical model based on that dataset is sometimes referred to as machine learning. It is assumed that the statistical model will be applied in some way to resolve the real-world issue (Burkov, 2019).

To address problems using machine learning techniques, an algorithm must be created. Machine learning algorithms use a variety of techniques from many disciplines, such as pattern recognition, data mining, statistics, and signal processing. This makes it possible for machine learning to benefit from the synergy between all of these fields, which in turn produces strong solutions that draw on several knowledge domains. Figure 1 depicts some of the most important algorithms that have been widely applied in supervised and unsupervised learning types.

Supervised learning is a sort of machine learning that involves training an algorithm with labelled samples or "inputs" and their matching "outputs." This way, the algorithm is taught how to predict or make decisions based on samples of what the correct answer should be for various inputs.

Figure 1. Machine learning types with commonly adopted algorithms



Source: Taffese & Sistonen, 2017.

Regression is a statistical technique used in machine learning to analyse the relationship between a dependent variable (also known as the target variable) and one or more independent variables (also known as predictors or features). It aims to find a mathematical model that can predict or estimate the value of the dependent variable based on the values of the independent variables. For example, we may declare that the output for a particular feature value x1 is y1, x2 is y2, x3 is y3, and so on. Based on this information, we instruct the computer to calculate an empirical relationship between x and y. Once the machine has been trained in this manner with a sufficient amount of data points, we may ask it to predict Y for a given X. Assuming we know the true value of Y for this given X, we may determine whether the machine's forecast is right. Thus, we will use known test data to determine whether the system has learned. We can halt further training the machine if we are happy that it can make the predictions with the necessary level of accuracy (say, 80 to 90%). We can now safely use the machine to forecast unknown data points, or ask it to predict Y for a given X for which we do not know the true value of Y (Tutorials Point, 2019).

Classification is a machine learning technique that categorizes or assigns data instances based on their properties or attributes into predetermined classes or categories. A software in Classification learns from a given dataset or observations and then classifies additional observations into one of several classes or groupings. For example, Yes or No, 0 or 1, Spam or Not Spam, cat or dog, and so on. Classes can also be referred to as targets/labels or categories.

In contrast to regression, the outcome variable of Classification is a category rather than a value, such as "Green or Blue", "fruit or Animal", and so on. Because the Classification method is a Supervised learning technique, it requires labelled input data, which implies it contains input and output (Javatpoint, n.d.).

Unsupervised learning is a sort of machine learning in which the algorithm learns from unlabelled data without any specific direction or output labels. In a word, clustering is about uncovering structure in data collections through abstraction. Clustering is a difficult task, both conceptually and computationally. As the name suggests, a good unsupervised algorithm is expected to be capable of detecting structure on its own by examining similarities or differences (such as distances) between individual data points in a data collection.

This extremely intuitive and appealing guideline is deceptively simple: cluster two data points if they are "close" to each other, and then repeat the process by examining the distances between newly formed clusters and the remaining data points. The number of alternative cluster formation algorithms is huge, and many approaches attempt to identify what "similarity" between data components entails (Cios et al., 2007).

Machine learning can ensure the green economy by identifying and implementing efficient and sustainable solutions to environmental problems. This can be done by analysing data and identifying patterns and trends that can be used to make informed decisions about managing natural resources, reducing greenhouse gas emissions, improving energy efficiency, and more. Machine learning can help optimize processes and develop innovative solutions to environmental problems, helping to build a more sustainable economy.

Machine learning can ensure a green economy in the following ways:

1. Energy efficiency: Machine learning algorithms can analyse energy consumption patterns and identify areas where energy is being wasted. By optimizing energy use, machine learning can reduce carbon emissions and help businesses save money.

2. Renewable energy: Machine learning can help predict renewable energy production based on weather patterns and other factors. This information can be used to optimize the use of renewable energy sources, reducing dependence on fossil fuels.

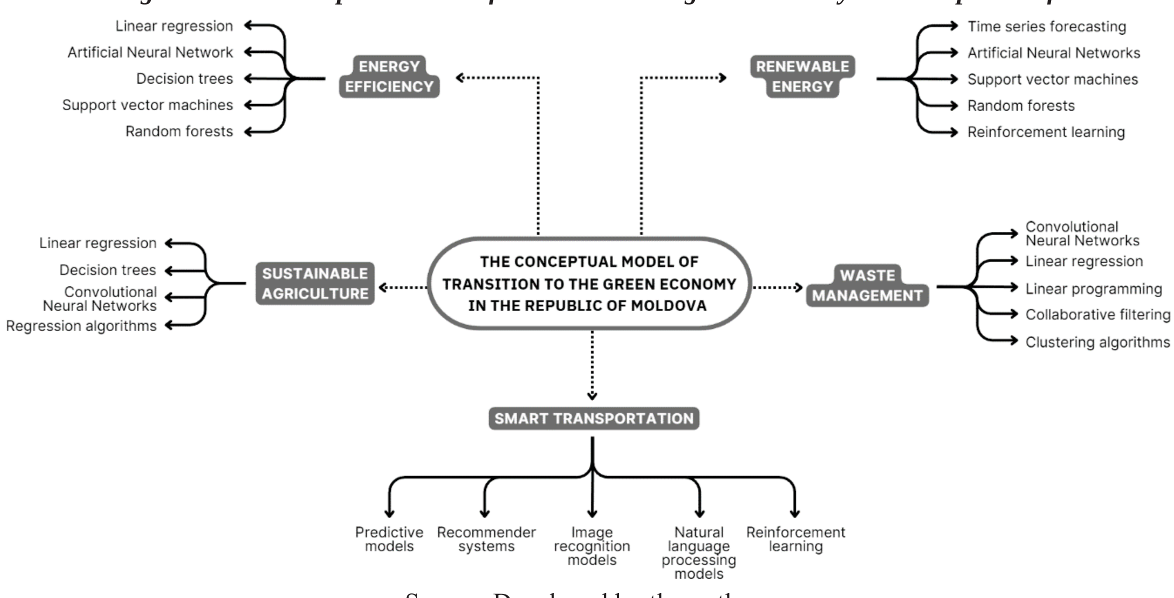
3. Sustainable agriculture: Machine learning can help farmers optimize crop yields while reducing pesticide and fertilizer use. This can help reduce the environmental impact of agriculture.

4. Waste Management: Machine learning can help identify patterns of waste generation and disposal. This information can be used to optimize waste management processes and reduce the amount of waste that ends up in landfills.

5. Smart transportation: Machine learning can optimize transport systems to reduce congestion and emissions. This can be achieved through intelligent traffic management systems, carpooling services and electric vehicles.

The Republic of Moldova can benefit greatly from using different types of algorithms of machine learning in its route to a green economy transition. By identifying the suitable algorithms which can be used in order to ensure each of the five directions mentioned above, a conceptual model was created and presented in Figure 2.

Figure 2. The conceptual model of transition to the green economy in the Republic of Moldova



Source: Developed by the authors.

There is no denying that the algorithms presented in Figure 2 were already implemented at an international level in ensuring a green economy. In our opinion, these best practices can be adapted to the Republic of Moldova as well, by corelating the machine learning models to the country’s specifics.

For instance, Northmore Gordon, a boutique energy consultancy, uses a regression analysis approach based on the International Performance Measurement and Verification Protocol to offer a statistically accurate measure of the savings from an energy efficiency project or group of projects.

They can also provide the statistically verifiable likelihood of the savings results falling within the upper and lower bounds using this approach. Furthermore, they employ regression analysis to provide energy efficiency and carbon reduction certifications, which can generate additional cash for enterprises.

Their model of regression analysis can be adapted to the specifics of the Republic of Moldova by following the steps for developing the regression model:

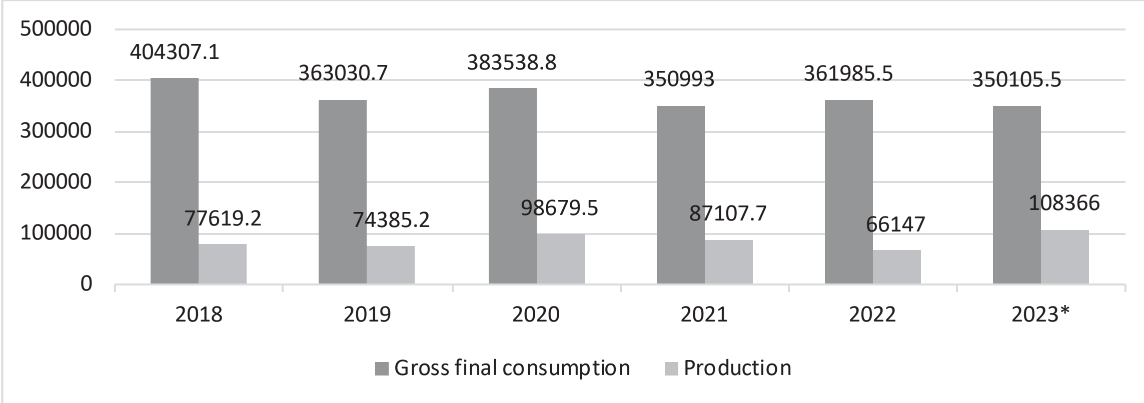
1. Identify all the independent variables. These are parameters that are known to influence the facility's energy usage. All of the variables can be combined into a single model to compare pre- and post-performance. The following examples of common independent variables are used in energy regression models: heating degree days, cooling degree days, ambient temperature, plant production, facility occupants;
2. Collect the data. Without a strong reference to how much was present previously, determining the amount to which something is absent is impossible. In terms of energy conservation, this entails defining a baseline period for a whole operating cycle, which can be a full calendar year. Data anomalies and obvious outliers should be resolved to ensure that only valid data points are used.
3. Graph the data. Graphing the data to gain a visual depiction of the independent variable impact on energy consumption might be useful if a single variable is responsible for the majority of the variance in energy consumption; however, a graph is less useful if there are numerous factors. A regression analysis is used to create a model, or algorithm, for the relationship between energy usage and the variables. A simple regression will suffice in some circumstances. However, in many circumstances, numerous independent variables influence energy use. In these cases, more complex multiple regression models will be required to accurately capture the dynamic effect of the factors on energy consumption.
4. Test the regression model's effectiveness. Several statistical tests can be used to verify whether the model is an accurate and fair representation of the system. While not exhaustive, R-squared t-statistics and residuals are the essential tests for validating a regression model (Clarke, 2022). The national development strategy "European Moldova 2030" (hereinafter NDS) adapts the priorities, objectives, indicators, and targets of the international commitments made by the Republic of Moldova to the local context in order to address the long-term development directions of the nation and society. In the NDS, the government establishes the priorities for the country (*The National Development Strategy "Moldova 2030"*, 2022). Its structure and components serve as the foundation for the creation of the national strategic planning framework. Using the conceptual model previously presented, we will concentrate on finding ways to accomplish the following specific goals from the NDS:
   - Increasing mobility via effective, environmentally friendly, and secure transportation systems;
   - Active transition to a circular and green economy.

At the same time, the conceptual model establishes the correlation between the above-mentioned objectives and priority policy directions and interventions, such as: security and energy efficiency; energy from renewable sources; sustainable development of agriculture; environmental protection policies and management; transport and road infrastructure policies and management.

Energy efficiency and renewable energy. The Republic of Moldova is almost entirely dependent on the importation of fossil fuels and electricity because it lacks any domestic energy resources (Figure 3).

Due to recent developments on the regional energy markets brought on by the recovery of the post-pandemic economy and the war in Ukraine, gas prices have significantly increased in the Republic of Moldova since October 2021 (the purchase price of gas increased from 265 USD/1000 m^3 in 2021 to USD 1193/1000 m^3 in April 2022 and USD 919/1000 m^3 in May 2022). The population's level of energy poverty increased as a result of the unanticipated excessive price increase, which led to price hikes in all commodities, including electricity. The ability of the most vulnerable residents to afford to pay their winter heating bill has also been significantly impacted by this (60% of Moldova's population lives in energy poverty and spends more than 10% of their income on energy bills) and the national finances. The conflict in Ukraine and the resulting refugee crisis, as well as a decline in remittances from Russia and Ukraine, increased the strain on the Moldovan economy (*Addressing the Impacts of the Energy Crisis in the Republic of Moldova*, n.d.).

Figure 3. Production and gross final consumption of electricity in the Republic of Moldova 2018-2023, MWh



* - the data represent the average of the period January - April 2023
Source: Stocks, Inputs and Electricity Consumption by Indicators, Years and Months-PxWeb, n.d.

The Republic of Moldova's energy strategy, which runs through 2030, lays out specific benchmarks for how the country should develop its energy industry in order to provide the required foundation for both social and economic progress. In the rapidly shifting energy context of the geopolitical area that includes the region of Central, Eastern, and Southern Europe, Russia, and the Caucasus region, the Government of the Republic of Moldova offers the vision and highlights the country's strategic potential through this document. The strategy highlights the country's top issues, which call for immediate solutions and a scaling back of the goals in order to strike an ideal balance between: domestic resources (both those available now and those anticipated in the future), the country's urgent needs, the goals of the European Union and the Energy Community, and the national targets; and international obligations regarding treaties, agreements, and programs (including the Kyoto Protocol).

Table 1. Existing renewable energy sources' electricity generation capacities (January 2023)

#	Source/ Technology	Installed power, [MW]
		Electricity
1.	Hydroelectric plant	16,25
2.	Photovoltaic /PV/ power plants, including net metering	60,13
3.	Wind power plants	115,10
4.	Biogas cogeneration power plants	15,33
	TOTAL	**206,81**

Source: Energy Efficiency Agency, n.d.

The Energy Strategy predicts that smart grid technologies and apparatus will indubitably will be economically feasible and will become a de facto norm for the power business between 2021 and 2030. The topologies, balancing, measurement, monitoring, and energy mix of the system will all be significantly altered by this form of structuring of the energy system. The assimilation of rising percentages of electricity from renewable sources will benefit from all these advances (HG 102/2013). Currently, the capacities of the renewable energy sources in the Republic of Moldova sum up 206.81 MW.

In order to guarantee progress in the energy efficiency and renewable energy, the following policy directions and priority interventions (*The National Development Strategy "Moldova 2030"*, 2022) can be ensured by using the ML algorithms:

1. Increasing energy autonomy at the local level by encouraging the establishment of regional eco-energy centres.

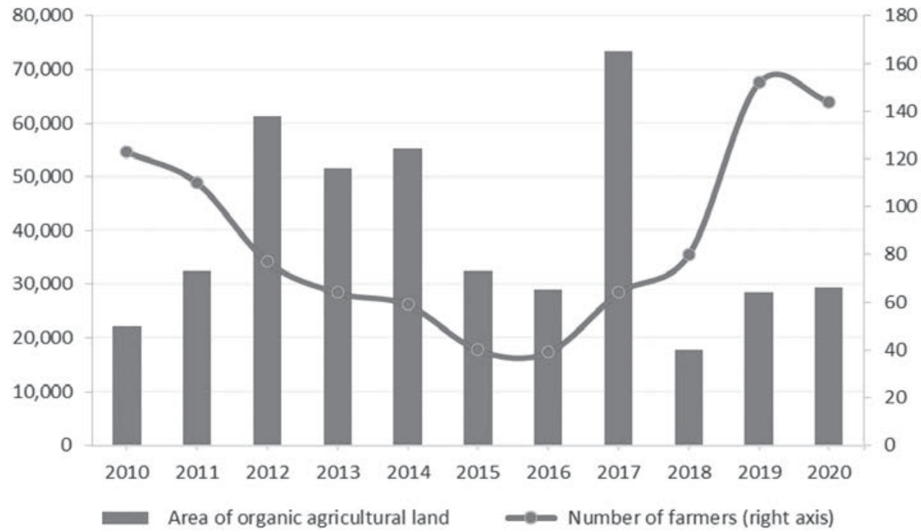
Linear regression and artificial neural networks can be used to evaluate and anticipate renewable electricity generation capacity depending on key influencing factors such as available natural resources, demography, or consumption trends.
Decision trees and support vector machines can be used to find and pick the best places for the establishment of regional eco-energy hubs, taking into consideration factors like solar exposure, wind speed, and power grid accessibility.

2. Subsidizing final consumers for setting up energy efficiency measures during the cold season.
   Decision trees and support vector machines have the potential to find and pick the most effective energy saving measures based on building and user attributes.
3. Promoting investment in energy storage from renewable sources.
   Artificial neural networks and time series forecasting can be used to estimate levels of renewable electricity output and consumption depending on influencing factors like renewable resource availability or consumption trends.
   Reinforcement learning and random forests can create algorithms for managing and optimizing energy storage systems to ensure an efficient and balanced usage of renewable energy based on market requirements and conditions.
4. Creating the environment for industrial-scale production of woody biomass and expanding production capacities for various types of biofuels.
   Based on characteristics like planted area, growth rate, and moisture content, linear regression and artificial neural networks can estimate the output of woody biomass and biofuels.
   Based on quality, yield, and environmental impact requirements, decision trees and support vector machines can select the best wood species and processing processes.
5. Promoting ecological entrepreneurship through the establishment of sustainable businesses and the provision of decent jobs.
   Linear regression and artificial neural networks can be used to evaluate the impact of environmental interventions on the economy, employment, and sustainable development based on factors such as investment, employment, and energy efficiency.
   Green business prospects, sectoral intervention models, and customized approaches based on local characteristics and resources can be identified using decision trees and random forests.

Sustainable agriculture. Agriculture is an important sector for the national economy, despite its declining GDP contribution. Agriculture's contribution to GDP formation in 2020 was around 10%, nearly half of what it was in the 2000s, and it will be 14% in 2021. Given that agriculture is a sector that is very vulnerable to climatic circumstances, the state has considered that sustainable agricultural growth, including greening the sector, is a recommended answer to the difficulties. As a result, ecological agriculture is viewed through the lens of agri-food items produced without the use of certain synthetic chemicals (also known as organic or eco production). In addition, industrial technologies must be environmentally benign and have a minimum detrimental impact on biodiversity.

Despite progress in the legislative dimension of organic agriculture (regulations pertaining to certification, inspection, marking, export, and so on), production capacity has not risen much. Figure 4 depicts an uncertain evolution of both the number of farmers involved and the size of ecological agricultural land. According to the Ecological Agriculture Atlas, 144 ecological agricultural producers were operational at the end of 2020, processing an area of around 29.3 thousand hectares, or 1.4% of the country's agricultural land. However, some statistical constraints must be considered, or official statistics in some places will exclude producers that use ecological farming methods but are not certified or are certified by foreign organizations (EU4Environment, 2022).

Figure 4. Organic agriculture



Source: EU4Environment, 2022.

The development of the green economy can be achieved by stimulating sustainable agriculture, a process which requires the implementation of the following actions (Law 758/2022 - The National Development Strategy "Moldova 2030"):

1. Assisting farmers in their efforts to create a sustainable value chain by developing post-harvest infrastructure and preserving agricultural production.
   In order to optimize the infrastructure building process, linear regression methods can be employed to detect associations between various aspects such as the kind of post-harvest infrastructure, storage capabilities, and agricultural production quality.
2. Promoting ecological agriculture by following organic and sustainable agriculture principles.
   When comparing organic farming techniques to conventional farming practices, linear regression algorithms can be used to determine the influence of organic farming practices on crop output and profitability.
3. Implementing required sustainable soil management practices to ensure long-term land and soil management.
   Decision trees can be used to create models that analyse soil quality and the influence of various agricultural methods on soil health and fertility, assisting in decision making for long-term soil management.
4. Ensuring long-term research funding for the creation of new indigenous types that are resistant to climate change.
   Linear regression methods may be used to assess historical data on crop variety performance under varying climate circumstances and to uncover genetic and environmental variables that influence resilience to climate change. This can help to produce new native varieties that are adapted to certain conditions and reduce agricultural risk.
5. Promoting a culture of local product consumption by making consumers aware of the need to develop the local economy.
   Linear regression algorithms may be utilized to analyse data on consumer preferences and behaviour in connection to domestic products, as well as to assess the impact of consumer culture awareness and education initiatives. This can aid in the identification of effective local economic development promotion and education strategies.

Waste management. Every year, a person from the Republic of Moldova generates around 53 kg of plastic waste. The Ministry of the Environment, in collaboration with the Pro Environment Experts Association and the National Institute of Economic Research, provided statistical data in this regard on June 6. According to experts, our country imports almost 20 kg of plastic products per inhabitant each year, the majority of which are single-use packaging. As a result, polyethylene and polypropylene are the most often used plastics in Moldova.

Every year, 430 million metric tons of plastic are manufactured worldwide. Because they are short-lived, more than two-thirds of these products are immediately discarded. According to the quoted estimate, 139 million tons of single-use plastic will be produced in 2021, an increase from previous years. According to the report, if current trends continue, plastic manufacturing will quadruple by 2060 (Arvintii, 2023).

For the rationalization of waste management in the NDS are stipulated the following necessary measures and actions to be undertaken (Law 758/2022 - The National Development Strategy "Moldova 2030") which can be facilitated by means of models and automatic learning algorithms, as follows:

1. Creation of an integrated system of chemical substance management aimed at decreasing and eliminating the impact of chemical substances on the environment and population health.
   Clustering algorithms may be employed to categorize chemicals based on their toxicity and environmental impact, allowing particular priorities and actions to be set for each group.
   Convolutional neural networks are typically used to assess air and water quality monitoring data in order to uncover associations between individual pollutants and population health issues.
2. Waste management integrated through the creation of required infrastructure and services to prevent environmental degradation.
   Linear programming techniques may be applied to optimize waste management system design and operation, taking into consideration elements such as recycling capacity, transportation and storage costs, and waste reduction goals.
   Clustering algorithms can be used to identify waste groups that can be effectively handled using specific activities like recycling or composting.
3. Encouraging car fleet modernization by instituting an environmental charge that is differentiated based on pollution level.
   Depending on the features of the vehicles and their environmental impact, linear programming techniques can be executed to optimize the charging scheme and establish the optimum charging levels for pollutant emissions.
   To aid in the establishment of successful environmental charging policies and schemes, collaborative filtering algorithms can be used to evaluate vehicle emissions monitoring data and discover patterns and trends.
4. Providing different facilities, such as access to financing, attracting green investments, and promoting green bonds, to encourage ecological companies and technology.
   Linear regression techniques can be used to quantify the influence of green business and project facilities and support measures on financial performance and profitability.
   Collaborative filtering algorithms can be used to find potential investors or financiers interested in green initiatives and technology, as well as to help match funding needs with investment opportunities.
5. Establishing a circular economy support platform, which will include a research and support system for technical transfer and innovation, extension, information and facilitation, as well as financial assistance.
   Collaborative filtering algorithms can be utilized to link firms and organizations in the circular economy with experts, technology providers, and possible investors.
   Clustering algorithms can be leveraged to identify the special demands and challenges of the circular economy sector, allowing for the development of tailored solutions and support programs.

Smart transportation. Road blocks, often known as traffic jams, are a widespread problem in many cities and regions around the world, including the Republic of Moldova. They arise when the number of cars exceeds the capacity of the available road infrastructure, or when unforeseen occurrences such as traffic accidents or building projects occur.

In Moldova, traffic jams are common especially in big cities like Chisinau, where a large number of vehicles are concentrated and the road infrastructure is often overloaded. For example, according to the 39 reports made by the "InfoTraffic" Service of the National Public Security

Inspectorate (*Info Trafic*, n.d.) in May of the current year, the biggest traffic jams were in the following locations:

- Roundabout intersection Petricani St. - Mihai Viteazul St.: 18 times;
- Intersection of Calea Orheiului – Studentiior streets: 18 times;
- Mihai Viteazul St., on both directions of travel: 16 times;
- Roundabout intersection Calea Orheiului St. - blvd. National Renaissance: 16 times;
- Renaissance National Blvd., in the direction of travel blvd. Grigore Vieru: 15 times;
- Grenoble – Costiujeni street intersection: 15 times;
- Intersection with roundabout Calea Ieșilor St. – Ion Creangă St.: 14 times;
- Balcani Road - Petricani St.: 11 times.

By analysing the necessary actions needed to be implemented in order to ensure smart transportation which were mentioned in the NDS (Law 758/2022 - The National Development Strategy "Moldova 2030"), we identified more relevant ML instruments. Thus, for:

1. Development of road safety policy documents, as well as policies stimulating the construction of road infrastructure suitable for the circulation of cyclists and other modes of individual mobility - natural language processing models can assess and extract essential information from existing documents such as road safety legislation and policies, as well as infrastructure designed to accommodate bikes and other modes of individual mobility. This can help in the process of creating policy documents and determining the best actions and suggestions.
2. Modernization of cars used in local/municipal traffic, as well as migration to non-polluting vehicles and alternate modes of transportation – image recognition models can detect and classify road transport trucks. This can aid in the monitoring and assessment of the car fleet, the identification of polluting vehicles, and the promotion of non-polluting and alternative vehicles.
3. Encouraging the progressive/phased elimination of polluting modes of transportation, the implementation of phased limits on the import of these modes of transportation, and the gradual implementation of payment mechanisms based on the level of pollution of cars - reinforcement learning can be used to create algorithms that learn and optimize rules for taxing and banning polluting vehicles based on pollution levels. This can aid in the phase-out of polluting vehicles and the implementation of appropriate charging systems to encourage the use of less polluting vehicles.

The application of machine learning is critical to establishing a green economy. Machine learning enables us to optimize resource utilization, eliminate waste, and make educated decisions for sustainable practices by leveraging the power of powerful algorithms and data analysis. It enables us to identify energy-saving opportunities, effectively integrate renewable energy sources, and operate smart networks for optimal energy distribution. Machine learning also helps to optimize supply chain operations, estimate maintenance requirements, and promote environmentally friendly waste management. Machine learning, with its ability to evaluate massive volumes of environmental data, assists us in monitoring ecosystems, detecting hazards, and making data-driven conservation decisions. Embracing machine learning in our goal of a green economy is critical not just for mitigating environmental concerns, but also for stimulating economic growth and ensuring a sustainable future for future generations.

5. Conclusions

The transition to a green economy can be achieved organically without using the opportunities offered by artificial intelligence tools, but it would take a lot of time, effort and economic resources. However, the implementation of algorithms and models of automatic learning as tools of artificial intelligence comes to facilitate the development of the directions of the green economy: energy efficiency, renewable energy, sustainable agriculture, waste management and intelligent transport, with tangible results in optimal terms and saving resources.

Based on the research, the following conclusions were established:

1. A conceptual model of the transition to a green economy in the Republic of Moldova has been developed, structured along five main directions: energy efficiency, renewable energy, sustainable agriculture, waste management and smart transportation. These directions were taken from the two National Strategies (National Development Strategy "European Moldova 2030", the Energy Strategy of the Republic of Moldova until 2030), for which the authors determined and exemplified different types of machine learning algorithms in order to facilitate the achievement of the desired results.
2. Based on the two national strategies of the Republic of Moldova and AI tools, there were identified relevant machine learning algorithms to facilitate the achievement of strategic objectives.
3. In order to provide a more realistic perspective, there have been illustrated different ways in which algorithms can be used to achieve effective results in implementing strategic objectives.

In order to ensure the transition to the green economy and the use of ML the following recommendations were proposed:

1. Investments from the state in purchasing the necessary tools for the implementation of algorithms and machine learning models;
2. Developing new programs to train specialists in the field of using artificial intelligence and machine learning;
3. The establishment of new positions regarding the monitoring of the correctness of the introduction and processing of the data entered into the systems;
4. Mandatory reporting of sustainability and green economy indicators for all entities within the economy and development of the statistical data bank on the results.

Authors' contribution*: Introduction, C.A.; Literature review, H.M.; Methodology and data, H.M.; Research results and comments, H.M., C.A.; Conclusion, C.A.*

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