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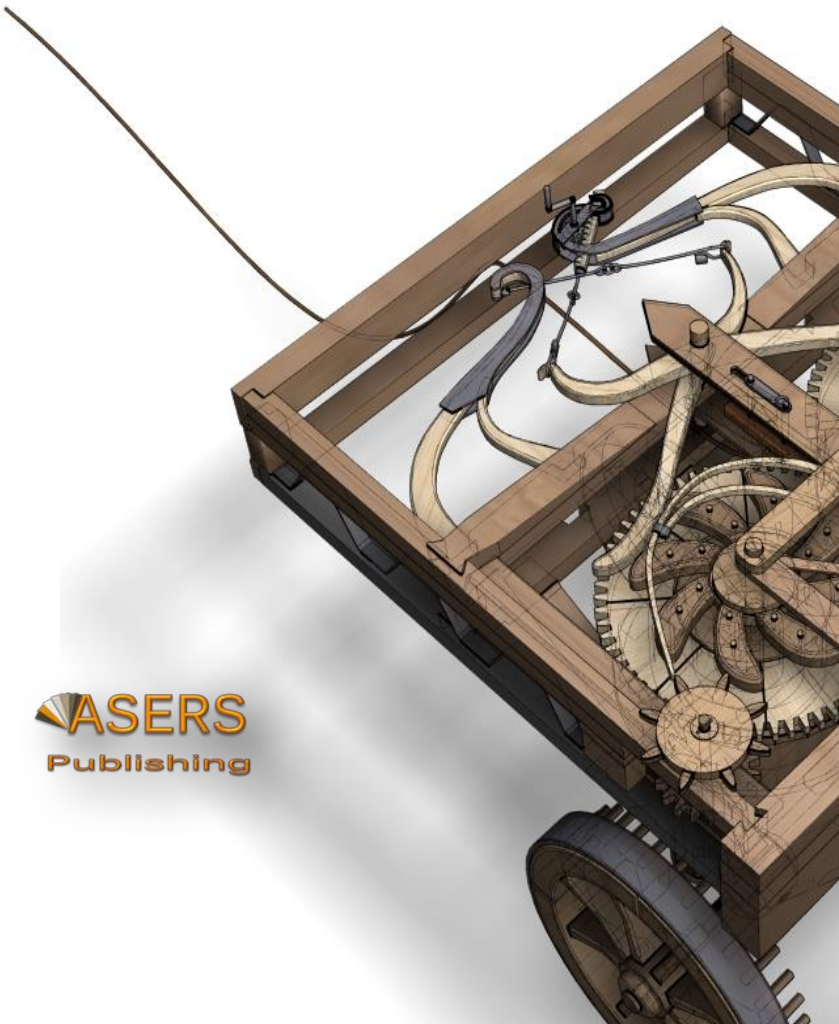

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Implementation of Green Banking in the Largest Polish and Romanian Commercial Banks – An Analysis of Progress, Strengths, and Weaknesses

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Abstract: In the context of the Green Deal, which set out to transform Europe into a climate neutral area by 2050, governments and international bodies have shown a growing interest in the financing activities that contribute to this objective. This is because the financial system plays a crucial role in channelling resources towards less polluting technologies. Due to its central place in the financial system, the banking system has obviously taken on the same responsibility. Commercial banks can make a change towards a greener economy through the services they provide (green financial products), their loan portfolio (financing companies with a lower carbon footprint instead of highly polluting ones) and the internal transformation of their own activities (using renewable energies, less paper, etc.). The main aims of this paper are the assessment of the degree of development of green banking in Poland and Romania and the identification of weaknesses and strengths in the following areas: strategy, best examples of ESG (environmental, social governance) practices, ESG rating, methods to calculate and reduce the CO2 emissions, risk management, organization and management of a bank, financing the bank's activities, credit activities (corporate banking and retail and mortgage banking). Using data from their reports and official websites, we find that steps have been made towards green banking, but progress is meagre, and the process is only in its early stages. This study will be useful to practitioners through the landmarks and set of criteria it proposes, as well as to researchers as a starting point for a deeper analysis of each area of green banking.

Keywords: green banking; green finance; Poland; Romania.

JEL Classification: G19; Q56; Q59; R11.

Introduction

Green banking has become one of the major strategic priorities in European banks. Banks are in the process of implementing the principles of green banking, using performance indicators to measure and monitor the greenhouse gas emissions related to their banking activities. On the other hand, banks are expanding green financial services. The scope of implementation of green banking may vary depending on the country.

The purpose of the research is to conduct a comparative analysis of the level of green banking implementation in Poland and Romania. To this purpose, and because there is no research tool suitable for this, the authors of this paper decided to construct a research tool, namely a green card/map, which will be presented further. The authors examined two transition countries in this respect, i.e., Poland and Romania. Both countries have transformed their banking systems and numerous reforms have been undertaken in order to increase the competitiveness of the above-mentioned sectors. It is important to understand the great role of the banking sector in the financial system of the two countries. In Poland, the share of the banking sector in the financial system is more than 70%, and in Romania it has a similar share-77% as of the end of the year 2020, https://www.bstdb.org/BSTDB_Overview%20of%20the%20financial%20sector_ROMANIA.pdf). This means that

the banking sector in the examined countries plays a vital role in the direction of green transformation. In both Poland and Romania there is a poorly developed corporate bond market. In addition, equity market is also poorly developed – the Warszaw Stock Exchange is developing slowly, and the Bucharest Stock Exchange is smaller in size than the Polish one. In 2021, the Polish banking sector assets totaled €559.40 billion. The value of the total balance sheet increased by 9.5% comparing to 2020 (https://www.ebf.eu/wp-content/uploads/2022/12/Banking-in-Europe-EBF-Facts-and-Figures-2022.-FINAL.pdf). The indicator of bank assets to GDP for Poland reached a level of 65.81% and for Romania - 40.8% in 2021 (https://www.theglobaleconomy.com/rankings/bank_assets_GDP). According to Statista, the latest data reported (for 2020), the first ten major banks in Romania totaled 97210 million euro in financial assets. In Poland only two big banks are controlled by the Polish capital (PKO BP and Pekao). The rest of 10 banks has majority foreign capital. In Romania, two banks have Romanian capital (CEC Bank and Banca Transilvania), the rest having majority foreign capital. The total assets of commercial banks in Poland increased annually during this period from approximately 940 billion zloty in 2009 to over 2.47 trillion zloty as of December 2022. In Poland, the first ten banks account for about 70% of total assets (Statista 2022a). In Romania, 113 billion EUR is the total market (https://seenews.com/news/banca-transilvania-maintains-lead-on-romanias-banking-market-in-2020-745910), and the first 10 banks account for roughly 86% of the total assets, based on the total assets of the biggest 10 banks using data of 2020 (Statista 2020).

1. Literature Review

The process of green transformation of EU member states towards low carbon emission strengthens the importance of green banking. Big banks in the world are joining alliances, which should help to reach climate neutrality. One of the examples is the Net-Zero Banking Alliance, which is committed to aligning banks' lending and investment portfolios with net-zero emissions by 2050.

The ratification and enforcement of the Paris Agreement and the preparation of the European Green Deal by the European Commission have been key factors in creating a new environment for the functioning of the banking sector. The role of green banking in corporate strategies of commercial banks has grown significantly. The pressure from shareholders is also growing. They are expecting the banks to include green financial products in their offer.

Green transformation in banking has two dimensions. On the one hand, banks implement the principles of green banking and expand their green products, on the other hand it can been noticed the process of decarbonization of the loan portfolio in Europe. This can be understood as the decrease of the number of credits and loans associated with "dirty" projects that are related to fossil fuels (Wass 2022).

Green banking is in the early stages of its development. Regulatory pressure is a key factor determining the transformation of banks towards green banking. Green banking is one of the components of environmental, social, responsible, sustainable banking (Park and Kim 2020). There is a strong connection between green banking and ethical banking (Miah and Hassan 2023). So far, there has been no universal definition of green banking. Green banking plays a significant role in the environmental pillar of sustainable development (Zioło 2020). One of the first definitions was the one proposed by Schultz (2010). The author understands green banking as a set of stimulating environmentally-friendly practices and decreasing the carbon footprint from banking activities (Schultz 2010). Bahl (2012), Islam and Das (2013) suggested a similar approach to the role of green banking. "Green banking adoption is not just a change in the business operations of a bank, instead it is a cultural shift within a bank and affects all aspects of the banking operations" (Bukhari, Hashim and Amran 2019)

From the banks' point of view, green banking is a component leading to competitive advantage. Moreover, banks underly their social and ethical character in the process of developing green banking. It can also be treated as a tool to build trust in a bank.

Green banking can be seen as a way to reduce environmental pollution and slow down climate changes from the entire economy perspective. Banking sector plays a vital role in promoting investments supporting the development of a zero-emission economy. Green banking has many advantages not only for individuals, but also for companies. The banking sector is the major access channel to green financial solutions. According to other authors, green banking is connected to discriminatory industry policy focusing on low carbon industries and excluding industries that have a negative impact on the natural environment (Niedziółka 2021).

Green banking should be considered in its three dimensions. The first one involves the development of the offer of green banking services. Banks may contribute to environmental protection and decline the carbon footprint through a green credit policy, green financing banking activities and green payment solutions. There are several objectives of green financial products so that banks can comply with government's regulations or guidance, enhance firm reputation, and seize emerging business opportunities (Park and Kim 2020).

Implementation of green credit policy plays an especially important role as it is seen as the main pillar of green banking. The second dimension is related to decarbonisation of loan portfolios in banks. The last dimension is connected to the internal transformation of banks towards green banks. Banks have been undertaking restructuring activities based on electronic circulation of documents, greening their branches and using renewable energy technologies. Green banking also means the development of mobile distribution channels and mobile payments. These three dimensions create green banking.

The banks that underline that they are green credit institutions because they made green electricity transformation and reduced paper usage in their activities have been accused of greenwashing. In order to reduce the scale of greenwashing in the European Union starting from 2024, banks will be required to disclose the level of the green asset ratio (GAR).

Banks pursue their macroeconomic and microeconomic goals. Green banking provides a different perspective than that of traditional banking. The macroeconomic role of banks operating in green banking means the development of green credit services supporting the transformation of the economy towards a climate-neutral economy. Indicators such as the share of green financing in the bank's total credits are gaining ground.

On the other hand, it is hard to imagine green banking without the process of decarbonizing loan portfolio. Green banking can play an important role in the development of a sustainable industry (Paluszak, Wiśniewska-Paluszak 2016). From a microeconomic perspective, green banking can be interpreted as a bank's profit while considering the environment.

"Research shows that for financial institutions, the simultaneous pursuit of strategic sustainability priorities and strong financial performance does not conflict with one another but rather, support each other when driven by consistent strong overall leadership" (KKS Advisors 2019, 2).

The research conducted by Kotsantonis and Bufalari on a group of 100 banks showed that there are conflicts between good financial results and implementation of ESG objectives (Kotsantonis, Bufalari 2019). Focusing on ESG in banks' strategies can impact organizational revenues, costs, risk exposure, access to capital, and its brand (Ritter, Forst and Pföstl 2021). It should taken into consideration that green loans are connected with higher level of credit risk, "for instance, a wave of insolvencies of solar panel companies has cost banks dear" (Lehmann 2020).

In the CEE countries, banks can motivate people towards savings or financing of enterprises. This is due to the large share of bank assets in the assets of the financial system and to the underdevelopment of the capital market. The development of green banking will be of key significance in the future for the transformation of the economy into a zero-emission economy. It should be kept in mind that banks have limited ability of financing innovation. It is difficult to imagine reaching a goal of climate neutrality without innovation on CO2 reduction techniques (Aghion et. al. 2022). Banks have extensive credit departments, which do not specialize in assessing the creditworthiness of start-ups. De Hass i Popov analyzed the relationship between financial development and structure and carbon emissions in countries and sectors during the period 1990-2013. They found out that "for given levels of economic and financial development and environmental regulation, CO2 emissions per capita are lower in economies that are relatively more equity-funded" (de Haas, Popov 2019). Public development or green investment banks are an important part of green banking sector. There is little research on the implementation of green banking in commercial banks.

Laskowska conducted a study on pro-ecological strategies of banks in Poland (Laskowska 2018). She performed a comparative analysis of two banks with strategic investors from Portugal (Millennium Bank) and France (BNP Paribas Bank). The author found that the above-mentioned banks do not have a sophisticated ecological financial offer, but they are leaders in the Polish banking sector. The second part of this research consisted in expert interviews and it was concluded that Polish banks should follow Scandinavian, German or Dutch banks in the field of green banking (Laskowska 2020). The comparison of the results of surveys conducted by PWC in 2021 and 2022 among Polish banks on the level of implementation of green finance shows that the green transformation has accelerated in the Polish banking sector (PWC 2022; PWC 2023). PWC's research covers aspects related to green banking in the area of strategy, banking service offering, procedures and risk.

Green banking is also a research interest in Romania. It was concluded that Banca Transilvania is worth mentioning in terms of expanding green banking (Dumitraşcu, Feleaga L. and Feleaga N. 2014; Druga 2022).

Implementation of green banking in banks' strategies was the subject of research in Indian banking. This banking sector has a different ownership structure in comparison to Poland and Romania. India's banking system is controlled by government-owned banks, which have a share of 60% of total commercial banks assets (Sutton 2021). Mekala claims that Indian banks are far behind the developing countries when we take into consideration green banking development (Mekala 2019, 21). We may assume that a large share of the state in the banking sector does not necessarily contribute to the development of green banking.

2. Methodology

Green banking is a relatively new research area. Commercial banks are currently in the early stages of implementing green banking. There is a lack of widely recognized tools for assessing the progress of green banking development. Meanwhile, this is a very important issue, because under regulatory pressure, the coming years in the banking sectors of CEE countries will be marked by the implementation of green banking.

In particular, it is necessary to develop a research methodology to assess banks and banking sectors in terms of the degree of development in green banking.

Table 1. Green banking evaluation areas

Area	Research questions
Strategy	1. Which place takes green financing in the bank's growth strategy (corporate strategy) for the coming 3-5 years? (Green assets ratio = The share of green assets/total assets in %) 2. Has the bank made a strategic decision about reducing financing of power engineering companies? (companies that reach at least 10% of their income from carbon)
The best examples of ESG practices	3. Has the bank signed the Principles for Responsible Banking? 4. Has the bank entered the Net-Zero Banking?
ESG rating	5. Does the bank use ESG rating? Which type, which ESG rating agencies? 6. Does the bank count its carbon footprint? Has the bank been evaluated in this field?
Methods to calculate and reduce the CO2 emissions	7. Does the bank use Science Based Targets Initiative (SBTI)?
Risk management	8. Does the bank take into consideration ESG risks in the process of evaluation of credit applications? 9. Does the bank calculate the CO2 emissions associated with its credit portfolio?
Organization and management of a bank (back office challanges)	10. Is there in the bank an organizational unit /department or position such as Chief Sustainability Officer? 11. What internal indicator does the bank use to measure green products in their business activity? 12. Does the bank use renewable energy sources to provide electricity in its buildings? 13. Has the bank eliminated/reduced significantly paper in its business activities?
Financing of bank's activities and deposit products	14. Has the bank issued/is issuing/is going to issue green bonds or green covered bonds? 15. Does the bank offer green products/deposits/investment products in its offer?
Credit activities – universal banking Corporate banking Retail and mortgage banking	16. Does the bank have an offer of credits for companies (especially for companies from the SME sector) warranted on green/ecological properties? 17. Does the bank have an offer of solutions for supporting clients in issuing green bonds? 18. Does the bank offer financing for small medium sized companies that are focusing on electric transformation? 19. Does the bank have in its offer loans for companies taken into consideration social and energetic criteria? (ESG-linked loans)? 20. Does the bank have guarantees for entrepreneurs related to sustainable development? 21. Does the bank have an offer for green mortgages for energy efficient houses or flats? 22. Does the bank have an offer in the field of electromobility for individual customers? 23. Does the bank offer Socially Responsible Investing (SRI) for customers?
Payment solutions – retail banking	24. Does a bank offer green cards to its customers made from recycled materials?

Source: Author's own research

Our research approach was, as a first step, to develop a list of criteria for assessing progress in green banking. In examining the progress of green banking in the largest Polish and Romanian banks, we focused on the following areas:

1.The banks' corporate strategies
2.Credit and payment services broken down into retail, mortgage and corporate banking,
3.Organization and management of a bank
4.Risk
5.Financing of bank's activities
6.Best examples of ESG (environmental, social governance) practices, ESG rating, methods to calculate and reduce CO2 emissions.

Within these areas, the authors of this research designed 24 specific questions (see Table 1). The implementation of green banking requires a strategic decision at the bank level and the provision of funds in the bank's budget for this purpose. Therefore, banks' corporate strategies were surveyed. The second area is the level of competitive strategies. Here we focused primarily on answering the question of whether the surveyed banks have taken steps to compete with green credit and payment products. Implementing green banking is also an area of bank and risk management.

In the second step, we conducted an analysis of the strengths and weaknesses of the surveyed banks in the field of green banking. Thus, our method refers to the SWOT method, which has been widely used in assessing competitive position and strategic planning. In this study, we focused on issues related to assessing the internal strengths. Our tool can be supplemented with external elements, thus obtaining a green SWOT of commercial banks.

The choice of countries is based on the economic and social similarities between Poland and Romania, and as a continuation of earlier studies in this field (Siemionek-Ruskań *et al.* 2023). The banking sectors studied are characterized by similar levels of concentration. The Herfindahl Index at the end of 2022 was 1017 in the Romanian banking sector, while in the Polish sector it was 833 indicating low concentration in the sectors surveyed. (https://sdw.ecb.europa.eu/servlet/desis?node=1000002869).

The chosen Romanian banks were: Banca Transilvania, BCR, BRD, ING Bank, Raiffeisen Bank, CEC Bank, UniCredit Bank, Alpha Bank, OTP Bank, Eximbank, the selected Polish banks were: PKO BP, Bank Pekao, Santander, ING Bank Śląski, mBank, BNP Paribas, Millennium, Alior, Bank Handlowy Citi, Credit Agricole.

3. Results

The first part of the research focused on the evaluation of the role of green finance in the strategies of Polish and Romanian banks. The results are ambiguous. Both Polish and Romanian banks indicate in their strategies the implementation of the aims of the ESG and green banking, but it is worth mentioning they are at the initial stage in the field of measurement of the share of green financing in total assets. Developing a taxonomy and the mandatory requirement to measure and monitor green finance in banks will strengthen green banking in commercial banks strategies. Banks will be challenged to decarbonise their lending portfolios. It is worth noting that, both Polish and Romanian banks have low level of credit exposure in the fossil fuels sector, which can be seen as their strategic advantage over the “old” EU banks.

The next question checked whether Polish and Romanian banks signed the Principles for Responsible Banking (ONZ initiative) and entered the Net-Zero Banking. Of the 10 Polish banks, seven signed the Principles for Responsible Banking. Three banks which are dependent on state, namely PKO BP, Pekao and Alior Bank, did not sign the above mentioned principles. In addition, PKO BP and Pekao play a significant role in the Polish banking market in terms of share in total assets as well as the number of the clients. In order to join Net-Zero Banking Alliance (NZBA), a bank should become a signatory to the Principles for Responsible Banking (https://www.unepfi.org/net-zero-banking/join-us/). All Polish and Romanian banks with foreign capital have joined Net-Zero Banking Alliance.

A necessary but not sufficient condition for the development of green credit offer is the embedding of ESG criteria in the creditworthiness assessment process. In particular, it is necessary to include climate risk, which affects both PD (Probability of Default) and LGD (Loss Given Default) parameters. Our research shows that the vast majority of Polish and Romanian large banks declare that they include such criteria in the evaluation of loan applications. Some of the banks surveyed (60 percent in the case of Romania and 70 percent of Polish large banks) also calculate the carbon footprint for the loan portfolio, but this type of measurement is in the early stages of development. Our research shows that the steps taken by Polish and Romanian banks in taking climate risk into account are a good starting point for the development of procedures and techniques for including climate risk in credit procedures, but an important barrier may be emissions databases.

Further on, we examined the use of ESG rating. They a relatively new assessment tool which, on the contrary to the credit rating of credit rating agencies, has not been standardized yet. ESG agencies enable the possibility of checking the company’s ESG results, like credit rating agencies, and they also enable the evaluation of creditworthiness of the company (Berg, Kölbel, Rigobon, 2022). Over 50 % of Romanian and 90% of Polish banks have ESG rating. The most popular agency used by the banks in this research was Sustainalytics. ESG rating (Mazzacurati 2021), undertaken by Sustainalytics is the evaluation of ESG risk. It is a type of rating that is used to measure exposure to ESG risk and to assess how these risks are managed.

In terms of organization and management of banks, four questions were answered. Of the 10 Polish banks, only one does not have a management position in charge of sustainability. The titles under which such functions are held are: Corporate Social Responsibility and Sustainability Committee; ESG manager; Corporate

Social Responsibility and Sustainability Committee; ESG Council and ESG Risk Committee. On the other hand, the largest Romanian banks are a bit behind when it comes to implementing such a position – only six out of the ten banks have such an officer or department – their names are: Sustainability Committee; Climate Change, Environment and Social Committee; Sustainability Department; Sustainability Council and a Committee for Sustainable Finance; ESG Governance Structure (at group level); Department of Sustainability and a Manager. In both countries, these bodies were created in 2021 or 2022, therefore the process in the banking system may be ongoing.

Half of the largest Polish banks have internal indicators to measure green products in their business. Of the Romanian banks, only three use such indicators. The largest Romanian bank uses non-financial indicators, such as green loans granted to Romanian companies, or the proportion in total assets of exposures related to eligible economic activities and other green funding. The second largest bank uses MSCI indicators, while the third one has put in place progress indicators regarding sustainability at group level.

In Poland, the five largest ten banks have already used renewable energy sources to provide electricity in their buildings. In Romania, the situation is better, in that seven out of the ten banks report usage of renewable sources of energy. Two banks do not provide any details on this issue, whereas one of them announces that the plan is to replace ten old thermal power plants with condensation power plants. Two banks having already made progress in this respect report that this has been a group strategy, which was also taken over in Romania; one bank 'rethought the entire policy related to environmental projects and implemented a large-scale program that aims to reduce carbon emissions and introduce green energy into our buildings', another one mentions that 26% of the electricity it uses comes from such sources and another mentions that the electricity supplier confirms that a significant share of the consumption is derived from renewable resources.

All top Polish banks confirm the reduction or elimination of paper from its business activities. Romanian banks display a similar situation, nine out of the ten banks reporting the same thing. Whereas some have benefited from such a measure at group level, other banks cut on paper consumption and put in place digital platforms for approvals to replace paper; reduce paper usage by using digital scanning and document archiving; recycle part of the paper consumed. The bank that has not yet put in place such a measure, however, confirms that waste management is on the agenda, including paper.

Regarding the financing of banks' activities, two items were analyzed. The five largest banks in Poland have already issued green bonds (PKO Bank Hipoteczny issued green covered bonds). In Romania, the six largest banks did that. These bonds are sustainability-related bonds. One bank has not yet issued such bonds, and it admits that it is still at the stage where the bank is adopting the EU taxonomy. The five largest banks in Poland offer green products of some sort. Romania has made more steps in this respect, with nine out of ten banks having already provided at least one type of green banking product, such as: green credits, sustainability bonds, green finance (broadly), credits for buying houses/apartments and credit lines for businesses, mortgage loan for green houses (with a RoGBC certification), green leasing to finance electric or hybrid cars. This type of product has been on the market since 2021.

Regarding the credit activities, two sectors were analyzed: corporate banking and retail and mortgage banking. In both Polish and Romanian banks, the biggest share in the total income are still traditional credits and loans. Green offer is treated as a supplement to the traditional product offer. There are two main barriers in the development of green credit offers. The first one is low customer demand, although our previous studies show that customers are interested in such products (Siemionek-Ruskań, Lepczyński, Fanea-Ivanovici, 2022). The second one is a slow speed of the development of electric cars.

The green deposit offer is poorly developed. Customers would have to accept a decrease in their income from the bank deposits. Such product can be associated with the fact that the bank can allocate part of the clients' interest to ecological or environmental protection objectives. Bank Ochrony Środowiska offered such solutions in the past but it did not meet customer's interest. In the area of deposits, the development of green products is very limited in the selected countries.

An interesting area from the point of view of the development of green banking is the area of private banking. In Poland, this area of banking is the concern of the largest banks. Their customers are among those with a higher level of economic education. In Romania, the six largest banks did not provide information if they offer SRI for customers, and three of them confirmed they did not. Only one Romanian bank (BRD) indicated offering it (SRI). In the research of Polish banks shows that 60% of 10 biggest banks offer not only traditional investment products in private banking, but they also provide SRI such as wealth Management as an example.

Regarding the payment solutions only one question was asked. Of the 10 Polish banks, three offered green cards to its customers made from recycled materials. On Romania 80% of the biggest banks confirmed not

using green cards. In both countries, banks should pay more attention to adapt to environmentally friendly payment solutions.

Conclusion

As for Polish large banks, our research shows that there is a preponderance of weaknesses, which is mainly due to the initial stage of green banking development in Poland. The inclusion of green strategic goals in the corporate strategies of the surveyed banks can be considered a strength. This means that green goals are becoming strategic priorities for the next few years. This, in turn, allows us to forecast that there will be an increase in the importance of green banking in the years to come. Of greater importance, however, are the current weaknesses. Our findings show that banks are in the early stages of introducing carbon footprint measurement and incorporating climate risk factors into their credit assessment procedures. The weak point of Polish banks in the context of green banking development is liabilities. Green wholesale financing (green bonds, green covered bonds) is very limited, which may inhibit green banking in Poland. The share of green loans in the loan portfolio is limited. Banks are just starting to make green retail and corporate loans, and are only looking to get a larger share of green project loans in a few years. Polish banks intend to focus mainly on supporting customers' energy transition.

The Romanian commercial banks have all included green orientation or a green transition in their strategies. However, the level of implementation largely varies from one bank to another. Some banks are adopting the terminology, while others have already created various sorts of green products and have been involved for a while in greening their activity too. Steps forward in terms of Net-Zero Banking Alliance have been made with the help of the groups' strategies most banks are part of. The main weaknesses of Romanian banks are that ESG rating is used by only half of the largest banks, only 6 out of 10 banks have created specialized departments and officers in charge of sustainability issues and strategies, the measurement of green products in the business, which is meagre. Also, we have not yet identified SRI offers in the Romanian banks. At the other end of the spectrum, Romania performs much better in terms of renewable energies use, paper use decrease or recycling, and more developed bond offer.

From the undertaken research we can observe that there is a positive correlation between the ownership structure and the level of implementing green banking principles and green financial services. Among 10 biggest players in each country, 7 Polish and 8 Romanian banks have a majority share of foreign capital in their structure. It is in these banks that the acquisition of green finance principles is most advanced.

The majority of Polish and Romanian banks has implemented green offer in retail banking sector which is promising for the future trends. On the other hand, it is worth taking into consideration serious barriers in developing green banking such as: 1) low level of an ecological culture 2) a lower level of the average household wealth in comparison to the older EU member states, which also negatively impacts on the green banking future.

Credit Authorship Contribution Statement

The authors contributed equally to this work.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Innovative and Marketing Features of Agri-Food Supply Chain Development

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Abstract: The article emphasises that geopolitical instability (russian aggression in Ukraine, sanctions, tensions between the US and China, inflation, recession) has a negative impact on agri-food chains. In particular, the war in Ukraine is affecting Africa by increasing food prices, destabilising the situation and creating the threat of famine.

The article examines the export challenges faced by Ukraine during the war. Smart solutions provided in Ukraine and around the world in order to develop export opportunities are analysed. The specifics of investing in nearshoring production are investigated. The market of "digital logistics" as a set of services and tools for transportation is analysed.

The research studied digital platforms that can effectively manage cross-border transport in a single system and optimise the many business processes involved. Services that help to track real-time information on cargo, their location and

transport conditions are analysed. They allow customers to reduce downtime costs, assess the efficiency of carriers, monitor cargo condition and quality.

This article focuses on the warehouse automation industry. In particular, it notes that robotic devices are already capable of sorting parcels, transporting them within warehouses and moving them from one shelf to another.

Particular attention is paid to the further transition to safer raw materials. The operators proposed to use green energy sources and support suppliers focused on renewable energy.

The main trends in 2023-2024 are expected to be the development of technology, flexibility, further transition to "green" solutions and other ways of developing the logistics market both in Ukraine and globally.

It is determined that Ukraine will be rebuild according to the principle of Build Back Better, in particular, it will build everything according to new rules and to the extent required, based on new realities.

Keywords: supply chains; export; logistics; economic instability; processing; agriculture; robotics.

JEL Classification: Q11; Q13; Q17; Q18; R11.

Introduction

The global logistics industry is constantly facing various challenges: the Covid pandemic, the russian invasion, and economic instability of global markets.

The problem of food security has been extremely relevant for Ukraine since the beginning of the full-scale invasion of Russia. The domestic agricultural sector provides food not only for Ukrainians but also for millions of people around the world. The year 2022 could have been a record export year for Ukraine in the history of its independence, if not for the russian invasion.

Now, in war, logistics chains are destroyed or changed in a completely unpredictable way, occupiers destroy storage and processing facilities, mine fields, steal crops and block the ports.

Food security remains an urgent issue, so it is essential to develop and implement startups that would accelerate victory and help improve logistics and export operations. The innovative technologies for the formation of agri-food supply chains will help to improve the efficiency of export and import operations.

1. Research Background

The transition of the agrarian economy to an innovative way of development is one of the most important and complex problems, the solution of which requires the systemic analysis of the main factors that can favor or, on the contrary, restrain this process. Innovation-oriented development of the agrarian production envisages the involvement of new technologies, creation of fundamentally new products and the use of modern innovative methods and techniques of management. In today's globalized world, the level of innovation development of the economy and society as a whole is not only one of the most important factors of success, but also the main resource of economic growth and geopolitical stability of states, which determines their place in the world politics and economy.

Innovative features of formation of agri-food supply chains have been studied by: V. Aranchiy (Aranchiy, 2019-2021), V. Povoroznyk (Agrarians and IT, 2023); O. Zoria (Zoria, 2022), L. Syhyda (Syhyda, 2023); N. Demianenko (Demianenko, 2020-2021), L. Sacher (Sacher, 2022), I. Yasnolob, (Yasnolob, 2018-2022) and others, but in a changing environment, new challenges arise that require adaptation and modification to the new realities of Ukraine and the world.

2. Methodology

The purpose of the article is to study the innovative features of the formation of agri-food supply chains.

The systemic and dialectical-cognitive methods were used during the study of scientific papers of Ukrainian and foreign scientists on approaches to ecologically and socially oriented development agri-food supply chains in the economy of Ukraine. The following methods were used while working on the article: abstract-logical (for carrying out theoretical generalizations and formulating conclusions), monographic (for retrospective analyzing and determining the peculiarities of agri-food supply chains in sustainable rural development), systemic-structural (for constructing a block-scheme of the system of analyzing); modeling (for developing the innovative model of environmentally and socially oriented economy), etc.

3. Results and Discussion

Global supply chains disrupted by aggression affect not just an individual country in Africa, but the entire world. The global challenges of 2019-2023 have affected supply chains (Table 1). And companies are trying to use smart technology to optimise processes.

Table 1. Features of global supply chains in the face of new challenges

Years/Situation	Features of supply chains
2019-2021	
Pandemic and traditional supply chain disruption	Changing the geography of production (nearshoring). Warehouse automation
2022-2023	
Geopolitical instability: russian aggression in Ukraine, further sanctions and tensions between the US and China. Many industry players are paying attention to record inflation and possible recession	Changing the geography of production (nearshoring). Negative impact on supply chains. "China+1" principle: a policy that provides an alternative to the traditional supply chain

Source: Author's notes: based on data from (What the logistics, 2022)

In this way, classic logistics is being transformed. The players who create an environment of additional services for supply chain support will win. As a result, digital logistics is developing. According to Allied Market Research (Allied Market, 2023), the market, which covers a wide range of services and tools for transport, will grow by more than 20% by 2030. As a result, companies will increasingly focus on automation, IT solutions and cloud services. According to KPMG, about 60% of companies plan to increase investments in digitalisation. The aim is to improve the processes of data delivery, collection and analysis. The emphasis will be on logistics tools, such as planning, fulfilment centres, and tracking, rather than on the overall infrastructure and user interaction (What the logistics, 2022). Smart solutions of global companies are shown in Table 2.

Table 2. Smart solutions for forming supply chains from global companies

Smart solutions	Companies
Transparency in the Distribution Chain	Meest, ClearMetal, project44, FourKites, Descartes MacroPoint, Hapag-Lloyd
Warehouse Robotics	Amazon, GreyOrange and Locus Robotics
Transport Automation	Automobile: Uber, Convoy.Inc. Multimodal: UTEC Logistics
Artificial intelligence (AI)	Gartner, DataRobot and others
Digital twins	Boeing, Airbus, SpaceX
Green economy	Ford

Source: Author's notes: based on data from [(What the logistics, 2022; Jitplus, 2022; UTEC Logistics, 2023; Innovations, 2022)

These services help to track the cargo information, its location and transport conditions in real time. This allows the customer to reduce downtime costs, assess the carrier's performance, and monitor the condition and quality of the cargo. There are also a number of benefits for the carrier, such as a better understanding of how to ensure additional cargo security and optimise transportation. The companies involved in this area are developing rapidly due to the market demand (Zoria 2022). ClearMetal, for example, not only provides transparency in supply chains, but also helps to analyse and forecast the quantity and type of cargo for months ahead. Meest has a service called Meest World Logistics Platform. This is a single digital window for managing cross-border transport processes: from transport management to control of the quality and delivery time. This digital platform allows partners to effectively manage their cross-border deliveries in one system, which significantly optimises many related business processes (What the logistics, 2022). By 2022-2023, robotic devices will be able to sort parcels, transport them within warehouses, and move them from one shelf to another. By 2026, three out of four companies will use warehouse robotics.

Bill Gates has invested in a new Uber startup - Uber for trucks. The Uber Freight app is used for long-distance freight transport. The app solves the following problems: empty trucks on the way back, carrier employment and environmental pollution. The app also improves transport efficiency, reduces costs and reduces the environmental impact of trucks (Demianenko and Yasnolob 2021)

The US Company Convoy. Inc. has developed software that searches for carriers near a customer who are ready to accept a transport order on a map. So far, the service works locally, in Washington state (Jitplus 2022).

In Europe and the US, traffic is managed over the phone at a pre-agreed rate, and fares are paid online. This creates an environment of reasonable competition, where the service provided by the contractor is evaluated based on the results of the work performed (Jitplus 2022).

Artificial intelligence is likely to be used alongside augmented reality and augmented intelligence. Augmented intelligence combines human intelligence with automated artificial intelligence processes. For example, in logistics planning, the use of augmented intelligence may even outperform the use of artificial

intelligence alone, as it combines human capabilities (experience, responsibility, customer focus, flexibility, common sense, etc.).

The potential uses of digital twins in logistics are enormous. Warehouses and businesses can also use this technology to create accurate 3D models of their centres and experiment with layout changes or the introduction of new equipment to see their effect (Innovations, 2022).

Logistics continues to be a major source of pollution: transport is responsible for 20% of global CO_2 emissions. Analysts emphasise that the supply chain would not be economically sustainable without environmental sustainability. The solution is to continue the transition to safer raw materials, encourage operators to use "green" energy sources, and support suppliers that emphasise renewable resource consumption (What the logistics, 2023). In addition, KPMG points out that in 2023, regulators and other stakeholders will focus on emissions of the third category - indirectly generated. Investors are likely to join this trend and require organisations to prove the low level of these indirect emissions (KPMG, 2023). Ukraine, the breadbasket of Europe, reduced its export potential in 2022. The factors that negatively affected supplies are shown in Table 3.

Table 3. Factors that negatively affected Ukrainian exports, 2022-2023

Factor	Reasons for the factor	Possible consequences
Decrease in venture capital investment in agricultural and food technology startups	Invasion of the russian federation	Rising capital costs, interest rates and questions about the business models of individual industry projects. Industry consolidation is likely and the number of acquisitions will increase
Economic crisis	Invasion of the russian federation	Hryvnia devaluation

Source: Author's notes: based on data from (In 2022, 2022)

Unfortunately, the technological development of the industry is slowing down because of decreasing investment and the economic crisis in Ukraine. However, the war has forced Ukrainian operators to switch to new, more flexible ways of operating. Meest has launched Meest Fulfilment, a service providing all logistics and postal services to companies entering the US market. The companies only deliver the goods to Meest's warehouses, while Meest handles the sorting, accounting, quality control and delivery to the end customers. Entrepreneurs who want to sell their product in the US market can ensure that local customers can get their goods quickly. This is highly important for gaining such a competitive edge (KPMG, 2023). Ukrainian exports are shown in Table 4.

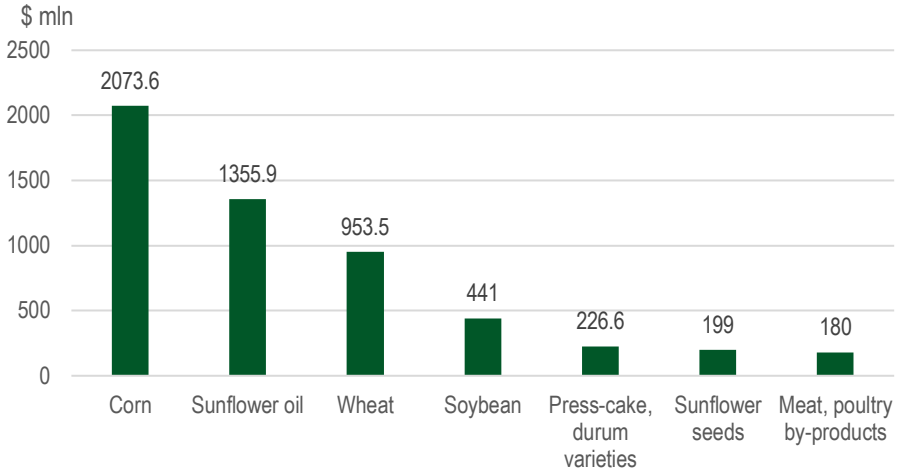
Table 4. Ukrainian exports, 2021-2022

Indicator	Years		2022 to 2021 %
	2021	2022	
Financing of technology companies in the agricultural and food sector of Ukraine, billion USD	53.6	30.0	56.0
Exports of all types of Ukrainian goods, billion USD	68.0	44.2	65.0

Source: Author's notes: based on data from (Ukraine's exports, 2022; In 2022, investment, 2022)

Agricultural and food products remain the most exported goods among sectors, accounting for 53% of total good exports in 2022 (Figure 1). Ukrainian products are exported to Poland (14.6% of total exports), Romania (9.7%), Germany (4.7%), Hungary (4.5%) and Spain (4.3%) (Syhyda, 2023).

Figure 1. Agricultural exports, first quarter of 2023



Source: the authors' development (Agrarians and IT, 2023)

Thus, grain crops (31%), fats and oils (14%), seeds and fruits of oilseeds (8%) accounted for the largest share in the export structure of the first quarter.

The year 2022 also revealed the benefits of domestic processing: companies focused on exporting raw materials were forced to reduce their activity or even stop it because of the blockade of ports on the Black Sea and the limited capacity of Ukrzaliznytsia. Instead, those who process their own products as feed or supply raw materials to the Ukrainian food industry ranked high in the rating (Aranchiy 2019). Oil and fat producers are the most resilient in terms of agribusiness sectors. However, they are reinforced by domestic contracts, or specialise in the production of bottled (more marginal products). Strong logistics, access to rail and proximity to the western borders meant production efficiency in 2022 (Rating of agricultural, 2023).

Innovative technologies for supply chain development are being introduced and developed in Ukraine (Table 5).

The government project eRobota provides Ukrainians with grants for starting a business, developing entrepreneurship and training. It aims to boost entrepreneurship and stimulate job creation. The development of the agro-processing industry significantly increases added value and reduces the burden on the capacity of export routes.

Since 2021, agri-tech and food startups have been booming, driven by global investors and entrepreneurs' awareness of the environmental impact of agriculture and meat production, as well as concerns about food security (Despite the war, 2023).

Grant support for export alliances will strengthen the potential of Ukrainian enterprises and encourage them to unite for a common goal of conquering new markets. The programme will provide about 15 grants ranging from $35,000 to $150,000. The grant program is aimed at supporting enterprises that seek to jointly promote their products in international markets. The initiative is implemented in partnership with the Office for Entrepreneurship and Export Development and the national project Diia. Business (USAID provides, 2022).

Group of Companies "Grain Capital" implemented a project to build a transshipment hub from 1520 mm gauge to 1435 mm European gauge on the border in Romania. The new facility was commissioned by one of the Ukrainian grain traders (Freight transport, 2022).

Nestlé has started construction of a new production site in Ukraine, which will be located in Volyn region. The new factory will be built near the distribution centre of Nestlé, which has been operating for over 10 years. Production is expected to start in the first quarter of 2024. The production network in Volyn together with the factory in Torchyn will become the European regional centre of the company in the category of culinary products.

The hub will employ 1,500 people at the production facility, which will supply products to the Ukrainian market and other European markets (Nestlé started, 2022). The new facilities will be equipped with state-of-the-art production technology and will meet the high domestic demand for food products, particularly instant noodles and condiments. Ukraine will remain the only European centre for instant noodles production for Nestlé, and the Volyn production hub will certainly play a huge role in exporting this fast-growing segment to European countries (Zoria, 2022).

Table 5. Innovative technologies for the development of a closed production cycle and supply chains from Ukraine, 2022-2026

Areas of development	Features
Development of agricultural and food technologies	Development of precision farming, improved agri-business management, irrigation and weather forecasting; B2B agri-business markets; improved food waste management; development of farm-to-table concept. Incentives - grants from eRobota State (garden grant, greenhouse grant, self-employment grant, grant for veterans and their families), various grants from USAD.
Development of the agro-processing industry	The government's grant project eRobota (grant for processing plant), from USAD. Transitioning from raw material exports to external sales of deeply processed products.
Support for startups	Development of biological fertilisers, vertical farms, agricultural robotics and alternative proteins, including plant-based and laboratory-grown meat
Grant support for export alliances	Support for businesses aiming to jointly promote their products on international markets
Hubs	A railway transshipment hub for Ukrainian grain was built in Romania. Nestlé in Ukraine will become the company's European regional hub for the culinary products. Coordination of IT solution providers, transport companies, warehousing, supply chain, foreign trade and distribution
Development of engineering and hardware programmes	Tracking and visibility of products. Development of digital logistics (JIT+ service for grain logistics in Ukraine). Improving customs logistics, the delivery market, and the use of drones for parcel delivery. Creation of robotic vehicle fleets, improvement of supply chain management, freight forwarding, warehouse automation, improvement of e-commerce logistics, creation of smart pallets and containers, and on-demand storage
Community autonomy	Each community should ensure maximum autonomy in the supply of agricultural products to its residents. Promote the cultivation, production and storage of as much food of plant and animal origin as possible
Human resources work	Outsourcing of logistics business processes
Export of niche high-margin cultures and products	Change in crop specialisation. Increase the area under peas, berries, mustard, etc., which are more variable in terms of transportation. Launching a line of unique Ukrainian types of honey directly from beekeepers, indicating the name of the beekeeper and honey terroir on a fair trade basis
Customs European Integration and Customs visa-free access for Ukraine	Obtaining European customs facilitation and benefits. Extension of zero duty on exports from Ukraine
Packaging design and functionality	In 2022, Syngenta purchased specialised bulk containers to export grain by rail. Important innovative solutions from technologists and branding agencies

Source: Author's notes: based on data from (Jitplus, 2023; Nestlé started, 2022; TA Ventures, 2023; USAID provides, 2022; Agricultural production, 2023; Freight transport, 2022; Exhibition, 2022; Window to Europe, 2021; Logistician's Day, 2023; Ukrainian brand, 2021; National Forum, 2022; Agriculture during, 2023; In 2022, 2023)

JIT+ specialises in building efficient grain transportation logistics in Ukraine. We have adopted effective European logistics principles and developed a unique service that allows us to track grain transportation online. With online tracking, the communication is two-way, and the cargo owner has the opportunity to contact the driver in real time, adjust movements, optimise routes and reduce downtime at loading and unloading points. A single information space allows customers, shippers, consignees and carriers to negotiate directly. Statistical data and carrier ratings help to find reliable partners and build long-term forecasts for the development of their business (Jitplus, 2023).

The main trends in 2023-2024 should be the development of technologies, flexibility, further transition to "green" solutions and other ways of developing the logistics market both in Ukraine and in the world. Ukraine will be rebuilt according to the principle of Build Back Better, in particular, it will build everything according to new rules and to the extent necessary, based on new realities (Agriculture during, 2023).

New export opportunities are emerging. African countries that have long been out of Ukraine's focus have now become important because of the russian federation's armed aggression against our country. The economic circumstances of the russian-Ukrainian war, with the blocking of our exports abroad, have a bigger impact on Africa (The forgotten, 2022).

Alongside intergovernmental negotiations and the creation of post-war reconstruction plans for Ukraine (infrastructure development), there is growing interest from private invest (Despite the war, 2023). International organisations and governments of the Western countries strongly support such initiatives of Ukraine and provide organisational, resource and financial support. But the main burden falls on the community leaders and domestic farmers and entrepreneurs. Significant results in production and exports can only be achieved with close cooperation of all stakeholders, active dialogue and coordination of efforts (National Forum, 2023). Ukraine will rebuild according to the principle of Build Back Better, in particular, it will build everything according to new rules and to the extent necessary, based on new realities.

The domestic market will quickly recover and new horizons will open up for Ukraine as an important player on the global agri-food map with the end of the war. As the population of the world is growing and diets are changing, the world will need to produce 50% more food by 2050 in order to meet the needs of humanity. According to the Food and Agriculture Organization of the United Nations (FAO), this demand will be met through sustainable agriculture (One step, 2023). International investors are waiting for the war to end so they can actively invest in Ukraine. Investments in logistics, transshipment terminals, and vehicles are still ongoing even today (Investment, 2022).

Conclusions

Global supply chains, which are disrupted by aggression, affect countries all over the world. And, smart solutions are being made in logistics tools: planning, the operation of fulfilment centres, tracking and so on.

In Ukraine, agricultural and food products are still the most exported goods among sectors, accounting for 53% of total goods exports in 2022. Modelling and optimisation of business processes, digital transformation of supply chains, management of big data and digital platforms, IT startups and the future of smart logistics, as well as further transition to green solutions, should be major trends in Ukrainian supply chains in 2023-2024. The Ukrainian logistics industry needs to integrate into the global digital logistics ecosystem.

Some of the statements and conclusions of the research paper are of scientific and practical value, in particular, the research paper analyses the innovative technologies for the formation of a closed production cycle and supply chains from Ukraine during the period of martial law and suggests the main development trends in 2024. In the context of global challenges, the development of agricultural enterprises is of utmost importance. In the war time, the agricultural sector is the second front in the struggle of the Ukrainian people for food and financial independence, and the exports of products. Moreover, Ukrainian grain and other agricultural products are a significant link in the chain of global food security, which points to the importance of developing agricultural enterprises.

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Credit Authorship Contribution Statement

Ilona Yasnolob: analysed innovative technologies for the creation of a closed production cycle and supply chains in Ukraine during the period of martial law.
Nataliia Demianenko: conducted a formal analysis and delineated the main trends in the development of supply chains from Ukraine during martial law in 2024.
Oleg Gorb: researched and analyzed the export challenges encountered by Ukraine during the war.
Yurii Tiutiunnyk: conceptualized innovative solutions both within Ukraine and on a global scale to enhance export opportunities.
Svitlana Tiutiunnyk: the specifics of investing in nearshoring production are investigated.
Lyudmyla Shulga: the market of "digital logistics" as a set of services and tools for transportation is analysed.
Tetiana Dugar: researched digital platforms capable of effectively managing cross-border transport within a unified system and optimizing numerous business processes.
Olena Maiboroda: analyzed services that assist in tracking real-time information regarding cargo, its location, and transportation conditions

Svitlana Pysarenko: researched the methodology, administered the project, and oversaw its software and support.
Yuliia Pomaz: supervised, curated data, verified and edited it, and was responsible for data visualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Impact of the Perceived Quality of Traditional Villages' Cultural Landscapes on Tourists' Loyalty

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Abstract: This study explored the relationship between the perceived quality of cultural landscapes and tourists' loyalty to traditional villages using structural equation modeling (SEM) by collecting data from 463 tourists in Huangdu Dong Village within China's Hunan Province. The results reveal that the perceived quality of traditional villages' cultural landscapes indirectly and significantly affected tourist loyalty; its influence was primarily transmitted through the mediating variable of tourist satisfaction. Meanwhile, no significant difference in loyalty was observed between tourists' gender, occupation, and place of residence, while age, educational background, and income level had significant effects on loyalty. This study reveals the importance of cultural landscapes in traditional village tourism and provides important ideas for traditional village tourism marketing. In doing so, this study enhances the competitiveness and influence of traditional village tourism and provides theoretical contributions to sustainable village development.

Keywords: traditional village; cultural landscape; perceived quality; loyalty

JEL Classification: Z32; C12; Q01.

Introduction

Traditional villages are an important part of Chinese culture, as they provide both tangible and intangible forms of non-renewable heritage, including historical, cultural, archival, and research values (Gao, Wu, and Zhao 2020; Tang *et al.* 2021). These villages' rich human resources are critical in developing rural tourism (Gao and Wu 2017), which serves as a carrier of regional, traditional characteristics and historical heritage; they also tangibly

preserve many historical landscapes and intangibly, many traditional customs, which are key in attracting tourists to rural areas (Li and Wang 2023; Tieskens *et al.* 2017). Coupled with a series of national documents and policies on rural revitalization development, this has contributed to the gradual emergence of traditional villages as important destinations in rural tourism (Demirović *et al.* 2019; Long and Tu 2018). In 2018, of the 5.54 billion domestic tourists to China, approximately 3 billion engaged in some form of rural tourism, and rural tourism accounts for more than half of domestic tourism (Han 2020). Economically, tourism positively impacts local economies and livelihoods (Job and Paesler 2013) by generating higher income, promoting employment, and facilitating foreign trade (Haber and Lerner 1999).

Tourism in particular can generate economic income for rural communities outside of their intensive agricultural production (Buijs, Pedroli, and Luginbühl 2006). Additionally, rural tourism provides financial security toward the conservation of traditional villages to a certain extent, activates a momentum in their endogenous development, and compensates for the lack of industries in traditional villages in the era of the non-agricultural economy (Chi *et al.* 2020; Lv 2017). However, as with other types of tourism, rural tourism faces fierce competition (Chin 2022; Soeswoyo *et al.* 2021). A region that wants to gain a competitive advantage in tourism must ensure that tourists are highly satisfied with their perceptions of the experience (Prayag and Ryan 2012). In this regard, one influencing factor is tourists' perceptions of the quality of services offered (Ranjbarian and Pool 2015). Moreover, understanding visitors' perceptions of quality regarding a region's cultural landscape is essential, and can help managers improve and optimize the quality of tourists' experiences (Liu, Lin, and Chen 2022).

The appearance of tourism is the economy, the core of tourism is culture, and the tourism process is more of a cultural experience (C. Huang 2006). Cultural landscapes provide tourists with different experiences and meanings (Rakić and Chambers 2011), and tourists' behavioral intentions reflect a process in which perceptions trigger emotions and influence behaviors (Chen *et al.* 2016). Moreover, tourists' impressions of the tourism experience are a reliable source of information for judging tourist behavior (Coudounaris and Sthapit 2017). Revisit and recommendation intentions are two forms of behavioral intentions that reflect the degrees of tourists' loyalty to experience an activity again (Baker and Crompton 2000). Enhancing tourists' loyalty to rural tourism is important for improving rural economic income and promoting sustainable rural development; it is an important measure of whether the quality and appearance of rural tourism has improved and rural revitalization is promoted (Oppermann 1998).

Customer loyalty is the key to businesses' survival and success (Charinsarn, Diallo, and Lambey-Checchin 2023), and the key to gaining tourists' loyalty is to provide them with a high-quality, comfortable, and unique experience (Cao, Xie, and Qu 2023). Increased tourist loyalty can promote the sustainable development of scenic spots and enhance tourism competitiveness. In particular, traditional villages have rich cultural characteristics, such as the crystallization of rural cultural heritage (Gao and Wu 2017). Tourists' intuition after a tour--and subsequent loyalty level--is based on their perceptions of traditional villages' cultural landscapes (Suo and Sun 2014). Therefore, it is necessary to explore the influence mechanism between traditional village tourists' perceptions of the cultural landscape and their loyalty, clarify the direction to enhance tourists' willingness to be loyal, and provide a theoretical basis for the optimization and enhancement of the cultural landscape and tourism development in traditional villages.

Tourist loyalty has become an important aspect of rural tourism research. First, current research has focused on the destination's image (Pan, Rasouli, and Timmermans 2021; J. Wang *et al.* 2021; L. Wu and Shimizu 2020), tourism satisfaction (Ma *et al.* 2021; Mouratidis, Ettema, and Næss 2019), tourism motivations (Aebli, Volgger, and Taplin 2022; Khan *et al.* 2019), and value perceptions (Dedeoğlu 2019; Jeong and Kim 2020). However, literature has rarely examined the perceived quality of cultural landscapes from tourists' perspective, and few empirical studies have observed the relationship between the perceived quality of cultural landscapes and tourists' loyalty intentions. Second, few rural tourism studies have explored traditional villages as cultural heritage sites, with exceptions from Li and Wang (2023), and Hidayana *et al.* (2019). For example, Li and Wang (2023) used structural equation modeling to explore the interactions among traditional villages' cultural landscape authenticity, the memorable tourism experience, and place attachment in driving tourists' behavioral imagery and significantly influencing tourists' behavioral intentions. Hidayana *et al.* (2019) explored the relationships between tourism motivation, satisfaction, and the willingness to revisit and found that tourist motivation significantly and positively affected tourist satisfaction, which significantly and positively affected the willingness to revisit; tourist motivation had no significant effect on this willingness.

Third, many studies have examined the relationship between perceived quality and tourist loyalty. For example, Ni *et al.* (2023) analyzed the relationship between tourists' perceptions of the landscape's quality and their loyalty to rural tourism to note that the perceived quality primarily influences tourists' loyalty, with perceived

value and satisfaction as mediating variables. In an analysis of consumer purchase intentions, Khan (2019) found that consumer-perceived quality significantly influences loyalty. However, the author did not clarify the relationship between the perceived quality of the traditional village landscape in the cultural heritage tourism context, tourists' loyalty intentions, and the mediating role between them.

This study fills this research gap by exploring the relationship between tourists' perceptions of quality among traditional village cultural landscapes and their loyalty from the cultural landscape perspective, with perceived value and satisfaction as mediating variables. Thus, this study attempts to answer three research questions:

What dimensions of the traditional village cultural landscape do tourists perceive?

Does the perceived quality of traditional villages' cultural landscapes significantly affect tourists' loyalty?

Do perceived value and satisfaction mediate the relationship between the perceived quality of the cultural landscape and loyalty, and if so, which factors are the most significant?

Based on this research gap, this study introduces two mediating variables from the perspective of tourists' cultural landscape perceptions: perceived value and satisfaction. A system to determine tourists' perceptions of quality in the cultural landscape was constructed based on previous studies. A combination of field research, theoretical construction, and empirical testing allows this study to explore not only the relationship between the perceived quality of the cultural landscape in traditional villages and tourists' loyalty intentions, but also the mediating role of perceived value and satisfaction in this structural relationship. The results from an examination of these relationships can help managers better understand tourist psychology and behaviors, and thus, help better provide services that meet tourists' needs.

1. Theoretical Background and Hypotheses

1.1 Perceived Quality of Traditional Villages' Cultural Landscapes

In China, traditional villages convey both tangible and intangible types of cultural heritage (Fu, Zhou, and Deng 2021), and embody thousands of years of cultural and historical roots (Li and Wang 2023). These villages showcase diverse regional cultures and folk customs, with rich historical, cultural, social, artistic, and economic values (J. Zhou *et al.* 2023). Against the backdrop of rural revitalization in China, traditional villages' cultural landscapes have become important tourism resources (Martínez, Sanagustín, and Blanco 2018; W. Yang *et al.* 2022). When these cultural landscapes lead cultural tourism development, they can effectively guide and promote traditional villages' conservation and revitalization (J. Zhou *et al.* 2023).

Current research on traditional villages' cultural landscapes primarily focuses on cultural landscapes' planning and design (Adhika and Putra 2020; An-rong Dang, Zhang, and Chen 2013), evolution (Fang and Liu 2008; Sun and Ou 2021), perception assessments (Li and Wang 2023; J. Zhou *et al.* 2023), and conservation and development (Anrong Dang *et al.* 2020; X. Wang 2022). Research on the perceived quality of traditional villages' cultural landscapes primarily assesses the quality of cultural perceptions from the tourist's perspective. Zhou *et al.* (2023) conducted an online text-based assessment to evaluate tourist perceptions of cultural landscapes in traditional villages; while they observed that tourists generally had positive perceptions of cultural landscapes, their perceptions of the landscapes' cultural significance was lacking. Beeho and Prentice (1997) employed in-depth interviews to analyze tourists' experiential perceptions at New Lanark Village, a World Heritage Site in the United Kingdom. They used an activities, settings, experiences, and benefits (ASEB) grid analysis to note that tourists primarily enjoyed the site's historical and cultural aspects. Yang *et al.* (2023) analyzed tourists' perceptions of the cultural landscape quality of island-based greenways and found that they had better perceptions of the cultural aspects related to slow-walking facilities within the greenways. Although these studies focused on tourists' perceptions of quality, they rarely explored the connections between perception, value, satisfaction, and loyalty, or the relationships among them.

In tourism behavioral research, researchers define perceived quality as tourists' overall perceptions of their tourism experience(Jin, Lee, and Lee 2015). Literature considers this as a multidimensional assessment in which various perceptual experiences help form a final overall vision (Fernandes and Cruz 2016). The overall perceived quality then reflects the tourism destination's various attributes (Park, Lee, and Nicolau 2020). Researchers have suggested the use of multidimensional scales to measure perceptual quality (Kiatkawsin and Han 2017). By combining and summarizing the literature on traditional village cultural landscapes, this study classified the perceived dimensions of traditional village cultural landscapes into 11 categories: architectural, spatial, water system, plant, paved road, service facility, handicraft, costume, folklore, agricultural, and food culture (Li and Wang 2023; Zhang *et al.* 2023; J. Zhou *et al.* 2023) Appendix A further defines these 11 dimensions.

Previous studies have revealed that multidimensional quality and attribute scales are strong predictors of perceived value (Suhartanto *et al.* 2020). For example, in the context of China's rural tourism destinations, four perceived quality dimensions significantly affect tourists' perceived value (Chi *et al.* 2020). In a study of island-type greenways, it was also proven that tourists' perceptions of their cultural landscape's quality positively impacted value (Y. Yang *et al.* 2023). Researchers have indicated that the study of perceived value can comprehensively reflect tourists' perceived quality of tourism products and their unique value (Jin, Lee, and Lee 2015), which can help tourism destinations seize a competitive advantage while guiding tourism theory and practical research. Academics have also posited that perceived quality is the main variable of satisfaction in the tourism process, and that perceptions of a high-quality experience will enhance tourist satisfaction (Lin and Kuo 2016). Moreover, Jridi *et al.* (2014) discovered that the perceived quality of five dimensions of coastal tourism in Tunisia significantly impacted tourist satisfaction. The perceived quality of festivals and activities at tourist destinations also significantly influenced satisfaction (Pivac *et al.* 2019). Therefore, this study proposes the following Hypotheses 1 and 2:

Hypothesis 1. The perceived quality of the traditional village's cultural landscape significantly and positively affects perceived value.

Hypothesis 2. Perceived quality positively affects tourist satisfaction.

1.2 The Relationship between Perceived Value and Satisfaction

Perceived value is not only key to understanding the consumer experience (S. Huang and Hsu 2009), but also a comprehensive assessment of a product's effectiveness after the consumer perceives it (Zeithaml 1988). In tourism research, the perceived value concept has been developed primarily based on perceived value. It is defined as an individual's evaluation of a tourism product or service based on the ratio of tourism benefits to costs during tourism consumption (Al-Ansi and Han 2019; Li and Wang 2023). Perceived value is also a key factor that influences satisfaction (Oriade and Schofield 2019; Yu *et al.* 2023). It has been found to be a prerequisite for satisfaction in various research settings (Assaker, Hallak, and El-Haddad 2017; Paulose and Shakeel 2022). Therefore, this study proposes the following Hypothesis 3:

Hypothesis 3. Perceived value positively affects tourist satisfaction.

1.3 The Relationship between Satisfaction and Loyalty

Satisfaction is defined as a positive psychological state resulting from the customer's perception of the consumption process, and is considered an integrated, positive response to the product or service experience (Oliver 1980). Numerous tourism studies have extensively validated the relationship between satisfaction and loyalty intentions (Islamy, Trisnawati, and Rahayu 2022; Kusdibyo 2022; M. Zhou and Yu 2022). Satisfaction is typically a significant predictor of tourists' loyalty (Kiatkawsin and Han 2017; Olya *et al.* 2019; H.-C. Wu, Cheng, and Ai 2017). For example, satisfaction is a variable mediating the relationships between the quality of festivals, the event experience, and loyalty in Serbian destinations, while tourists' satisfaction with festivals and events significantly influences their behavioral intentions (Pivac *et al.* 2019). In another study, Tourists' satisfaction with their perception of the cultural landscape has positively affected loyalty in island-based greenway studies (Y. Yang *et al.* 2023). Tourist loyalty includes the willingness to revisit, willingness to recommend, and willingness to convey positive word-of-mouth (Kiatkawsin and Han 2019; Suhartanto *et al.* 2020), all of which are tourist behaviors desired by tourism firms. As measuring actual customer behavior is challenging for many researchers, this study uses visitors' willingness to revisit and recommend as an indicator of loyalty. Therefore, this study formulates the following Hypothesis 4:

Hypothesis 4. Tourist satisfaction positively affects loyalty.

2. Study Case and Data Collecting

2.1. Study Case

Huangdu Dong Village is located southwest of Dong Autonomous County in Huaihua City, Hunan Province, China. The village was selected [for analysis in this study] based on the following criteria:

First, the selected village was listed in the third batch of traditional Chinese villages in 2015, and had rich natural and cultural landscapes and important conservation and research values. It is surrounded by mountains and trees and has an appealing natural scenery. The village's overall appearance is well-preserved, with many exquisite public structures and detailed craftsmanship.

Second, the selected village was built during the Ming Dynasty, has a more than 700-year history, and is located at the core of the 100-mile Dong Cultural Corridor. Additionally, the village has inherited Dong cultural

traditions, with rich folk connotations; Dong songs, dances, and costumes; various traditional sports and cultural programs; colorful folk activities; and flavorful Dong food. Collectively, these exemplify the essence of traditional Dong culture.

Third, this village also has a complete spatial pattern and a well-protected historical style, and is well-known in the area.

2.2. Scale Design

First, an initial scale was constructed by combining elements from prior literature, in four parts: perceived quality, perceived value, satisfaction, and loyalty. The research questionnaire contained two parts: 1) tourists' demographic characteristics, including gender, age, educational background, occupation, place of residence, and income; and 2) a questionnaire with four dimensions: perceived quality, perceived value, satisfaction, and loyalty. The latter part was further divided into 18 items, with each scale item scored on a five-point Likert scale that displays good reliability and validity.

2.3. Data Collection and Sample Characteristics

This survey was conducted over two weekends: February 25 to 26 and March 4 to 5, 2023. People typically have more leisure time on weekends, which results in more visitors during these periods. The survey targeted tourists who visited Huangdu Dong Village and employed a random sampling method to distribute the questionnaires.

Table 1. Tourists' Demographic Statistics

Characteristics		Frequency	Percentage
Gender	Female	254	54.9%
	Male	209	45.1%
Age	< 18	28	6.0%
	18–24	65	14.0%
	25–30	27	5.8%
	31–40	165	35.6%
	41–50	136	29.4%
	51–60	35	7.6%
	> 60	7	1.5%
Education	Junior high school or below	96	20.7%
	High school	84	18.1%
	Junior college	138	29.8%
	Undergraduate	115	24.8%
	Postgraduate	30	6.5%
Occupation	Students	82	17.7%
	Enterprise workers	75	16.2%
	Government/institutional personnel	80	17.3%
	Retirees	23	5.0%
	Others	203	43.8%
Place of residence	Rural	197	42.5%
	Urban	266	57.5%
Average monthly disposable income	< 1,000 RMB	76	16.4%
	1,001–3,000 RMB	72	15.6%
	3,001–5,000 RMB	174	37.6%
	5,001–8,000 RMB	104	22.5%
	8,001–10,000 RMB	8	1.7%
	> 10,001 RMB	29	6.3%

Of the 480 questionnaires distributed, the study excluded questionnaires with unclear or incomplete responses to obtain 463 valid responses, with a 96.5% response rate. The number of questionnaires satisfied the sample size

requirements for the confirmatory factor analysis. Among the survey participants, 45.1% were male and 54.9% were female, indicating a relatively balanced gender ratio. Most tourists' ages ranged from 31 to 50 (65%). Table 1 presents more specific visitor demographic information.

2.4. Analysis Method

This study employed AMOS 26.0 and SPSS 26.0 software to quantitatively analyze the questionnaire data. Initially, the data were collected using questionnaires, and the questionnaire items' reliability and validity were assessed. Subsequently, the constructed model was subjected to a goodness-of-fit analysis using the collected data. Finally, structural equation modeling was employed to examine the interaction mechanisms among the latent variables.

3. Results

3.1 Common Method Deviation Test

As the questionnaire collected data from the same environment and items were described in a single context, a common method variance bias is likely to arise, creating potentially misleading study results (H. Zhou and Long 2004). To control for common method variance bias, this study began with an exploratory factor analysis of the scale items and used Harman's one-way test based on an exploratory factor analysis to test for common method bias. The exploratory factor analysis was performed using SPSS software for all scale questions corresponding to latent variables, with data extracted using a principal component analysis without rotation. Table 2 displays the obtained results.

Table 2. Total Variance Explanation

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.808	43.378	43.378	7.808	43.378	43.378
2	2.071	11.506	54.884	2.071	11.506	54.884
3	1.387	7.708	62.591	1.387	7.708	62.591
4	1.297	7.206	69.797	1.297	7.206	69.797
5	1.040	5.780	75.578	1.040	5.780	75.578
6	0.831	4.614	80.192			
.....						
18	0.153	0.849	100.000			

When performing the Harman's one-way test, if only one factor with an eigenvalue greater than one was obtained, or if the amount of variation explained by the first factor exceeded a critical value of 50%, then this indicates a serious common method variation problem. However, if multiple factors were obtained and the amount of variation in the first factor did not exceed 50%, the common method variation problem is not serious (Podsakoff and Organ 1986). The results revealed that five factors with eigenvalues greater than one were obtained, and the first factor's variance contribution was 43.378%, which was less than the critical value of 50%. Therefore, common method bias is not serious in the sample data, and this does not affect the subsequent model's construction.

3.2. Common Method Deviation Test

Reliability and validity tests were conducted to assess the questionnaire's reliability and consistency, as it is typical to review these two components in literature. According to Hair *et al.* (2021), evaluating a measurement model includes tests to determine internal consistency and reliability, indicators' reliability, convergent validity, and discriminant validity. The internal consistency and reliability was evaluated using Cronbach's alpha and composite reliability. The Cronbach's alpha and composite reliability values represent the lower and upper limits of internal consistency and reliability, respectively. Further, the Cronbach's alpha and composite reliability should be greater than 0.7. Convergent validity is assessed using the average variance extracted (AVE) values greater than 0.5. The indicator reliability is evaluated by measuring the items' outer loadings, and should be greater than 0.7. If the measurement scale's composite reliability is recommended to be greater than 0.7 and the AVE value greater than 0.5, then measurement items' outer loadings between 0.4 and 0.7 are also acceptable. We used SPSS 26.0

software to first test each latent variable using the Cronbach's alpha coefficient (Cronbach's alpha). Table 3 displays the results.

Table 3. The Measurement Model's Reliability

Latent Variables	Indicators	Load Values	Cronbach's Alpha	CR	AVE
Perceived Quality	PQ1	0.649	0.915	0.927	0.539
	PQ2	0.692			
	PQ3	0.798			
	PQ4	0.763			
	PQ5	0.789			
	PQ6	0.787			
	PQ7	0.653			
	PQ8	0.740			
	PQ9	0.745			
	PQ10	0.653			
	PQ11	0.782			
Perceived Value	PV1	0.882	0.847	0.907	0.766
	PV2	0.866			
	PV3	0.877			
Loyalty	Sat1	0.915	0.775	0.898	0.816
	Sat2	0.891			
Satisfaction	Loy1	0.927	0.802	0.909	0.834
	Loy2	0.899			

In this study, the Cronbach's alpha values were between 0.775 and 0.915 for the perceived quality, perceived value, tourist satisfaction, and tourist loyalty scores. The perceived quality, perceived value, visitor satisfaction, and visitor loyalty scores were 0.915, 0.847, 0.775, and 0.802, respectively, and all of these exceeded the recommended 0.7 threshold. The composite reliability values were between 0.898 and 0.927, both of which exceeded the recommended value of 0.7. The AVE values for convergent validity were between 0.539 and 0.834, and both were greater than 0.5. The outer loadings of the measurement items were between 0.649 and 0.927, and both were greater than 0.6. Therefore, the data within the measurement scales were highly consistent and exhibited good reliability.

Discriminant validity can be assessed using either the heterotrait-monotrait ratio (HTMT) or the Fornell-Larcker criterion. The HTMT value is judged as follows: the HTMT value should be less than 0.85, or more leniently, less than 0.9 (Franke and Sarstedt 2019; J. F. Hair, Howard, and Nitzl 2020). The Fornell-Larcker criterion judges that the square root of each latent variable's AVE should be greater than the maximum correlation coefficient of any other latent variable (Fornell and Larcker 1981). Table 4 displays the results of assessing discriminant validity using the Fornell-Larcker criterion and HTMT.

Table 4. Distinct Validity Test

	Perceived Value	Perceived Quality	Loyalty	Satisfaction
Perceived Value	0.875			
Perceived Quality	0.483 (0.529)	0.734		
Loyalty	0.435 (0.524)	0.479 (0.549)	0.913	
Satisfaction	0.434 (0.535)	0.523 (0.605)	0.508 (0.638)	0.903

* *Note*: The diagonal values are $\sqrt{AVE}$, the lower triangular area is the correlation coefficient between latent variables, and the values in parentheses are the HTMT values.

It can be found that the square root of the AVE on the diagonal (noted in bold) is greater than the correlation between the latent variables, and all the HTMT values are less than 0.85, indicating that this study's research scale exhibits good validity.

3.3. Testing the Model's Goodness-of-Fit

The model's fit was first evaluated using a partial least-squares algorithm (SRMR = 0.069, < 0.08; NFI = 0.915, > 0.90; d_ULS = 2.368; d_G = 0.826; chi² = 2,208.286). The model demonstrates a good fit according to the evaluation criteria developed by Henseler *et al.* (2014).

In summary, the measurement model's reliability, validity, and degree of fit reached an acceptable standard, and a subsequent structural model analysis was conducted.

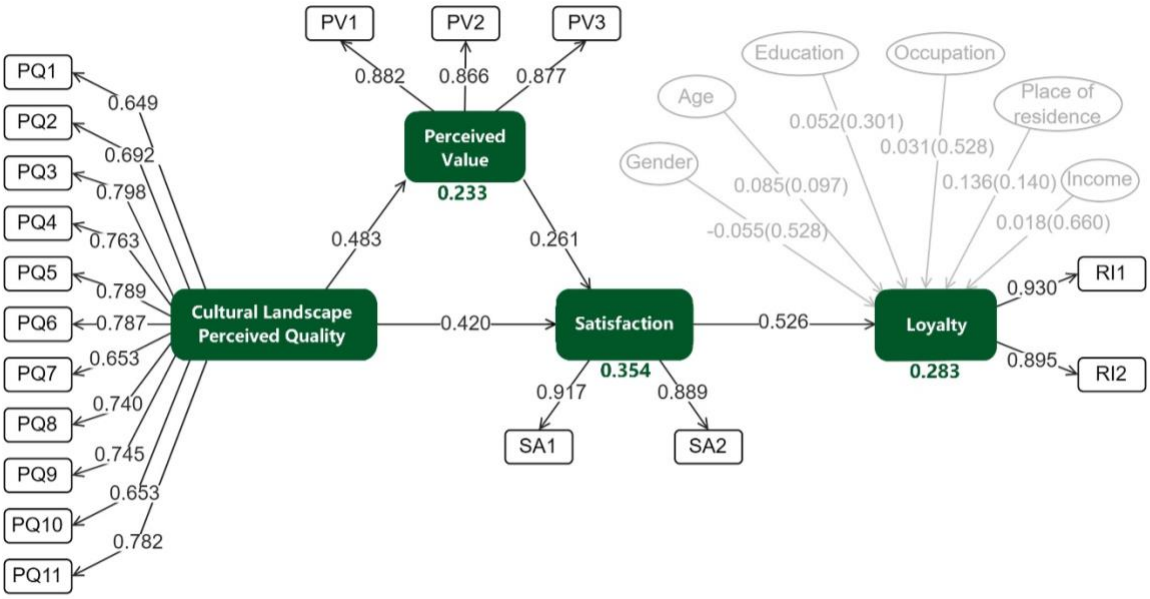
3.4. Structural Equation Model Testing

The structural model path coefficients' significance was assessed using a bootstrap method by setting the bootstrap samples to 5,000 and selecting a 95% quantile confidence interval. When analyzing the structural model, demographic variables were included as control variables. Table 5 and Figure 1 present the analysis results.

Table 5. Estimation Results for the Structural Model's Path Coefficients

Hypothesis	Paths	Path Coefficients	*t*-value	*p*-value
H1	Perceived Quality -> Perceived Value	0.483	12.720	< 0.001
H2	Perceived Quality -> Satisfaction	0.420	7.741	< 0.001
H3	Perceived Value -> Satisfaction	0.261	4.235	< 0.001
H4	Satisfaction -> Loyalty	0.526	12.522	< 0.001
	Gender -> Loyalty	-0.055	0.631	0.528
	Age -> Loyalty	0.085	1.659	0.097
	Educational Background -> Loyalty	0.052	1.034	0.301
	Occupation -> Loyalty	0.031	0.631	0.528
	Place of Residence -> Loyalty	0.136	1.477	0.140
	Average Monthly Disposable Income -> Loyalty	0.018	0.440	0.660

Figure 1. The structural model's estimation results



At the 0.05 significance level, it can be observed that the paths corresponding to Hypotheses H1 to H4 are statistically significant, and thus, these hypotheses are all verified.

3.5. Intermediary Effect Analysis

Table 6 presents the findings pertaining to the two mediating paths for the impact of the perceived quality of the cultural landscape on tourist loyalty. The study observed that perceived quality's impact on visitor loyalty was

mediated by perceived value and visitor satisfaction, with a path coefficient of 0.066 that accounted for 23.0% of the total effect of perceived quality on visitor loyalty. This study also discovered that perceived quality significantly impacts visitor loyalty through visitor satisfaction, with an effect value of 0.221 that accounts for a substantial proportion (77.0%) of the perceived quality's total effect on visitor loyalty. These findings indicate that the perceived quality's impact on tourist loyalty is primarily conveyed through the intermediary factor of satisfaction.

Table 6. Mediated Path Effect Value Analysis of Perceived Quality's Influence on Tourist Loyalty

Paths	Intermediary Effect Value	*t*-value	*p*-value	Percentage
Perceived Quality -> Perceived Value -> Satisfaction -> Loyalty	0.066	3.517	< 0.001	23.0%
Perceived Quality -> Satisfaction -> Loyalty	0.221	6.566	< 0.001	77.0%

3.6. Analysis of Group Differences

To examine each demographic variable's effect on visitor loyalty, an analysis of variance (ANOVA) between the groups used demographic variables as grouping variables. Both gender and residence had only two options, and independent sample t-tests were used, while the ANOVA was used for all other variables. If the ANOVA's F-statistic is statistically significant, it is then used for two-by-two comparisons between groups using Duncan's method. The analysis results are as follows.

Gender

As the comparative results in Table 7 indicate, the sample groups of different genders did not significantly differ in any dimension ($p > 0.05$) at the level of $\alpha = 0.05$.

Table 7. Analysis of Differences between Genders

Variable	Gender	N	Mean±Standard deviation	*t*-value	*p*-value
Loyalty	Female	254	3.80±0.86	0.815	0.416
	Male	209	3.72±0.97		

Age

As noted in Table 8, at the level of $\alpha = 0.05$, a significant difference can be observed between the different sample age groups in the visitor loyalty dimension ($F = 4.100$, $p = 0.001, < 0.01$). The highest loyalty was found among the 50 to 60 sample group age group (4.09±1.02). The sample group of those younger than 18 exhibited the lowest visitor loyalty (3.05±0.96).

Table 8. Analysis of Differences between Ages

Variable	Age	N	Mean±Standard deviation	*F*-value	*p*-value
Loyalty	< 18	28	3.05±0.96a	4.100	0.001
	18–24	65	3.87±0.88b		
	25–30	27	3.70±1.13b		
	31–40	165	3.83±0.91b		
	41–50	136	3.72±0.80b		
	51–60	35	4.09±1.02b		
	> 60	7	3.57±0.35b		

Educational Background

Table 9 indicates, at the level of $\alpha = 0.05$, a significant difference in the visitor loyalty dimension among the sample groups with different educational backgrounds ($F = 8.402$, $p < 0.001$). The sample groups with an education of junior high school or below, and postgraduate or above, were relatively less loyal as visitors, while the junior college sample group had the highest visitor loyalty (4.08±0.85).

Table 9. Analysis of the Differences between Educational Backgrounds

Variable	Educational Background	N	Mean±Standard Deviation	*F*-value	*p*-value

Variable	Educational Background	N	Mean±Standard Deviation	*F*-value	*p*-value
Loyalty	Junior high school or below	96	3.52±0.96a	8.402	< 0.001
	High school	84	3.85±0.98bc		
	Junior college	138	4.08±0.85c		
	Undergraduate	115	3.60±0.75ab		
	Postgraduate or above	30	3.47±1.01a		

Occupation

As noted in Table 10, at the level of α = 0.05, none of the sample groups in the different occupations significantly differed in terms of loyalty (p > 0.05).

Table 10. Analysis of the Differences between Different Occupations

Variable	Occupation	N	Mean±Standard Deviation	*F*-value	*p*-value
Loyalty	Students	82	3.60±0.96	2.316	0.056
	Enterprise workers	75	3.77±0.90		
	Government/ institution personnel	80	3.93±0.88		
	Retirees	23	3.41±0.47		
	Others	203	3.80±0.94		

Place of residence

As indicated in Table 11, at α = 0.05, no significant difference exists in the visitor loyalty dimension between the sample groups from different places of residence (p > 0.05).

Table 11. Analysis of the Differences between Different Settlements

Variable	Place of residence	N	Mean±Standard deviation	*t*-value	*p*-value
Loyalty	Rural	197	3.73±0.91	0.607	0.544
	Urban	266	3.79±0.92		

Average monthly disposable income

The results in Table 12 reveal that a significant difference exists in tourist loyalty (F= 2.939, $p = 0.013$, < 0.05) among the sample groups with different average monthly disposable incomes at the level of α = 0.05. The sample group with an average monthly disposable income of 5,001 to 8,000 RMB had the lowest tourist loyalty (3.58±0.81), which significantly differed from the sample groups with an average monthly disposable income of 8,001 to 10,000 RMB and 10,001 RMB and above.

Table 12. Analysis of the Differences between Different Average Monthly Disposable Incomes

Variable	Average Monthly Disposable Income	N	Mean±Standard Deviation	*F*-value	*p*-value
Loyalty	< 1,000 RMB	76	3.72±1.09ab	2.939	0.013
	1,001–3,000 RMB	72	3.65±0.85ab		
	3,001–5,000 RMB	174	3.86±0.91abc		
	5,001–8,000 RMB	104	3.58±0.81a		
	8,001–10,000 RMB	8	4.31±0.70c		
	> 10,001 RMB	29	4.10±0.77bc		

4. Discussion

4.1. General Discussions

The previous section's data processing revealed the following relationships among tourists' perceived quality of the cultural landscape, including their perceived value, satisfaction, and willingness to revisit:

First, a significant, positive influence exists in the relationship between the perceived quality of traditional villages' cultural landscape and perceived value and satisfaction. The perceived quality's influence on perceived value is slightly greater than its influence on satisfaction, and the corresponding path coefficient reaches 0.483; specifically, for every one unit of increase in tourists' perceived quality of cultural landscapes, the perceived value of the traditional villages' cultural landscape accordingly increases by 0.483 units.

The perceived quality of traditional villages' cultural landscape contains 11 dimensions that stimulate tourists' multiple senses through environmental elements, humanistic inculcation, and the activity experience, enabling them to form subjective evaluations. These dimensions are ranked as follows, according to the size of their path coefficients: the aquatic system's cultural landscape (0.798) > paved road cultural landscape (0.789) > service facilities cultural landscape (0.787) > food cultural landscape (0.782) > vegetal cultural landscape (0.763) > handicraft cultural landscape (0.745) > folklore activity cultural landscape (0.740) > space cultural landscape (0.692) > costume cultural landscape (0.653) = agricultural cultural landscape (0.653) > architectural cultural landscape (0.649).

Given this ranking, tourists' perceptions of the aquatic cultural landscape are the most critical factor to enhance tourists' satisfaction and perceived value of the factor. This also implies that tourists currently tend to prefer the aquatic cultural landscape of Huangdu Dong Village. Onsite research indicates that a river runs through the village, and the buildings on both sides are staggered according to the water's flow, forming an appealing aquatic landscape as well as water activities and increasing visitors' perceptions of the quality and value in the cultural experience. The second and third cultural landscape factors involve the paved road and service facilities. In the tourism development process, the village's original roads were repaired and service facilities increased, and their styles coordinated with the village's regional landscape. Therefore, tourists perceive the village as higher quality. The path coefficients demonstrated that architectural, agricultural, and costume-related cultural landscapes had the weakest influence on enhancing tourist satisfaction and perceived value.

Site research revealed that the village's traditional architecture manifested in different building styles, as some more modern buildings were built in the village before it was rated as a traditional Chinese village. This affected the traditional architectural style, thus reducing the perceived quality and value of the traditional village's architectural cultural landscape for visitors. The village's agricultural production crops are relatively singular—primarily rice and corn—and its scale is relatively small. Visitors are unlikely to view the crop landscape from the village's core area, as all the farmland is concentrated in nearby hills. Additionally, few of the cultural landscapes related to the villages' agricultural landscapes. Respondents perceived the costume-related cultural landscape as poor quality because most of the villagers dress in a modern style, and only a few people who need to perform folklore-related activities wear regional costumes. Hence, villages should consider these factors in their future tourism development.

A significantly and positively influential relationship exists between the tourists' perceived value and satisfaction with the traditional village's cultural landscape, but its influence regarding satisfaction is relatively weak compared to the perceived quality of the cultural landscape, with a path coefficient of 0.261. A significantly and positively influential relationship exists between tourists' satisfaction and loyalty; the greater the tourists' satisfaction with the traditional villages' cultural landscape, the greater their loyalty. Their satisfaction was scored with a variance of 0.283. Hence, in developing specific tourism for traditional villages, factors affecting tourists' satisfaction must be considered to improve the tourists' loyalty index. This path of influence is counteracted by the perceived quality of the cultural landscape, which will promote the construction of constituent aspects of perceived quality of the traditional villages' cultural landscape. In this study, the cultural landscape perceptions of traditional villages led to high satisfaction among tourists, which increased their willingness to revisit the place and recommend it to people around them. Ultimately, this reflects these tourists' high loyalty to this village. The mediating effect analysis also revealed that the effect of perceived quality on tourist loyalty through tourist satisfaction was 0.221, or 77.0% of the total effect of perceived quality on tourist loyalty. Therefore, the effect of perceived quality on tourist loyalty is primarily transmitted through tourist satisfaction as the mediating variable.

4.2. Implications

Theoretical implications

This study examined tourists' perceived quality of traditional village cultural landscapes and empirically demonstrated perceived quality's impact on tourist loyalty. It also explored the mediating roles of perceived value and satisfaction in this association. This study provides two theoretical implications for modern rural tourism and cultural heritage preservation. First, although some previous studies have considered the cultural landscape, most have focused on the overall landscape level, with the cultural landscape only as a subset. Additionally, few studies have focused on traditional villages as cultural heritage sites. Therefore, this study extends the application of a theoretical model on the perceived quality of cultural landscapes and tourist loyalty in traditional villages. To a certain extent, it not only bridges the knowledge gap regarding tourists' perceptions of the perceived quality of cultural landscapes in traditional villages, but also enriches the literature related to cultural landscapes for perceived quality research.

Practical implications

Currently, tourism development for and construction of traditional villages are in a critical transformation period (Li and Wang 2023). A better understanding of tourists' perceived quality regarding the cultural landscape in traditional villages and their subsequent behavioral intentions can help develop tourism in traditional villages. First, as this study indicates, the perceived quality of traditional villages' cultural landscape indirectly, significantly, and positively affects tourist loyalty; positive tourist loyalty can better help managers to value the cultural landscape, adjust management services, and protect villages' cultural landscapes. This has increased the competitive advantage for traditional tourism villages. Therefore, before the development of traditional village tourism, the traditional villages' original appearance should be protected. Simultaneously, the characteristics of villages' cultural landscape resources should be understood. Given this, and combined with the needs of tourists in the cultural landscape, cultural experience projects in line with the village characteristics should be developed. This should improve the quality of tourists' perceptions of the cultural landscape and increase their loyalty while enhancing the traditional village tourism industry's competitiveness. Only then can sustainable development finally be realized for traditional villages.

4.3. Limitations and Recommendations for Future Research

This study has the following limitations: First, only one sample site was selected, and although it has regional characteristics and specific values, it cannot represent all Chinese traditional villages; therefore, this study's results are not conclusive for all Chinese traditional villages. As China has a rich and diverse geographical and natural environment, each specific area can offer different tourism experiences (Chi *et al.* 2020), and thus, subsequent studies should consider their sample sites' diversity. Second, this study did not sufficiently refine the perceived quality dimension in the traditional village's cultural landscape, and the dimension is not specifically divided into subcategories, such as the architectural shape, architectural decorative patterns, and architectural style for evaluation. Future studies should further refine and explore this facet of the cultural landscape. Finally, the study design only targeted Chinese domestic tourists and ignored international tourists; therefore, future studies should consider a comparative analysis of domestic and international tourists to further explore their understanding of traditional villages' cultural landscapes.

Conclusions

Based on the theory of landscape perception, this study takes Huangdu Dong Village as a case study to conduct a measurable examination of the perceived quality of traditional villages' cultural landscape. Subsequently, this study constructs a model to gauge the perceived quality of the cultural landscape, perceived value, satisfaction, and loyalty. A survey of 463 village visitors revealed that the perceived quality of the traditional village's cultural landscape indirectly and significantly affected visitor loyalty; perceived value and satisfaction mediate this relationship. The study also demonstrated that the perceived quality of the traditional village's cultural landscape affects perceived value and satisfaction before positively influencing tourist loyalty. The perceived quality's effect on tourist loyalty was mainly transmitted through the mediating variable of tourist satisfaction. The study also observed that tourists' demographic characteristics influenced loyalty; the respondents' gender, occupation, and place of residence did not result in significant differences in loyalty, while their age, education, and income level had significant effects.

This study unveils the mechanisms through which the perceived quality of traditional villages' cultural landscapes influences tourist loyalty, with a particular emphasis on the mediating roles of perceived value and satisfaction within the context of traditional villages. Through an on-site survey conducted in Huangdu Dong Village, the research not only enriches the theoretical framework of destination loyalty but also identifies key demographic factors affecting loyalty, offering fresh, practical insights for the conservation, marketing strategies, and sustainable development of cultural tourism destinations. Furthermore, by delving into tourists' perceptions and responses to cultural landscapes, the study underscores the urgency of preserving indigenous cultural heritage in the face of globalization and commercial pressures, setting new research directions and practical benchmarks for the field.

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Credit Authorship Contribution Statement

Huaheng Shen: He provided the research ideas, developed the conceptual theoretical framework, interpreted the results, and wrote the paper for this study.

Nor Fadzila Aziz: She provided careful guidance throughout the writing of the paper, such as the construction of the indicator system, the analysis of the data, and other details.
Menglan Huang: She collected, organized and analyzed the questionnaire data for the study.
Lingyun Yu: She made suggestions and proofread the entire manuscript.

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Appendix A

Table A1. Questionnaire and question code

Dimension	No.	Variable

Demographic variables	1	Gender
	2	Age
	3	Education background
	4	Occupation
	5	Place of residence
	6	Average monthly disposable income
Cultural Landscape Perceived Quality	PQ1	Architectural cultural landscape (architectural shape, type, decorative patterns, style and other features).
	PQ2	Spatial cultural landscape (site selection, layout, street space, etc. of the village).
	PQ3	Water culture landscape (water activities, naming of water systems and legends and stories, etc.).
	PQ4	Plant culture landscape (more characteristic compared with plants in other places, plant legends, etc.).
	PQ5	Cultural landscape of paved roads (antiquity of paving, presence of decorative patterns, etc.).
	PQ6	Cultural landscape of service facilities (how well the facilities such as lamps, garbage cans and signage are coordinated with the village environment).
	PQ7	Cultural landscape of costumes (whether the patterns, designs and accessories of costumes have Dong culture).
	PQ8	Cultural landscape of folklore activities (the degree of excitement and characteristics of folklore performance activities).
	PQ9	Cultural landscape of handicrafts (degree of beauty and characteristics of handicrafts: Dong brocade, cloth weaving, etc.).
	PQ10	Agricultural cultural landscape (the degree of awareness of agricultural landscape, farming tools, crops, farming process, etc.).
	PQ11	Food culture landscape (whether the food has characteristics).
Perceived Value	PV1	Will the trip relieve fatigue or emotions from work, study and life?
	PV2	Will the trip increase your knowledge and experience?
	PV3	Is the time, energy and money invested in this trip worth it?
Satisfaction	Sat1	Overall satisfaction of the trip.
	Sat2	Satisfaction level of the trip compared with the ideal traditional village.
Loyalty	Loy1	The degree of willingness to recommend friends, relatives or colleagues to come to Huangdu Dong Village.
	Loy2	Willingness to visit similar traditional villages again.

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Influence of Digital Technologies on Transition to a Circular Economy in Tourism: Values and Barriers

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Abstract: Circular economy (CE) designed as a socio-economic system where resources are maintained for a long term with minimal leakage and waste, making them circular through closing, narrowing and slowing resource loops. In this system, we should not only consider materials and technical resources but also human capital. Creating circular business strategies is one of the paradigms of sustainable development and has potential to achieve many of the SDGs. Digital technologies (DT) enable this movement to CE including in the service sectors as a tourism. The aim of this paper is to identify how DT supports the transition to CE in tourism (CET). In this study, we conducted semi-structured interviews with 12 experts from tourism, CE and DT fields. Findings determined main values created by DT in CET, with special attention to values for human development, and existing barriers to utilize whole potential of DT for CET. This study contributes to conceptualization of knowledge about the role of digitalization in transition to CE in tourism and outlines future research areas.

Structured abstract: Purpose: to show how DT aids in the transformation of tourism to CE business model, by examine values created by DT for CE in tourism and human development and determine barriers for DT in transition to CE in tourism.

Design/methodology/approach: In this study, we applied semi-structured interviews with experts. To address study subjects, we employed a non-random judgment sampling strategy. Twelve specialists in total participated in semi-structured interviews.

Findings: Enhancing community participation, provide educational and training resources, access to information about sustainable tourism practices – are values created by DT for social development in tourism. Findings from the study suggest that DT can provide platforms for collaboration and innovation in tourism development. This can lead to new business models, products, and services that are more sustainable, inclusive, and resilient. However, in order to utilize DT in CET more effectively required particular economic, social, legal conditions, in the other word there are barriers and challenges.

Originality: The present study reveals roles of DT for transition to CE in tourism particularly outlining human-centered approach. The exciting frameworks considering links between DT and CE in the literature mainly directed for closing, narrowing and slowing material resource flow and only few included human capital. In this study, we outlined the main DT important for transition to CE in tourism, values created by this DT for CE and human development in tourism and existing barriers for them.

Keywords: circular economy; digital technologies; social capital; circular business models; sustainable development.

JEL Classification: Q50; Q20; Z32; L830; O33; O35.

Introduction

Digital technologies (DT) are playing a more and more important role in many industries including tourism. Another trend that affects tourism is circular economy (CE), which changes the business landscape by

responsible usage of resources for a long period of time, which leads to sustainable development goals (SDG) (Jones and Wynn 2019). CE coupled with DT and human centric approach is a future for our society (Schröder, Lemille, and Desmond 2020).

Concept of circular economy in tourism (CET) concentrates on a sustainable approach to travel that prioritizes local communities, the environment, and responsible tourism practices (Sørensen, Bærenholdt, Andreas, and Møller 2019). This idea stems from the principles of CE, which aims to minimize waste and promote the efficient use of resources. In CET, tourists travel to various places in a way that minimizes their impact on the environment, supports local economies, and contributes to the well-being of the local community. Circular business model (CBM) supports engagement of stakeholders and values co-creation which leads to a more inclusive society and contributes to SDGs.

CET is becoming a prevalent approach compared to the traditional linear model of tourism, which mainly concentrates on short-term economic gains and disregards the long-term effects on the environment and local communities (Rodríguez, Florido, and Jacob 2020). CET pursues a more responsible and sustainable approach to travel by promoting best practices, supporting local businesses, and encouraging environmental conservation.

The purpose of this article is to show how DT aids in the transformation of tourism to CE business model. And research objectives are determined as a following:

- Examine values created by DT for CET and human development
- Determine barriers for DT in transition to CET.

The findings give practical suggestions for application of DT to sustainable tourism practices and policy implication in this area.

1. Literature Review

In this study, we reviewed both academic and gray literature to find existing frameworks how DT can enable CET. The reviewed frameworks can be divided into three groups 1) the frameworks illustrating CE or CBM without specification of industry, 2) application of CE principles to business models in the tourism industry and 2) frameworks displaying relationships between DT and CE also general for all industries

Circular Economy

CE is a balanced socio-economic system where human and natural resources should be used as long as possible and ideally be regenerative as a natural system and benefiting all stakeholders (Einarsson and Sorin 2020). In CE, products are designed to last longer and should be repaired easily to extend their lifespan. And one of the main ideas of CE is resource efficiency, which requires adoption of closing-the-loop production where resources should be used more efficiently and waste is minimized through the use of renewable energy, recycling, redesign, repurposing or refusing (Bocken, Olivetti, Cullen, Potting, and Lifset 2017).

To transform of existing leaner business models, which performed according to principles “make-take-waste”, to circular models, requires implementing collaborative business models, to share resources, reduce waste, and create value (Ranta, Aarikka-Stenroos, and Väisänen 2021). Transition to CE requires systematic approach and institutional changes including regulation, consumption behavior, networks, even though in the level of single company principles of CE can be adopted (Manniche, Larsen, and Broegaard, 2021). The important role in the transition to circularity plays consumption patterns and customers, they also can contribute to CE through new, slow or low-consumption-oriented practices (Sørensen and Bærenholdt, 2020).

Ellen MacArthur Foundation developed one of the first frameworks of CE as a “butterfly” diagram, where the linear flows of products and materials are replaced by circular flows in two separate cycles, the biological cycle and the technical cycle (EMAF, 2015). The main criticism for this study was that it is considering only material flows (bio- and techno-spheres) in CE, restricted consideration of the role of human sphere (Schröder *et al.* 2020), while movement towards Industry 5.0 accented social-centered approach (Müller 2020). Integrative conceptual framework for a Human Development-focused Circular Economy offered by Schröder, Lemille, and Desmond, (2020) where the human sphere given a central role thereby complementing the technological-material focused CE.

One of the pioneering conceptual frameworks for guiding a sustainable, resilient and future proof transition of tourism to CE was offered by Einarsson and Sorin (2020). This framework of CE for tourism is based on the mentioned “butterfly” diagram with specifications for asset heavy and light companies within the tourism sector. And later Sorin and Sivarajah (2021) developed a conceptual circular applicability framework for tourism. By reviewing best Circular Hotel’s practices, Sgambati, Acampora, Martucci, and Lucchetti, (2021) created a framework for the implementation of Circular hotels. The reviewed frameworks of CE in tourism are considered

material loops (bio and techno-spheres. However, studies of CE practices in the tourism industry are not in considerable number, and authors call for future research in this area.

Digital Technologies and Circular Economy

As one of the enablers of CE is recognized DT (Burmaoglu, Ozdemir Gungor, Kirbac, and Saritas 2022), furthermore DT considered as a critical component and accelerator (Nassanbekova and Yeshenkulova 2022). Hence, understanding the relationship between CE and digitalization is important to achieve sustainable growth.

Different DT proposed to use in CBM including technologies for data collection, data integration and data analysis (Pagoropoulos, Pigosso, and McAloone 2017). While according to the review of Chauhan, Parida and Dhir, (2022) the key role in the transition to CE is given to AI and IoT. Digital tools such as big data analytics, machine learning, and IoT sensors can be used to optimize resource management, such as predicting maintenance needs, reducing energy consumption, and managing waste more effectively (Ping 2011). Digital platforms can facilitate sharing of resources and assets, enabling better utilization of resources and reducing the need for ownership (Schulz, Hjaltadóttir, and Hild 2019). Digital tools such as 3D printing, virtual prototyping, and simulation can be used to design products that are more durable, repairable, and recyclable (Centobelli, Cerchione, Chiaroni, Del Vecchio, and Urbinati 2020).

Table 1. DT and CE in tourism: Existing frameworks and identified gaps

Authors	Main results relating to the current study)	Identified Gaps
EMAF, (2015)	The relationship between the technical and natural resource flows is depicted in the CE outline's "butterfly" diagram.	The limited role of human sphere to only being either consumers or users.
Schröder, Lemille and Desmond, (2020)	Developed integrative conceptual framework for a Human Development-focused Circular Economy based on observation of academic and grey literature	Exploratory research needs future application and empirical testing of the framework. Accented on human loop in CE. The framework for all industries as a general, not specified the role of DT
Einarsson and Sorin, (2020)	Developed conceptual framework of circular economy in tourism and travel	General framework without specification the role of DT. White paper, requires future verification.
Sorin and Sivarajah, (2021)	Developed conceptual circular applicability framework for tourism - empirical evidence from Scandinavian hotel operators.	The framework for CE in tourism is considered mainly a material loop. The research approach limits the exploration of the social capital regeneration potency in hotels.
Sgambati *et al.* (2021)	The Reviewed the case studies showing best practices of Circular Hotels and developed framework for the Implementation of Circular Hotels	The paper presents just the results of a preliminary study on circular practices implementation in hotels. Further efforts dedicated to fill in the framework. More attention paid to the loops in bio- and techno-spheres, not considered loop in human sphere
Ranta, Aarikka-Stenroos and Väisänen, (2021)	Synthesized framework on how digital technologies catalyse business model innovation for CE through value creation and capture and developed a model of four key types of business model innovation for circular economy catalysed by digital technologies.—Multiple case study.	Study mainly focused on industrial businesses, limited applicability for the service sector as tourism, in addition the study has not considered the human sphere in CE.
Hedberg and Šipka, (2020)	Explored the linkages between digitisation and the circular economy, the opportunities created by data and digitally-enabled solutions, and the challenges associated with harnessing their full potential for the transition to a circular economy. - Report	Mainly focused on industrial sectors of Europe and without specification of human capital.

Source: Completed by authors

Digital tools such as blockchain can enable greater transparency and traceability in supply chains, facilitating more efficient and sustainable use of resources (Chauhan *et al.* 2022). Digital technologies can support the development of circular business models, such as product-as-a-service, in addition product-service systems (PSS) recognized as innovation to achieve CE (Chauhan *et al.* 2022).

In Table 1, we summarized existing frameworks relating to the studied topic and identified gaps in the chosen studies, particularly, integrative framework on the role of DT in transition to CE in tourism focused on human capital was identified as a gap uncovered by the studies.

The studies studying link between DT and CE considered also values created by DT in CBM (Ranta, Aarikka-Stenroos and Väisänen, 2021; Neligan *et al.* 2022) (Uçar *et al.* 2020)(Chauhan *et al.* 2022), but mostly focused in industrial business and have not considered the specifications of DT playing in CE of service sector such as tourism. Values created, captured and delivered by DT in CBM aimed at narrowing, slowing and closing resuorce loops (Ranta *et al.* 2021).

By the reviewing the values created by DT for CE, we grouped them as a following:

Resouce efficiency: DT can help optimize resource use, reduce waste, and enable more efficient production and consumption processes including energy consuption.

Monitoring and tracing: DT such as blockchain can increase transparency and traceability in supply chains, monitoring product location availability and control of resource flows.

Enhanced collaboration: digital platforms can facilitate collaboration and knowledge sharing between different stakeholders, enabling better coordination and integration across the value chain.

New business opportunities: DT can support the development of new business models, such as product-as-a-service and sharing platforms, that can create new revenue streams and value propositions.

Even DT considered by most of the studies as a supporter and enabler of CE, there are different barriers and challenges, apart from the fact that movement to CE has their own difficulties. Within the studies investigating link between DT and CE we searched the barriers and challenges in application of DT in transition to CE. The barriers can vary widely from cost-associated to psychological issues (Alcayaga, Wiener, and Hansen, 2019; Chauhan *et al.* 2022), however, most of them surrounding data management and use of digital solutions (Hedberg and Šipka, 2020).

To address the call for research in CET and identified research gap regarding relation between DT and CET we conducted exploratory research with Delphy method.

2. Methodology

In this study, we applied semi-structured interviews with experts. To address study subjects, we employed a non-random judgment sampling strategy. We applied the following selection criteria: (1) background—experts needed to be either knowledgeable in DT and active in tourism or in CE; (2) policymakers, scholars, experts linked to CE, DT and tourism advising, or being advised due to their wide expertise on a few subjects across various sectors. We identified and contacted with 18 experts and 12 of them agreed to take part. Twelve specialists in total participated in semi-structured interviews.

In order for the respondents to follow a standardized procedure, we used semi-structured questions. Questions included but not limited the following statements: How and which particular DT contributes to movement to CET? What kind of value creates DT for CET? What kind of value can create DT for human development in CET? What are barriers to using DT for CE in tourism? During the interviews, we also stated findings from the literature and asked about their comments and applicability to tourism industry.

Everyone received an email from the interviewers prior to the interviews outlining the goals of the study and inquiring if they would agree to participate in an interview. In this research, three different categories of specialists were asked for semi-structured conversations. First, we spoke with experts on CE and DT who were involved with or related to various economic sectors (6 respondents), then with experts from the tourist sector and CE, including policymakers (4 interviewees), and finally with experts in DT who were involved with the tourism sector (2 interviewees) The conversations were recorded throughout with the participants' permission. The interviews were conducted in online (video-conference through Zoom and Teams) and offline formats, duration of the interview was an average between 40-60 minutes.

Then, after transcribing the interviews, we coded and analyzed the data manually.

3. Results and Discussion

Most of interviewees supported the statement that DT enablers of CE and CET. As main promising technologies in the movement to sustainability and CE models were mentioned mostly: Internet of Things (IoT), Big Data and Analytics, Blockchain and Artificial Intelligence (AI).

By the participants were mentioned and other DT such as: sharing platforms, mobile applications, finTECH and Virtual reality (VR) and Augmented reality (AR) technologies. Which is interesting, attitudes of the experts towards VR are contradicting. One of policymakers in tourism industry expressed opinion that:

"VR may pose a threat to the development of tourism, as it can potentially reduce the tourism flows .."

While by the other expert VR were considered as technology, which contribute to makes it possible to visit sensitive and hard-to-reach destinations with less environmental impact.

From the interviews, we can highlight the following values created by DT for CET:

Enhance transparency and traceability, for example, blockchain technology allows the tracking of materials, products, and transactions. This can help verify sustainability claims, enable peer-to-peer transactions, and facilitate the sharing economy within the tourism industry.

Optimizing resource allocation and reducing waste in tourism operations: for example, smart sensors can monitor water and energy consumption in hotels, enabling more efficient resource management. Big Data also help identify patterns and trends to support decision-making in CE.

Customer centricity and involvement - analysing large volumes of data collected from various sources, including social media, booking platforms, and customer feedback, can provide valuable insights for designing sustainable tourism experiences and AI based technologies help to offer customized options and improving resource efficiency.

Promoting sustainability - digital platforms facilitating peer-to-peer sharing of resources, such as accommodation, transportation, and experiences, play a crucial role in promoting the circular economy in tourism. In addition, DT can empower tourists to make sustainable choices by providing information about eco-friendly accommodations, local circular economy initiatives, responsible tour operators, and sustainable transportation options.

However, one of the values created by DT mentioned in the literature – cost reduction, caused doubt by some the participants in our study. The expert mentioned:

"high implementation and maintaining cost of DT, particularly for SMEs in tourism are not always affordable. I would say it is one of the main barriers for DT."

Big Data and Analytics: Big data analytics can also help identify patterns and trends to support decision-making in the circular economy.

The experts also highlighted as a possible value created by DT for CET – social inclusion and equality – in CET it helps to human resource development. The growth of ICT and digital platform creates opportunity for local society to participate in the development of tourism in their destinations. Particularly, rural tourism development requires high involvement of local society and in the same time creates different opportunity for them. One of the expert who is policymaker in tourism industry told the success story from his experience how local people from rural area run business in tourism industry by opening tulip farm for Instagram photo sessions. In this case, social media (digigital marketing) was used for promotion and increasing role of digital presents (beautiful photos in Instagram) helped to create new business in tourism.

Schröder, Lemille and Desmond (2020) included to CE framework human sphere, while the frameworks describing the relationship between digital technologies and CE have not included human loop, so the current study sheds light on this topic to some extent and is exploratory in the nature. In this study, we would like to outline human-centred values created by DT for CE in tourism and asked opinion of the experts.

One of the first values created by DT for human development within the CE is - enhancing community participation. Particularly, DT can provide platforms for local communities to participate in tourism planning and development. This can promote community engagement and ownership, leading to more sustainable and inclusive tourism practices (Perez-Vega *et al.* 2021).

The experts also agreed that DT can provide educational and training resources to promote sustainable tourism practices, improve skills and knowledge, and support local entrepreneurship. This can lead to improved livelihoods and economic opportunities for local communities.

And because for creation CET the role of tourist is quite important (Sørensen and Bærenholdt 2020), DT can provide tourists with access to information about sustainable tourism practices, cultural and natural heritage, and local communities. This can promote awareness and understanding, leading to more responsible tourist behaviours and increased appreciation of the cultural and natural diversity of tourism destinations.

Findings from the study suggest that DT can provide platforms for collaboration and innovation in tourism development. This can lead to new business models, products, and services that are more sustainable, inclusive, and resilient. This opinion shared by the respondents also as a value of DT for CE as a whole and not only for human development.

Overall, DT can help tourism operators and local communities to capture more of the economic benefits of tourism, leading to more equitable distribution of wealth and opportunities. This can also lead to improved social and environmental outcomes, contributing to human development.

However, in order to utilize DT in CET more effectively required particular economic, social, legal conditions, in the other word there are barriers and challenges. Data from this study regarding to barriers and challenges we grouped as a following:

Lack of awareness and understanding, many organizations and individuals may not fully comprehend the potential benefits and opportunities offered by DT in the context of the CE, at the same time there are skills and knowledge gaps. The participant expressed opinion:

"since the tourism sector is dominated by SMEs, there is always an acute problem of lack of competence and financial resources."

That is cause of the next barrier, cost and financial constraints. Implementing DT can require significant upfront investments and ongoing operational costs. Some organizations, particularly SMEs, may face financial constraints that make it challenging to adopt and integrate these technologies.

Next barrier for DT is infrastructure limitations, the effective use of DT often relies on robust and reliable infrastructure, such as high-speed internet connectivity and data storage capabilities. However, in some regions, especially rural areas or developing countries, the necessary infrastructure may be inadequate or unavailable. One of the interviewees was quite pessimistic regarding DT opportunities for tourism as a whole and stated:

"how we can talk about DT if in rural areas there is simply no access to high-speed Internet"

The expert also concerned data privacy and security issues; the utilization of DT involves the collection, storage, and analysis of large amounts of data. This raises concerns about data privacy, security breaches, and the misuse of sensitive information. Addressing these concerns and ensuring robust data protection measures are in place is crucial for widespread adoption. And the entrepreneurs can have fears regarding digitalization:

"they are afraid that their activities would be over regulated By whom? State, society"

Furthermore, CE requires collaboration and coordination among various stakeholders, including businesses, governments, and consumers. However, different DT and platforms may not always be compatible or standardized, making it difficult to share data and communicate effectively across the entire value chain. And there are increase interoperability and standardization challenges.

The regulatory and policy environment plays a crucial role in shaping the adoption and deployment of DT in CET. In some cases, outdated or unclear regulations can hinder innovation and create barriers to entry for new technologies. Therewith, incentives from state could push the process of moving to CE and as consequence to more sustainable development. One of examples was provided by the respondents:

"before in our country (Kazakhstan) there were tax incentives for SMEs who use renewable energy sources, nowadays these incentives eliminated, which lead to slowing the process of moving to CE…"

"if there would be ecological certification for hotels as in, which could affect their image, this could be driver for CE, accordingly to search for digital solutions in this context"

Addressing these barriers requires a multi-faceted approach involving collaboration among stakeholders, policy support, investment incentives, and capacity building initiatives. By overcoming these challenges, digital technologies can significantly enhance the transition to a circular economy by enabling increased resource efficiency, enhanced transparency, and improved decision-making processes.

Conclusions and Further Research

The present study reveals roles of DT for transition to CET particularly outlining human-centered approach. The exciting frameworks considering links between DT and CE in the literature mainly directed for closing, narrowing and slowing material resource flow and only few included human capital. In this study, we outlined the main DT important for transition to CET, values created by this DT for CET and human development and existing barriers for them.

This study contributes to conceptualization of knowledge to the resolution of sustainable development issues in tourism. By identifying gap in the literature, following future research direction recommended:

- Digitalization and CE linkage in tourism, particularly policy frames and required institutional changes and the role of customers and behavior change;
- Barriers to digitalization led CE in tourism should be identified and discussed, and way to mitigate faced challenges;
- Enablers of digitalization led CE in tourism, empirical studies assessing impact and valuable outcomes generated by DT;
- Digitalization-led business models in CT, circular strategies and cases;

- Inter-sectoral studies in CT (Accommodation, food and beverage, leisure and travel), partnership within the destination for transition to CE and creation value chain for the sector.

The present study entails some important implications for practitioners. To play a pivotal role in the transition from a traditional to a CE- based setup, managers and policymakers must develop a detailed understanding of the role of digitalization in CE adoption. Managers can refer to the analysis of the present study as they work to identify potential DT applications for boosting CE. Value co-creation framework of DT for transition to CE in tourism provides structured view of application of DT for CE in tourism. Policymakers could use the framework as a foundation for updating existing rules and regulations to boost transition to sustainable development and increase investment attractiveness and competitiveness. For business, the framework could provide bases for strategic analysis and adjustment of business models in order to improve customer experience of loyal customers and attract new. The study contributes to increase awareness among tourists and to promote more environmentally conscious behavior.

The results of this study should be generalized with caution due to sampling bias, the experts where from one country (Kazakhstan) and in further samples that are more representative should be used. In addition, empirical studies from the tourism field is desirable.

In this study, we reviewed English language papers; the authors acknowledge the likelihood that they missed some relevant studies because of these criteria. The review also excluded book chapters and reports. Therefore, future studies could include book chapters and studies in other languages and examine other academic databases.

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Credit Authorship Contribution Statement

Samalgul Nassanbekova: Writing – original draft, Data collecting (Expert Interviewing), Data analysis (Coding, Interpretation), Writing – review and editing.
Gaukhar Yeshenkulova: Methodology, Project administration, Formal analysis, Supervision, Funding acquisition.
Nurkhat Ibadildin: Conceptualization, Investigation, Supervision, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Quality of Environmental Impact Assessment Reports for Lodge Developments in Protected Areas: The Okavango Delta Case, Botswana

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Abstract: This paper evaluates the quality of environmental impact assessment (EIA) reports for lodge developments in Botswana's Okavango Delta, which is a wetland of international importance and forms part of a transboundary conservation area and world heritage site. A quality review of 31 EIA reports, approved between 2013 and 2021, was conducted by applying a context specific EIA report quality review package. The review package consists of four review areas with seventeen categories and 64 sub-categories, adapted from similar international packages to address the specific legal requirements for EIA in Botswana as well as best practice. Results show that the overall quality of the reports are poor, with 71% graded 'unsatisfactory'. In general, descriptive areas of the EIA reports fared better, while the performance of the more analytical areas was 'poor'. Key areas of weakness include - the identification of impacts; prediction and assessment of impact magnitude; as well as identifying alternatives and mitigation measures. Overall results suggest that currently EIA

report content is insufficient to inform decision-making towards sustainable tourism development in the Okavango Delta. It is recommended that areas of weakness can be addressed by providing clear strategic direction; developing a central data management system; setting norms and standards for tourism development as well as building capacity and awareness of key stakeholders. This will ensure that EIA remains a tool of choice for decision making and avoid becoming a mere 'red-tape'/administrative process aimed at securing development approvals.

Keywords: environmental impact assessment; quality; report review; lodge development; protected areas; tourism; Okavango Delta, Botswana.

JEL Classification: Q56; Q24; Q26; R11; Z32.

Introduction

Internationally, expansion of tourism infrastructure (such as lodges) places increased development pressure on often sensitive protected areas (Li, 2023), especially in regions such as sub-Saharan Africa where nature-based tourism contributes significantly to the overall economy of many countries (Spenceley, 2003; Manrai *et al.* 2020). Various policy instruments exist to regulate the environmental performance of tourism developments, dealing with for example water, waste and energy (Alberts *et al.* 2022; Morante-Carballo *et al.* 2023). In this regard, environmental impact assessment (EIA) is internationally recognized as one of the most successful and widely applied environmental policy instruments (Bond *et al.* 2020), also within the African context (Sandham *et al.* 2022). EIA is generally understood as a pro-active decision support instrument, that aims to predict and consider mitigation options for potentially significant environmental impacts before decisions are made or actions taken (Yan, 2023). For this reason, EIA has an important role to inform decisions on future tourism developments, such as lodges, within protected areas.

1. Research Background

Whilst the potential contribution and importance of EIA as a decision support instrument is recognized, much research has gone into designing frameworks for environmental assessment performance evaluation, to determine how well EIA is being done and what it is achieving (Marsden 1998; Retief, 2007; Bond *et al.* 2022). Much of the performance evaluation research focus on EIA 'effectiveness' (Sadler 1996; Morrison-Saunders and Retief, 2012; Alberts *et al.* 2020). Different dimensions of 'effectiveness' have been identified of which a key dimension is so-called 'substantive effectiveness'. This dimension evaluates the quality of inputs to decision making, as mainly reflected in the EIA reports submitted to regulators. The rationale being that good quality EIA report inputs/content would lead to better decisions and ultimately more effective outcomes. Numerous studies exist in several regions of the world that focus on evaluating EIA report quality, including southern African countries (see Sandham *et al.* 2022 for a detailed literature review). EIA report quality is commonly evaluated within specific country jurisdictions and for specific sectors. For example, EIA report quality has been reviewed in the South African context for sectors such as the explosives industry (Sandham *et al.* 2013a), mining (Sandham *et al.* 2008a), water management (Sandham *et al.* 2008a), tourism (Malepe *et al.* 2022), biological control (Sandham *et al.* 2010), as well as for protected areas (Wylie *et al.* 2018; Sandham *et al.* 2020). The reason for the regional and sectoral focus is that report quality is context specific and will depend on the local legislative and policy context as well as sector specific requirements (Sandham *et al.* 2013b).

The uniqueness of EIA in the context of protected areas and the need for report quality research within the tourism sector has recently been highlighted by several authors (see for example Sandham *et al.* 2020; Alberts *et al.* 2021, Malepe *et al.* 2022, Zaini *et al.* 2023). It is pointed out that these EIAs are conducted within a unique biophysical, socio-economic and governance context. This requires tailored EIA practice and specific skills to confront the many complexities and challenges, such as weak public participation and dealing effectively with mitigation and monitoring. Moreover, although protected area management authorities are responsible for the management of these areas, EIA provides, in many cases, the only regulatory measure outside of the management authority's mandate to regulate development. It, therefore, provides an important addition to regulatory checks and balances where regulatory systems are weak or non-existent. EIA, thus, has the potential to strengthen the management authority's and affected communities' ability to influence development decisions and deal with developmental pressures affecting protected areas.

Botswana provides an ideal case country against which to explore the quality of EIA reports in the context of tourism related protected area development. This is because tourism is one of the primary economic sectors, and the majority of EIAs undertaken has been for the development of tourism infrastructure (Tshwene-Mauchaza, 2013; Segosebe 2020). Moreover, within the Botswana tourism context, the Okavango Delta is considered the premier tourist destination with nationally the highest tourism related lodge development pressure (Mochankana *et al.* 2023). The delta is considered the jewel in Botswana's biodiversity and tourism crown. In addition to being

rich in biodiversity, it is also a formally declared protected area (Republic of Botswana, 1992), a world heritage site (Matswiri 2017), the only Ramsar wetland of international importance in Botswana (Department of Environmental Affairs, 2008), part of a transboundary conservation area, and a site of key bird diversity (Ratsie *et al.* 2011). This pristine area is a hotspot for nature-based tourism and, thus, vulnerable to degradation by the very tourism resource that drives the region's economy (Keitumetse *et al.* 2023). According to the country's legislation, developments in a protected area, such as the Okavango Delta, trigger the need to conduct an EIA (Republic of Botswana, 2012). Yet, unlike its neighbor, South Africa, research evaluating EIA Report quality in Botswana generally, and in relation to tourism specifically is seriously lacking. This, despite EIA practice being mandatory since 2005 (Segosebe 2020). Therefore, this research aims to evaluate the quality of EIA reports for lodge developments in the Okavango Delta with a view to make recommendations to improve EIA practice for tourism development in protected areas.

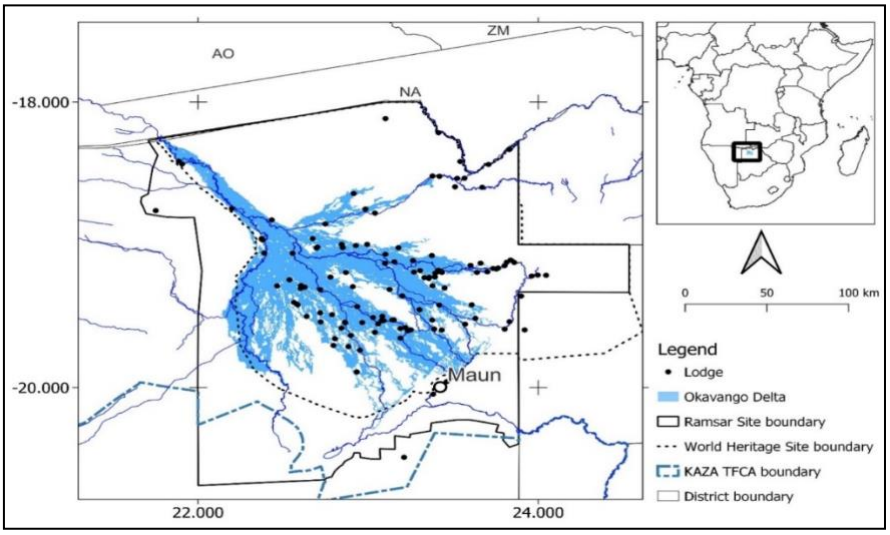
2. Method

To address the aim of the paper, a case study approach, which is commonly employed in research dealing with EIA report quality, was applied (Sandham *et al.* 2020; Alberts *et al.* 2021; Claassens *et al.* 2022). Section 2.1 provides an explanation of the selection of cases, while Section 2.2 outlines the EIA review package used. Finally, Section 2.3 describes the evaluation and analysis of the EIA reports. From an ethics perspective this research was approved by the North-West University's Faculty of Natural and Agricultural Sciences Ethics Committee (NWU-01218-22-A9) as having 'low risk' because it involves content evaluation of documentation that is generally available in the public domain.

2.1. Selection of Cases

A sample of 31 EIA cases was purposively selected from a pool of more than a hundred approved EIA reports for developments in Botswana's North-West District. The 31 selected EIA cases are summarised in Table 1 and the location of lodge developments in the core area of the Okavango Delta is shown in Figure 1. An attempt was made to ensure representation across years and across consultants.

Figure 1. Distribution of lodge developments in the Okavango Delta



The following five report selection criteria were used:

- Criterion 1: The complete and final EIA reports had to be readily available to the reviewer.
- Criterion 2: EIA reports had to relate to tourism lodge developments. Although tourism infrastructure such as guesthouses, campsites, hotels, agrotourism projects, houseboats, boat rides and general safaris also triggers EIA, to ensure consistency in the types of infrastructure - only lodge development were considered for this research.
- Criterion 3: EIA reports had to include lodge developments located within the core area of the Okavango Delta (see Figure 1).
- Criterion 4: EIA reports had to be relatively recent (i.e. the last decade - developments between 2013 and 2021); and
- Criterion 5: EIA reports had to be representative of different environmental consultants to ensure a level of representivity across the pool of EIA professionals working in the Okavango Delta.

The lodging types included in the selected EIA cases (Table 1) were primarily tented camps, although brick and mortar facilities were occasionally included.

Table 1. Summary of 31 selected EIA cases for lodge developments in the Okavango Delta

Year	Case study selection
2013	Mopiri Lodge by Leganang Motanzi
2013	Sandibe Okavango Safari Lodge by andBeyond
2013	Tubu Tree Camp by Ngamiland Adventure Safaris (Pty) Ltd
2014	Banoka Bush Camp by Safari Adventure Company (Pty) Ltd
2014	Linyanti Tented Camp by Linyanti Explorations (Pty) Ltd
2014	Little Vumbura Camp by Okavango Wilderness Safaris (Pty) Ltd
2014	Shakawe River Lodge by Shakawe Fishing Safaris (Pty) Ltd
2015	Camp Okavango by Desert and Delta Safaris (Pty) Ltd
2015	Chief's Camp by Sanctuary Retreats
2015	Gomoti Tented Camp by Santawani Partnership (Pty) Ltd
2015	Mombo Camp by Wilderness Safaries (Pty) Ltd
2015	Vumbura Plain Camp by Okavango Wilderness Safaris (Pty) Ltd
2016	Drotsky's Cabins by Eileen Drotsky
2016	Jacana Camp by Ngamiland Adventure Safaris (Pty) Ltd
2016	Jao Camp, Concession Headquarters and related infrastructure by Ngamiland Adventure Safaris (Pty) Ltd
2016	Kwetsani Camp by Ngamiland Adventure Safaris (Pty) Ltd
2016	Zarafa Camp by Linyanti Explorations (Pty) Ltd
2017	Camp Moremi by Desert and Delta Safaris (Pty) Ltd
2017	Chitabe and Chitabe Lediba camps by Flamingo Investments
2017	Khwai Camp by Kgori Safaris (Pty) Ltd
2018	Baines' Camp by Sanctuary Retreats
2018	Khwai Leadwood Camp by Ntsogotlho Holdings (Pty) Ltd
2018	Xigera Camp by Great Explorations (Pty) Ltd
2019	Mankwe Bush Lodge by Kgori Safaris (Pty) Ltd
2019	Selinda Camp by Linyanti Explorations (Pty) Ltd
2019	Shinde Camp by Ker and Downey Botswana (Pty) Ltd
2020	Pepere Island Lodge by All Star Investments (Pty) Ltd
2020	Two Lagoons Camp by Makgobokgobo Youth Trust
2021	Little Vumbura by Okavango Wilderness Safaris (Pty) Ltd
2021	Seba Camp by Abu Private Reserve
2021	Xaro Lodge by Xaro (Pty) Ltd

The accommodation tourism grading of these facilities ranked from three to five stars. The average bed size across the facilities included in the sample was eight rooms, while the average number of staff units was 24. The 31 EIA reports were compiled by eight different environmental consultants. On average, 3 to 5 reports were reviewed per year between 2013 and 2021. The cases are dealt with anonymously in the results and discussions section.

2.2. EIA Quality Review Package

The Lee and Colley EIA report quality review package (Lee *et al.* 1999), initially developed for the United Kingdom context, is commonly adapted internationally to different national and sectoral contexts. The package

consists of multiple criteria arranged in a four-level hierarchical structure that consists of an overall report grade, review areas, categories and sub-categories (see Lee *et al.* 1999, Sandham and Pretorius, 2008).

For the Botswana EIA report review, a total of seventeen categories, with 64 sub-categories were developed (see Table 2). Since the legal provisions for EIA in Botswana specify only the minimum report requirements, a report that satisfies these requirements would be regarded as minimally complete, rather than necessarily of good quality. To enable the determination of quality beyond legal compliance (completeness of information), international literature was used to develop the review sub-categories as part of the review package. Additional literature considered to adapt the sub-categories included EIA quality review research on wetland-affecting projects (Sandham *et al.* 2008), biodiversity-rich areas (Hallatt *et al.* 2015; Swanepoel *et al.* 2019), tourism facilities (Wylie *et al.* 2018) and protected areas (Sandham *et al.* 2020). Ramsar recommendations for EIA in wetlands of international importance were also included (Ramsar Secretariat Convention, 1997).

Table 2. Summary of review areas and review categories applied for the quality review of EIA reports for lodge developments in the Okavango Delta

Review Area	Review category	Review sub-category
Review area 1: Description of project and environment	1.1 Project description	1.1.1 Proponent identification 1.1.2 Purpose and objectives of application 1.1.3 Time and space boundaries 1.1.4 Description of design, size, coordinates 1.1.5 Presence and appearance of development 1.1.6 Nature of production process 1.1.7 Nature and quality of raw materials 1.1.8 Identification of applicant 1.1.9 Details of EAP 1.1.10 Identification of legislation and guidelines
	1.2 Site description	1.2.1 Need and desirability of the application 1.2.2 Area of development site 1.2.3 Demarcation of land use area 1.2.4 Duration of project phases
	1.3 Waste	1.3.1 Means of transporting raw materials 1.3.2 Types and quantities of waste 1.3.3 Waste treatment, disposal and disposal routes
	1.4 Environmental description	1.4.1 Area to be affected by development: geographical, physical, biological, social, economic and cultural aspects
	1.5 Baseline description	1.5.1 Effects occurring away from immediate affected environment 1.5.2 Important components of the affected environment 1.5.3 Existing data sources 1.5.4 Local land use plans, policies consulted, and other data collected
Review area 2 Impact identification and evaluation	2.1 Definition of impacts	2.1.1 All possible effects on environment, cumulative, short, medium and long term, permanent and temporary, positive and negative 2.1.2 Interaction of effects on human beings, flora and fauna, soil, air, water, climate, landscape, material assets and cultural heritage 2.1.3 Impacts from non-standard operation conditions -accidents etc 2.1.4 Impacts from deviation from baseline conditions
	2.2 Identification of Impacts	2.2.1 Impact identification methodology - project specific checklists, matrices, panels of experts, consultations, etc 2.2.2 Brief description of impact identification methods used
	2.3 Scoping	2.3.1 Contact general public and special interest groups 2.3.2 Proof of advertising and notifications to interested and affected parties(IandAPs) 2.3.3 Collect opinions and concerns of IandAPs and notify IandAPs 2.3.4 List of all persons identified as IandAPs 2.3.5 Summary of issues raised by IandAPs
	2.4 Prediction of impact magnitude	2.4.1 Data to estimate magnitude of key impacts 2.4.2 Methods used to predict impact magnitude 2.4.3 Predictions of impact in measurable quantities

Review Area	Review category	Review sub-category
	2.5 Assessment of impact significance	2.5.1 Significance of impacts on affected community and society in general 2.5.2 Significance of impacts in terms of national and international quality standards 2.5.3 Justification of proposed method of assessing significance
Review area 3: Alternatives and mitigation	3.1 Consideration of feasible alternatives	3.1.1 Description of alternatives 3.1.2 Description of alternative processes, designs, and operating conditions 3.1.3 Reasonableness of identified alternatives 3.1.4 For severe adverse impacts, rejected alternatives identified 3.1.5 Comparative assessment of all alternatives identified 3.1.6 Identification of best feasible available environmental option
	3.2 Scope and effectives of mitigation measures	3.2.1 Consider mitigation of all significant adverse impacts 3.2.2 Mitigation measures 3.2.3 Extent of effectiveness of mitigation when implemented
	3.3 Mitigation and Monitoring plan	3.3.1 Record of commitment to mitigation measures 3.3.2 Monitoring arrangements
Review area 4: Presentation and communication	4.1 Layout	4.1.1 Introduction/description of layout 4.1.2 Information logically arranged 4.1.3 Use of maps, figures and charts 4.1.4 Chapter summaries for very long chapters 4.1.5 External sources acknowledged
	4.2 General Presentation	4.2.1 Presentation of information 4.2.2 Technical terms, acronyms/abbreviations defined 4.2.3 Statement presented as an integrated whole
	4.3 Presentation of Environmental Issues	4.3.1 Emphasis to potentially severe impacts 4.3.2 Statement must be unbiased 4.3.3 Opinion as to whether activity should/ should not be authorised 4.3.4 Minutes of meetings and responses to comments
	4.4 Emphasis of impacts	4.4.1 Non-technical summary of main findings and conclusions 4.4.2 Summary must cover all main issues

2.3. Evaluation and Analysis

The relevant EIA-related documentation associated with each of the 31 EIA cases was carefully and systematically reviewed against the sub-categories (Table 2) to determine the extent/degree to which each criterion was addressed. Assessment symbols ranging from A to F (Table 3) were used to score/grade each of the sub-categories. The review is hierarchical and for each level, the review is based on the review grades of the previous level. The scoring of sub-categories informed the scoring of the review categories, which in turn informed the scoring of each of the four review areas.

Table 3. List of assessment symbols/scores (from Lee *et al.* 1999)

Symbol	Explanation
A	Well performed. No important tasks left incomplete.
B	Generally satisfactory. Completed, only minor omissions and inadequacies.
C	Just satisfactory. More pronounced omissions and/or inadequacies.
D	Just unsatisfactory. Parts are well attempted but must, as a whole, be considered just unsatisfactory because of omissions or inadequacies.
E	Unsatisfactory. Significant omissions or inadequacies.
F	Very unsatisfactory. Important task(s) poorly done or not attempted.
N/A	Not applicable. The review topic is not applicable or irrelevant in the context of this EIA report.

A pilot review phase was included where five EIA reports were independently co-reviewed by a second reviewer. The two reviewer scores were then compared towards reaching a consensus score. This was done to calibrate the single scoring of the remaining 26 reports. The use of multiple reviewers to calibrate and refine the review method is commonly used and considered best practice for EIA report evaluation (Lee *et al.* 1999).

3. Results

Table 4 summarizes the overall report grades, review area grades and review category grades of the 31 EIA reports for lodge developments in the Okavango Delta. Reports graded A to C were deemed to be "satisfactory", while reports graded D to F were deemed to be "unsatisfactory".

The analysis of the overall quality of the 31 EIA reports shows that only 29% (n = 9) of the reports were of satisfactory quality. None of the reports were described as 'well performed' (A) and only three (9%) of the reports were 'generally satisfactory' (B), while six (19%) were 'just satisfactory' (C). The majority of the EIA reports (71%, n = 22) were graded as unsatisfactory (D to F). Ten of the reports (32%) were regarded as 'just unsatisfactory' (D), while nine of the reports (29%) were graded as 'unsatisfactory' (E) and three of the reports (9%) were 'very unsatisfactory' (F). A summary of the quality review results (A to F) of the four different review areas is outlined in Figure 2.

Figure 2. Grading (A to F) per review area for the 31 EIA lodge development reports

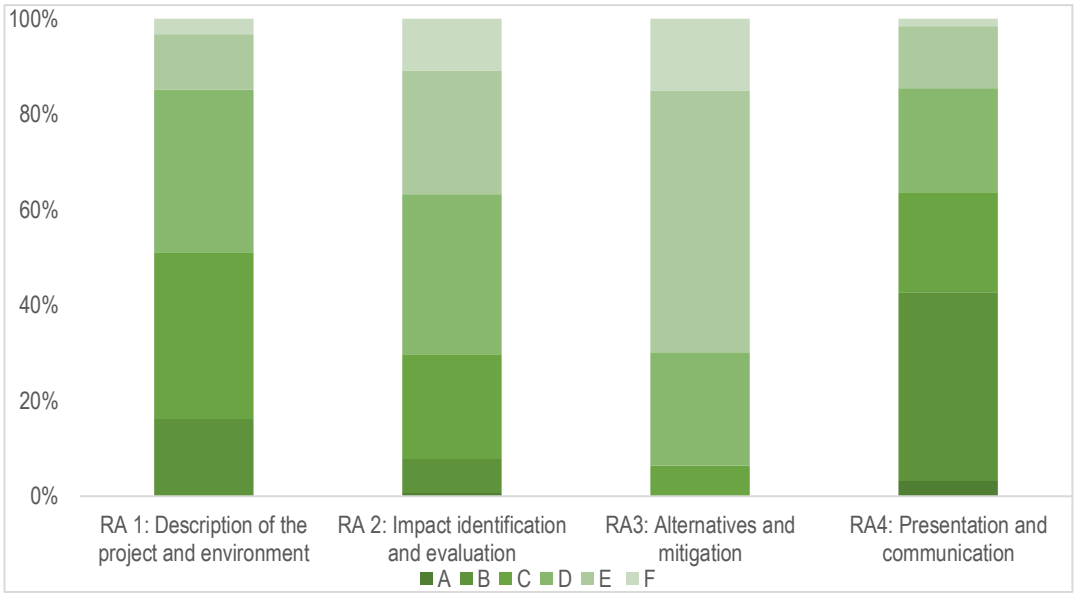


Table 4. Overview of results of the quality review of a sample of 31 EIA reports for lodge developments in the Okavango Delta

Summary of review sub-category		A	B	C	D	E	F	% A – C (satisfactory)	% D – F (unsatisfactory)
	Overall report grades	0	3	6	10	9	3	29	71
1	Description of project and environment	0	3	13	11	3	1	51	49
1.1	Project description	0	6	18	7	0	0	77	23
1.2	Site description	0	9	11	10	1	0	64	36
1.3	Waste	0	3	4	16	6	2	23	77
1.4	Environmental description	0	4	11	10	5	1	48	52
1.5	Baseline description	0	3	10	10	6	2	42	58
2	Impact identification and evaluation	0	2	7	12	8	2	30	70
2.1	Definition of impacts	0	0	7	16	7	1	23	77
2.2	Identification of impacts	0	4	9	9	7	2	42	58
2.3	Scoping	1	3	11	8	0	8	48	52
2.4	Prediction of impact magnitude	0	4	2	9	14	2	19	81
2.5	Assessment of impact significance	0	0	5	10	12	4	16	84
3	Alternatives and mitigation	0	0	2	8	16	5	6	94
3.1	Consideration of feasible alternatives	0	0	2	3	17	9	6	94
3.2	Scope and effectives of mitigation measures	0	0	3	9	16	3	10	90

Summary of review sub-category		A	B	C	D	E	F	% A – C (satisfactory)	% D – F (unsatisfactory)
3.3	Mitigation and monitoring plan	0	0	1	10	18	2	3	97
4	Presentation and communication	0	12	8	8	3	0	64	36
4.1	Layout	2	15	9	4	1	0	84	16
4.2	General presentation	1	17	7	4	2	0	81	20
4.3	Presentation of environmental issues	1	11	6	4	8	1	58	42
4.4	Emphasis of impacts	0	6	4	15	5	1	32	68

In general, performance of descriptive report areas (Review Area 1 and 4) constantly outperformed analytical report areas (Review Area 2 and 3). The best performing area was Review Area 4 (presentation and communication) where 64% of the reports (n = 20) were regarded as satisfactory (A to C) and 36% (n = 11) were regarded as unsatisfactory. The second-best performing review area was Review Area 1 (description of the project and environment) where 16 of the reports (51%) were graded as satisfactory and 15 of the reports (49%) were regarded as unsatisfactory. Review Area 2 (impact identification and evaluation) performed poorly, with 70% (n = 22) of the reports graded as unsatisfactory and only 30% (n = 9) of the reports graded as satisfactory. The weakest performing review area in this research was Review Area 3 (alternatives and mitigation), which had the lowest frequency of satisfactory scores of only 6% (n = 2), with 94% (n = 29) of the reports scoring unsatisfactory grades (D to F). Each of the four review areas are individually discussed in the next sub-sections.

4. Discussions

The sections below provide discussions on the performance of the EIA reports against the four review areas.

4.1. Review Area 1: Description of the Project and the Environment

The descriptive sub-categories of Review Area 1 performed satisfactorily. Reports largely included a description of the location of the proposed lodge development (1.1), supported by aerial photographs and maps. The better-performing reports provided additional information on building designs and structural plans (1.1.4). However, for a number of the reports the consultants provided background on the geographical setting of the development at a too large scale (1.2.2) (entire Delta area), without providing adequate site-specific information. Better-performing reports provided site descriptions at a concession scale, which is an improvement from the Delta-scale descriptions, but still did not contain sufficient site-specific information. Ideally, the project and site descriptions should focus on the locality (zone) as well as the buffer area to inform decision-making. Site-specific geographic descriptions will allow for more accurate impact identification and assessment, and improved EIA follow-up and monitoring.

When reflecting on the description of the proposed lodge developments, the project descriptions mainly focused on the construction phase of the proposed project (1.1.3). The operational, decommissioning and modification phases of the proposed lodge developments were, mostly, not adequately addressed. Given that the construction phase would generally have shorter-term, local impacts, compared to the other project phases, this omission is regarded as a major weakness. Similarly, the nature and quantity of raw materials (1.1.7) was limited to the construction phase of the proposed lodge developments.

Another important category, which generally scored poorly, was the description of the legal setting/framework (1.1.10). This provides, amongst others, a benchmark for determining significance of impacts in terms of local, national and international legal requirements. Consultants generally provided exhaustive lists of potentially applicable legislation, however, the applicable provisions/requirements of the legislation and how it may apply to the specifically proposed lodge development, was generally not addressed.

Finally, considerations for the storage, handling and transportation of waste were poorly addressed in most of the EIA reports reviewed (1.3.3). Some of the reports, however, attempted to estimate the types and quantities of waste that will be generated from the proposed developments (1.3.2). Again, the estimations generally focused on the construction phase of the proposed developments, without adequate consideration of the operation- and decommissioning phases. The management of waste was also identified as a weakness in other research on EIA report quality in South African protected areas (Sandham *et al.* 2020; Claassens *et al.* 2022; Malepe *et al.* 2022). Dealing effectively with waste management is seemingly a key challenge for tourism developments in sensitive areas such as protected areas.

4.2. Review Area 2: Identification and Evaluation of Key Impacts

Review Area 2 scored the second lowest of the review areas, with 70% of the reports being of unsatisfactory quality. Except for archaeological impact assessment (AIA), which is a legal requirement, specialist reports were generally lacking from the EIA reports. Therefore, impacts on the environment, communities, flora and fauna, soil, air, water, climate, landscape, material assets and cultural heritage (2.1.2), were generally poorly defined and assessed despite the availability of a wealth of published research in these areas. Because of its biodiversity richness and international importance, the Okavango Delta region leads the entire country in environmental-related research and could therefore be considered data rich. Research conducted cover a range of focus areas including fish and wildlife, ornithology, environmental economics, nature-based tourism, community-based natural resource management, climate, conservation, hydrology, and forest resources. Despite this, evidence of research uptake in the EIA reports was lacking except in cases where the relevant EIA consultant happened to be part of a relevant research project. More importantly, the link between available research/data/information and impact assessment was found to be low. While some reports might have indicated important information during the baseline description, this information did not inform the assessment of impacts. Impact assessment (specifically, severity and magnitude estimations) never referred to existing data/information. Similarly, results of existing monitoring reports were surprisingly not considered during impact identification and assessment. Existing monitoring data could have informed the identification or impacts as well as their probability and magnitude. Impact assessment (specifically, severity and magnitude estimations) never referred to existing data/information.

The performance of public participation considerations included in the reviewed EIA reports were variable, ranging between adequate and not addressed at all. One consultant claimed that IandAP consultation was unnecessary given that the environmental management plan was addressing pre-existing facilities. In most cases, the method for the identification of IandAPs were not indicated (2.3.1 – 2.3.4). It was thus difficult to determine who were included and excluded and for what reason. The weak public participation could also be as a result of weak scoping, treated mostly as a box-ticking exercise, rather than an integral part of impact identification and assessment. Impact identification and analysis remained generic and did not integrate scoping considerations.

Predictions of impact magnitude (2.4) and assessment of impact significance (2.5) were two of the poorest performing areas. Impact statements were generally vague and EIA reports did not indicate how consultants derived impact magnitude and significance ratings. Again, existing research, specialist reports and monitoring reports did not inform the assessment of magnitude or significance of impacts (2.4.1). These are the key areas informing the EIA decision-making process. When these areas are inadequately addressed, impact assessment is not only in vain, but also adds little value for the time and money spent by the project proponent. Additionally, in the absence of this information, decision-making by the authorities is based on guesswork and not reliable EIA information. The prediction of impact magnitude and assessment of impact significance were also identified as key areas of weakness by Malepe *et al.* (2022) and Sandham *et al.* (2020) for EIA report quality in South African protected areas.

4.3. Review Area 3: Alternatives and Impact Mitigation

Review Area 3 was the poorest performing review area with 94% (n = 29) of the EIA reports graded as unsatisfactory (D to F). Most notably, the consideration of feasible/reasonable alternatives was not adequately addressed (3.1.1 and 3.1.3). In effect, the majority of the EIA reports only seem to defend and justify the initial proposal ("preferred alternative"). The statement that there were no alternative sites to consider was repetitive across the reports. To state that there were no siting alternatives for a 2500 m2 facility in a 6 500 km2 concession suggests no serious attempt to consider siting alternatives. This similarly applies to the description of alternative processes, designs, and operating conditions (3.1.2), where consultants dubiously indicated that no alternatives were available for consideration.

In relation to the consideration of effectives of mitigation measures (3.2.3), the summary recommendation was always to approve the proposed development, which implies that for 31 lodge developments in a pristine natural environment all impacts could be mitigated to an acceptable level. This seems hard to accept and begs the question if mitigation in EIA is taken seriously. Moreover, proposed mitigation measures (3.2.1 and 3.2.2) were highly generic, not reflecting unique site-specific or process-specific characteristics of individual lodge developments. Recommendations made from the EIA were mostly vague, for example "consider environmental law" or "prevent pollution from waste". Mitigation measures were not explicit to the type of activities and significance of its impacts. Generic mitigation measures make EIA follow-up, monitoring and auditing difficult to implement and ultimately unenforceable.

4.4. Review Area 4: Communication of Results

Review Area 4 was the best performing of all the review areas, with 64% (n = 22) of the EIA reports being of satisfactory quality. Two areas for improvement were identified for Review Area 4. Firstly, although maps, charts and images were generally provided in the EIA reports (4.1.3), in some instances this information was left for the reader to interpret, without the necessary elaboration of what it means in relation to the proposed lodge developments (4.1.1). While this might seem trivial to more-sophisticated audiences, it generally creates a limitation to some non-technical readers. Secondly, the lack of emphasis on particularly severe and significant impacts (4.3.1) tend to obfuscate the key message. Most of the reviewed EIA reports resorted to providing a list or inventory of impacts, leaving it to the reader or decision makers to rank them. Communicating the most significant impacts in the executive summary section is probably the best way to ensure that the most important message gets communicated to stakeholders and decision makers.

Conclusions and Further Research

This paper aimed to evaluate the quality of EIA reports for lodge developments in the Okavango Delta with a view to make recommendations to improve EIA practice for tourism developments. The results reveal that the overall quality of EIA reports for lodge developments were unsatisfactory for the majority of reports (71%). In general, performance in analytical areas consistently performed worse than more descriptive areas. These results mirror those for tourism developments in protected areas in the broader region, specifically South Africa (see for example Wylie *et al.* 2018; Sandham *et al.* 2020; Malepe *et al.* 2022). In order to improve quality, and consequently - EIA practice, we make the following recommendations towards addressing some of the key identified weaknesses. Although these recommendations are directed at the Botswana context, we believe they do have broader application for international EIA practice in protected areas with high tourism development pressure:

- *Need for clear strategic direction*: Many of the identified weaknesses could be addressed by providing clear strategic direction to inform project level EIA reports and decision making. The strategic direction starts with clear policy on development in protected areas linked to strategies and plans that set out well defined outcomes. Strategic environmental policy instruments such as strategic environmental assessment (SEA) has been applied successfully to guide project level tourism development in protected areas internationally (Retief, 2006). Such strategic instruments could pro-actively guide decision around for example location alternatives and tourism densities, that are notoriously difficult to deal with at project level, and which has also been highlighted as particular weaknesses in the evaluated EIA reports. Without strategic direction decision making tends to be piece meal and *ad hoc* leading to cumulative effects and unintended impacts that cannot be accurately predicted as project specific level.
- *Establishment of a data and information management system*: Decision making and prediction in protected areas happen, in many cases, in a data rich context, because many of these areas house extensive and long-term research projects. This is also the case for the Okavango Delta. However, the research results suggest that even amidst the wealth of data and information, gaps in baseline information and data exist. Moreover, there seems to be a lack of awareness by the consultants of the existence of much of the information. For this reason, the development of a central and well-coordinated information management system is recommended for the Okavango Delta region, with the sole aim to coordinate, collate and make available all existing information for the purpose of decision making. Current practice, in a comparative context in South Africa, suggests that a web-based spatial environmental screening decision-support tool has had a meaningful level of success in sharing information and guiding EIA screening and prediction decisions (Cilliers *et al.* 2022).
- *Development of norms and standards*: The development of norms and standards for lodge developments in protected areas in Botswana generally, and the Okavango Delta specifically, could address many of the EIA weaknesses related to impact prediction, mitigation and monitoring. Combined with strategic instruments such as SEA that deals with location alternatives and densities, norms and standards could deal with project specific operational and design aspects such as waste, water and energy management. Moreover, the norms and standards would ensure feasible compliance monitoring and enforcement and significantly strengthen the environmental management plan component of the EIA report. Examples of norms and standards for nature-based tourism and lodge development already exist and could be adapted and contextualised for Botswana.
- *Capacity building and awareness*: Capacity building and awareness is needed at two levels. Firstly, the consultants and regulators involved in EIAs for lodge developments in protected areas need to be made aware of the strategic context (once developed), relevant norms and standards (once developed) as well as available information and data. This will allow them to prepare quality EIA reports that align with strategic and project level best practice. The existing professional registration system in Botswana could also serve as a mechanism to facilitate the latter. This could even be in the form of a separate certification for consultants, as well as dedicated

regulators working specifically in protected areas. Secondly, awareness needs to be built with relevant communities to allow them to participate meaningfully in the EIA process. As already highlighted, EIA is in many instances the only voice afforded to marginalized communities, about developments that affect their livelihoods. Best practice guidelines already exist for Africa, that could be adapted more specifically for Botswana (Aucamp *et al.* 2023).

The EIA report quality results suggest that significant weaknesses exist within the Botswana EIA system, as it relates specifically to tourism development in some of the most iconic protected areas in the country. The pressure for tourism development such as lodges is unlikely to abate, and therefore addressing these key weaknesses in EIA is important. By implementing the recommendations described above many of the weaknesses could be addressed resulting in better quality EIA reports and ultimately better strategic and project level decision making. Improvement in the quality of EIA in Botswana would support responsible tourism development while at the same time protect the sanctity of unique and precious protected areas of international significance such as the Okavango Delta.

Credit Authorship Contribution Statement

Leungo Boikanyo L. Leepile: Conceptualization, Investigation, Methodology, Formal analysis, Writing – original draft;
Claudine Roos: Validation, Writing – review and editing;
Francois Pieter Retief: Conceptualization, Methodology, Supervision, Writing – review and editing;
Hans Jurie Moolman: Writing – review and editing;
Reece Cronje Alberts: Writing – review and editing;
Dirk Petrus Cilliers: Writing – review and editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Mitigating Pollution at the Source and Textile Waste Minimization in Poland: Findings from In-House Research

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Abstract: Currently, since the fast fashion phenomenon has existed, the number of new collections appearing in chains and online stores has increased from four to about fifty per year, thus the amount of clothing bought by one person per year is on average 16 kilograms, and as a result, the amount of clothing thrown away by Poles themselves is approximately 2.5 million tons of waste per year. From 1996 to 2012, the amount of clothing purchased per capita increased globally by 40%. In the years 2000–2014 it was 60% more. The problem needs to be solved because it causes a lot of damage to the environment and pollutes the environment a lot. All we need to do is extend the life cycle of clothes by 10% and we will save as much as three million tons of CO2 and 150 million liters of water per year. The aim of the article is to analyze two closely related areas: customers' awareness of the impact of clothing production on the environment and their attitude towards reusing unwanted clothing, and solutions implemented by e-shops in the fashion industry in the area of consumer returns management. The analysis used the results of secondary research and the author's own periodic research from 2017-2023.

Keywords: environmental protection; clothing production; reverse logistics; reuse; second life of the product.

JEL Classification: L81; L67; M11; P56.

Introduction

The textile and clothing industry plays an important role in the global economy. Its trade value is estimated at over USD 1.5 trillion per year (Leal Filho *et al.* 2019). It provides many jobs, and for some areas of the world it is often the most important sector generating income and ensuring economic development. Based on data published by Clean Clothes Campaign (Stotz and Kane, 2015), it can be stated that approximately 100 million people are employed in the textile, clothing and footwear industries around the world. EU-28 textile and clothing industry reported a turnover of 178 billion Euros and investment of more than 4 billion Euros, in 2016, and the main exporters to the EU are the China, Bangladesh, Turkey and India (L'Abbate *et al.* 2018). It is worth noting that this industry is also characterized by dynamic development in the use of the latest technological and material solutions. Apart from the positive aspects activities of this sector, however, attention should be paid to numerous problems that require solutions in accordance with the assumptions of sustainable development of the world economy, the basic message of which is to prevent undesirable society and the environment, instead of removing the negative effects of human activity that disturb the balance in these areas.

In the textile industry, sales have doubled between 2000 and 2015, and the trend is still upwards. At the same time, disposal has decreased and only 1% of products are returned to circulation (Šajn, 2022), so the system is almost completely linear (European Parliament, 2020). The challenges facing the industry are enormous, so it is worth taking a closer look at them and jointly showing the possibilities of a positive impact. The long-term strategy for the industry assumes a closed textile cycle. We need recycling technology that will allow clothes to be converted into virgin fibers in a cost-effective and large-scale manner. This will actually reduce the use of primary raw materials and the amount of textile waste. Currently, only 10% of fabrics used in the fashion industry in the world come from recycling - mainly recycled PET bottles (Majumdar *et al.* 2020). Efficient fabric recycling is not only the appropriate technology, but also a whole system involving the effective collection and sorting of clothing.

This article analyzes the development of the textile and clothing market and the problem of clothing returns from consumers in Poland, as well as consumers' attitudes regarding the frequency of clothing purchases, management and use of used or unwanted clothes. The article is based on the literature on the subject and the results of own and secondary research.

1. Research Background and Impact of Textile Production on the Natural Environment

Clothes are the first necessities, after food. The clothing industry consumes the most water (after agriculture) and releases it toxic chemical compounds into the environment and is a significant source of carbon dioxide emissions into the atmosphere. Clothing sector is supported by a long and complex supply chain. At one end there is a sales market dominated by well-known brands and clothing chains, dealing mainly with retail sales, which is the most lucrative side of the clothing industry. At the other end of the chain there is production subcontracted, mainly from weaker countries developed: primarily from Asia and Eastern Europe. The relocation of clothing production to these countries has created an opportunity lower price both at the expense of lower quality and environmental standards.

It is estimated that approximately 63% of the textile fibres are derived from petrochemical products whereas cotton, the most popular natural fibre, contributes only about 24% (Sandin and Peters, 2018). Of all the synthetic fibres available, polyester is the most commonly and frequently used in the textile industry because it is economical, and has good physical and mechanical properties (L'Abbate *et al.* 2018). However, textile industry is also facing tremendous environmental problems and resource challenges. Use of large amount of chemicals, energy and water, emission of greenhouse gases, and generation of huge quantity of waste and effluent are some of the serious environmental impacts of textile industry (Leal Filho *et al.* 2019).

Textile production requires a lot of water, as well as land to grow cotton and other fibres. It is estimated that in 2015 the global textile and clothing industry used 79 billion cubic meters of water, while the needs of the entire EU economy amounted to 266 billion cubic meters in 2017. It is estimated that the production of one T-shirt consumes 2,700 liters of fresh water, which is enough for one person for 2.5 years.

The textile sector was the third largest contributor to water and land use degradation in 2020. In the same year, the production of clothing and footwear for one EU citizen required on average nine m3 of water, 400 m2 of land and 391 kg of raw materials (European Parliament, 2020).

According to estimates, textile production is responsible for approximately 20% of global clean water pollution due to the dyeing and finishing of products. Every year, an estimated half a million tons of microfibers released when washing synthetics end up in the seas and oceans.

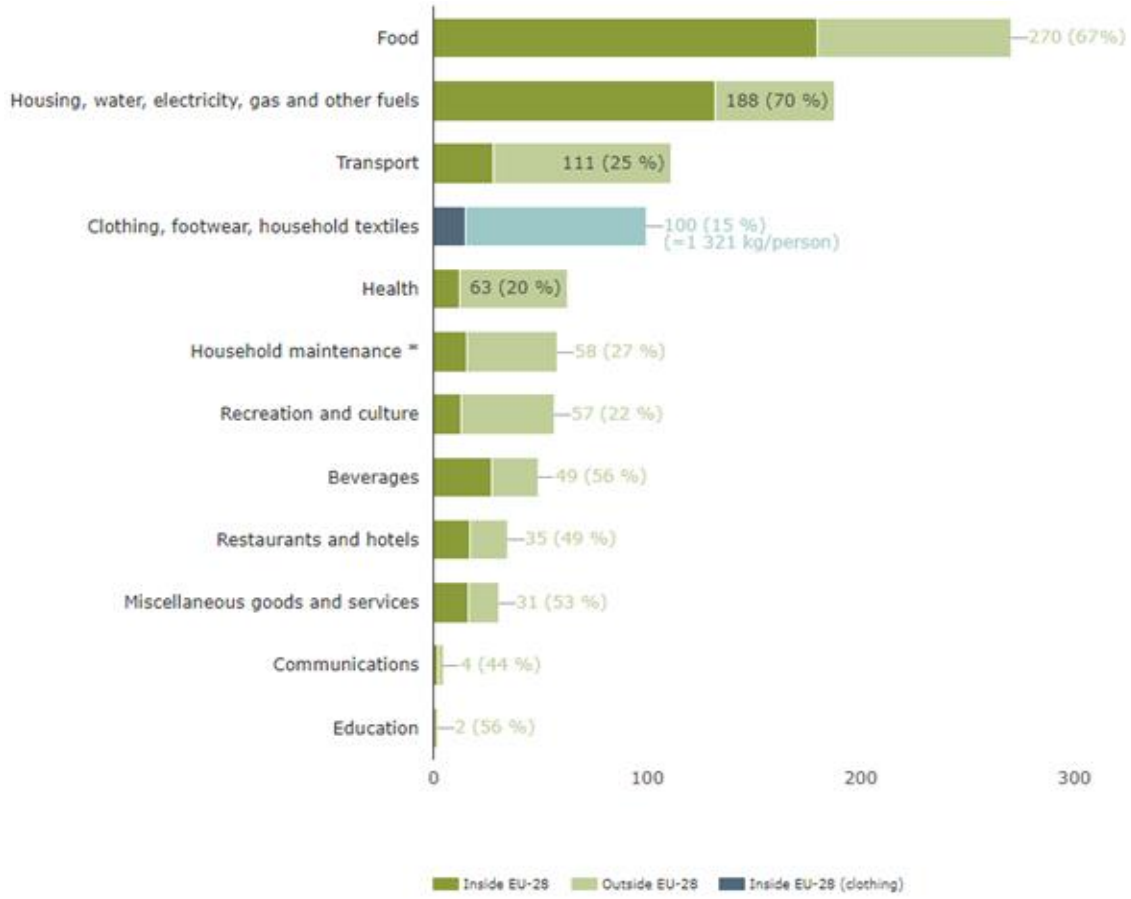
Washing synthetic clothing is responsible for 35% of the primary microplastics released into the environment. Washing polyester clothes can release 700,000 microfibers that can enter the food chain (https://ungc.org.pl). Most microplastics from textiles are released during the first few washes. Fast fashion is based on mass production, low prices and high sales volumes, which favors many first washes. Laundering of synthetic products has resulted in over 14 million tons of microplastics accumulating at the bottom of the oceans. In addition to this global problem, pollution generated by clothing production has a devastating impact on the health of local residents, animals and the ecosystems in which factories are located.

It is also estimated that the clothing industry is responsible for 10% of global carbon dioxide emissions - more than emissions from international flights and shipping combined. According to the European Environment Agency, EU textile purchases in 2020 resulted in around 270 kg of CO2 emissions per person - or greenhouse gas emissions of 121 million tones (European Environment Agency).

Regarding total use of primary raw materials in the supply chain for consumption in the EU, clothing, footwear and household textiles represents the fourth highest pressure category after food, housing and transport (Figure 1). These textiles are also the fourth highest pressure category for water use.

An estimated 1.3 tones of virgin raw materials and 104 m3 of water per person were used to produce and process all clothing, footwear and home textiles purchased by EU-28 households in 2017. About 85% of these virgin materials and 92% of the water were used elsewhere in the world, the highest levels of any consumption area. When it comes to upstream pressure on land use for EU consumption, clothing, footwear and home textiles constitute the second highest category of pressure, after food consumed in the EU (European Environment Agency). Most of the pressure on land use comes from outside the EU (93%) and is largely a consequence of cotton farming.

Figure 1. The use of primary raw materials in the upstream supply chain of EU-28 household consumption domains, 2017
indexed values with textile consumption = 100



Source: EXIOBASE, Netherlands Organization for Applied Scientific Research, 2019

Another problem is how to dispose of unwanted clothes, which people throw away rather than donate to charity. Less than half of clothing used is collected for reuse or recycling. Europeans buy almost 26 kg and dispose of about 11 kg of textiles every year. Used clothes can be exported outside the EU, but are mainly incinerated or landfilled (Sandin, 2018).

New strategies to address this problem include developing new business models for clothing rentals, designing products to facilitate reuse and recycling (circular fashion), persuading consumers to buy fewer, better-quality clothes and, in general, driving consumer behavior towards more sustainable options.

2. Development of Textile Industry in World and Poland

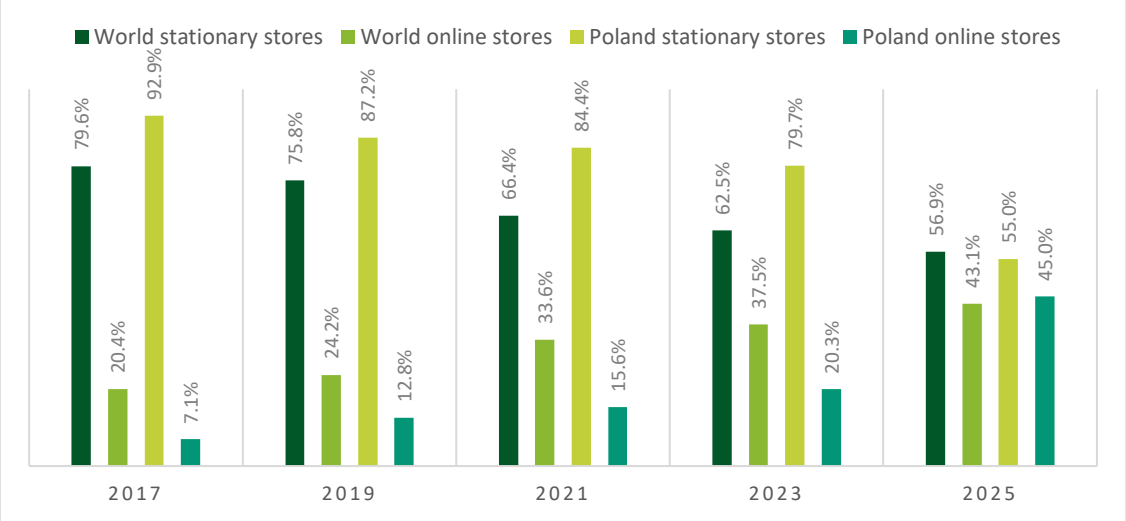
Statista estimates that sales on the global clothing market decreased in 2020-2021 at an average rate of 5.2% annually, reaching a value of EUR 1,269.8 billion in 2021. The largest clothing market in the world is Asia - in 2021 its value revenues reached EUR 492.8 billion, which is 38.8% of global sales. The largest importer of clothing in 2020 was the United States - with a 19.1% share in global imports. In turn, China is the world leader in clothing exports. In 2020, they achieved market share at level of 30.2%. The first position in the world in terms of per capita expenditure on clothing is occupied by the inhabitants of Hong Kong, who spent an average of EUR 2,177 for this purpose in 2021. Second place was taken by the Norwegians (EUR 1,018), and third - with a slightly smaller amount - by the Swiss (EUR 1,011). The average spending per person on clothing in Europe was over €428 in 2021 (Statista).

Figure 2. Clothing market in the world - sales by continent (EUR billion) and growth forecast for 2022-2026

Source: Department of Economic Analysis, PKO BP

According to Statista estimates, in 2021, 33.6% of clothing sales revenues will come from online stores. A significant increase in interest in this distribution channel and an increase in share is forecast to 43.1% in 2025. In Poland, according to own research[1], in 2023 approximately 1/4 of revenues in the clothing industry are generated by online stores (Figure 3).

Figure 3. Clothing sales structure in the world and in Poland by distribution channels, forecast 2025, (%)



Source: Statista and own research

The Polish textile and clothing market is one of the largest and most attractive markets in Central and Eastern Europe. In 2017, 13,485 enterprises were involved in the production of clothing, and 5,813 entities were involved in the production of textile products, most of which were private enterprises employing up to 50 employees (enterprises producing clothing employed a total of 96.8 thousand people, and producers of textile products – 59.9 thousand. people). The great openness of the Polish market is visible: in 2018, the value of Polish exports of clothing amounted to PLN 24.3 billion, and footwear - PLN 7.6 billion, while imports reached PLN 29.9 billion and over PLN 10 billion, respectively (Palmowska and Karasek 2019). The main export direction are European Union (EU) countries, primarily Germany (52% of exports in 2019), as well as the Czech Republic (6.2%), Romania (5.5%) and Hungary (3.7%). In the period 2015–2019, clothing exports to these countries

[1] Own research conducted in 2017, 2019, 2021 and 2023 on a group of at least 110 business entities declaring sales via the Internet.

increased dynamically. In the case of Germany, it was almost 60%, the Czech Republic – 97.2%, Romania – 220.8%, and Hungary – 172.7% (Impact of the global pandemic…, 2020).

In 2020, Poland was the 11th largest exporter of clothing in the world - with a share of 2.1% - and the 9th largest importer - with a share of 2.7%. Poland systematically improves its position on the global clothing market. In 2020, she was 11th. the largest clothing exporter in the world. Economic crisis caused by the pandemic COVID-19 has not affected what has been observed for years upward trend in Polish clothing exports – According to data from the Central Statistical Office, exports for the entire 2020 have ended an increase of 19.1% compared to the previous year (GUS, stst.gov.pl).

The most important phenomena determining the current dynamics of changes in the textile and clothing industry in Poland in the long term include: the political transformation and opening of the Polish economy in the 1990s, changes in international trade policy taking place in the first decade of the 21st century, the spread fast fashion phenomenon and the gradually growing popularity of the slow fashion strategy.

In the last century, the life cycle of clothing products lasted from several to even several dozen years. For decades, clothing products have been offered at high prices by luxury boutiques. Over time, they were offered to the remaining group of recipients at much better prices. Increasing competition among clothing companies contributed to the emergence of the fast fashion strategy (Kowalski and Salerno-Kochan 2018). This phenomenon appeared in Poland at the turn of the 20th and 21st centuries and caused profound changes in the field of fashion and clothing consumption (Palmowska and Karasek 2019). The fast fashion strategy contributed to reducing the time needed to introduce a model to the market from six months to two weeks. The introduction of two collections a year (spring-summer, autumn-winter) has been replaced by a multi-season concept (up to a dozen or even several dozen seasons a year), which is characterized by rapid turnover and arousing customers' feeling of scarcity of goods (so-called scarcity value) (Kędzia 2015).

According to the concept of fast fashion, the shortened life cycle of products in the clothing sector results from social phenomena, and not from the material consumption itself, although changing the collection every few weeks means that the clothing offered is made of low-quality materials. Low prices encourage numerous purchases, but also encourage frequent throwing away of clothes, as the poor quality of materials makes them more easily damaged. The negative impact of the fast fashion phenomenon on the natural environment has paved the way for a new strategy, slow fashion, i.e., the concept of more sustainable fashion, requiring, above all, changes in consumers' worldviews and habits. If consumers decide to buy clothing of higher quality and price, they are less likely to dispose of it, and thus contribute to extending the product life cycle. The slow fashion phenomenon is characterized by paying attention to respect for tradition and the environment. Clothing companies are involved in slow fashion, including: through small-scale production, use of regional materials and raw materials or used textile products (Kowalski and Salerno-Kochan 2018).

3. The Attitude of Polish Consumer Stores Towards a Responsible Approach to "Responsible Fashion"

When focusing on responsible fashion, the company must face many challenges. The first is creation long-term brand management strategy in a responsible manner. This strategy should apply to everyone areas of the company's operations, combining both social aspects, such as care for employees at each level stage of the supply chain as well as a comprehensive plan to minimize the impact of production on the environment (Camacho-Otero, Boks and Pettersen, 2018). Optimally, the strategy should include as many possible pro-social and pro-ecological solutions as possible.

Companies can choose from a wide range of options related to a responsible approach to the clothing industry, including:

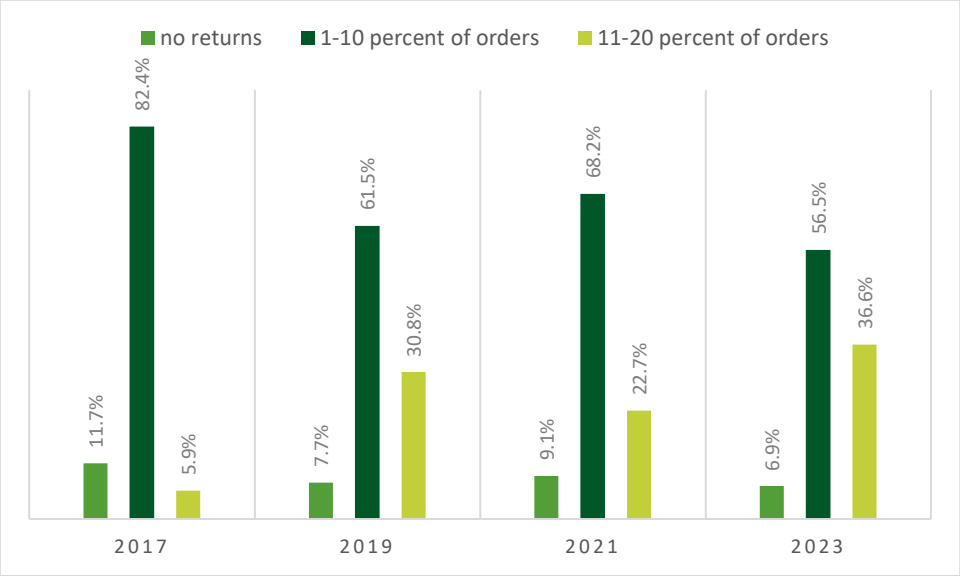
- recycling involves reducing waste by reusing the raw material used to create the product (Villalba *et al.* 2002). The most common example of raw material recycling is the processing of PET bottles into rPET (recycled PET), which is used to produce coats and jackets;
- upcycling is a type of recycling, but it involves increasing the value of processed waste (Sung, 2015). The result of upcycling is a high-quality product made from seemingly useless things. Upcycling refers to both the re-use and processing of second-hand clothing as well as the use of products that had nothing to do with fashion in their original use;
- multifunctional clothing is not only a method of protecting the natural environment (Sharda 2012), but also an innovative solution for the customer. Clothes, which can fulfil many functions, for example it can be both a dress, a scarf, a skirt, a sweater and a blouse;
- reversible clothes allow customers to choose freely and are more environmentally friendly. They can be washed less often, because if they get dirty, all you have to do is turn them over. An additional advantage

of double-sided clothes is the ability to diversify them by rolling down the sleeves or legs, which makes the clothes even more interesting;

- clothes that do not follow trends, such as jeans or the "little black dress", last longer and replace many seasonal clothes. Thanks to their permanence and universality, they stay with the consumer for many seasons, reducing the amount of waste. Such clothes are useful for various circumstances, and therefore help to reduce the negative effects of overproduction of clothing.

In the era of dynamic development and the increasing share of online clothing sales, a problem has arisen regarding clothing returns. In recent years, a clear trend has emerged where consumers order large quantities of clothes in e-shops, then try them on at home and leave only single items of clothing, and return the rest, for example using the right to return the order within 14 days. In extreme cases, stores report that these clothes show signs of use, even though their tags are intact.

Figure 4. Percentage of returned orders recorded by online stores, clothing industry, 2017-2021, forecast 2023



Source: Statista and own research

According to the author's own research, in 2023 every third consumer surveyed declares that they buy clothes online, at the same time 55% of them order more and then return unwanted/inappropriate clothes to the store. In 75% of cases, the size of the product does not fit, and in almost 50% of cases, its use is uncomfortable. Every fifth consumer imagined the ordered item differently. In turn, other online stores operating in the fashion industry declared the level of returns at 10-20% of completed orders. As you can see, e-stores are reporting an increase in the level of clothing returns and this is a serious problem for them, as the product cannot always be re-sold.

Every second return recorded by stores is a consumer return without giving a reason, followed by: sending the wrong goods (25%), complaints related to the goods breaking down during use (15%) and damage to the goods during transport (10%). This is not only a problem for sellers, but also a threat to the environment. Transport from the store to the customer and then again from the customer to the store means twice as much fuel consumption, twice as much carbon dioxide emissions, more production of packaging and boxes, and above all, the problem - what to do with the returned product?

Fashion businesses must have a well-developed and organized returns policy to save money and valuable time. Especially nowadays when it is so easy to order and return products purchased online. In order for this entire process to exist, from the production of clothes in factories, to sale, purchase and, in some cases, return by the final customer, it must be accompanied by separate smaller processes that help and facilitate the functioning of the entire supply chain in the fashion industry, namely: control over received goods and checking the quality and quantity in stock, warehouse automation systems, reports, disposal, introducing new collections, personalization, efficient order completion and shipping, the shortest possible delivery time and an efficient returns handling system (Żurek 2021).

Although it may seem unlikely, some returned clothes and home furnishing textile products are incinerated after returning to the manufacturer. This especially applies to premium products with a well-known logo. Luxury brands want their clothes and accessories not to return to the market at lower prices, as this would lower their

status. As a result, it is more cost-effective from an image point of view to dispose of returned clothes - either by burning them or by throwing them in a landfill - rather than placing them back on the shelves.

In a situation where a piece of clothing that has not been removed is in perfect condition, but does not meet the customer's taste and is sent back, it is not immediately re-sold. To put the clothes back into circulation, the brand must incur costs of up to several zlotys. This is an income for the employee who checks whether the clothes are actually in intact condition, sometimes sending them to be washed, repacking the clothes in new foil, and possibly replacing the tag if the first one has been crumpled. The box must be disposed of and replaced with a new one. Additionally, you must remember that most brands currently offer free returns, which means that they cover the shipping costs (Skurpel 2019).

Instead of using worn-out slogans such as eco-fashion, green fashion, ecological clothing, companies should reliably and thoroughly inform consumers in what aspects the products offered are more environmentally and people-friendly. If only some products are more "ecological", this should also be clearly communicated. A consistent and honest message is very important and will certainly pay off more than hiding the truth. It is worth presenting what steps the brand has already taken towards greater responsibility, what has been achieved and what has not been achieved and what plans it has for the future. It is important to present this information in a clear and comparable way (*e.g.*, information about how many kg of organic cotton is used in production cannot tell much unless this value is expressed as a percentage of the company's entire production). It is also worth explaining to consumers why responsible products and services are more expensive than conventional ones.

4. Consumer Behavior towards Responsible Clothing Purchases

When buying clothes in the last six months or a year, almost every second Pole (49%) noticed that their quality had deteriorated. This is the result of a nationwide study by UCE Research conducted for the SkipWish Group. Consumers observe that now even renowned brands sew clothes from lower quality materials and use cheaper substitutes, *e.g.*, they replace 100% cotton fabric with a similar one, but with a large admixture of polyester. However, only slightly over 20% respondents did not notice any changes. Less than 22% consumers stated that they did not have sufficient knowledge on this subject. Nearly 6% respondents did not remember whether the quality of clothing was better before. In turn, slightly over 3%. respondents are not interested in this topic at all.

People who spend the most on clothing are more likely to buy clothes for new trends and style than for practical reasons (Ferraro, Sand and Brace-Govan 2016). Only slightly more than half of clothes are worn regularly, and consumers do not read labels and cannot indicate what their clothes are made of. However, customers declare their readiness to purchase products with ecological ingredients if the higher price goes hand in hand with the high quality of the goods.

A responsible fashion consumer thinks not only about himself and his comfort, but also about others and the impact of his choices on the environment. This is a person who has knowledge and awareness of where the materials from which clothes are made come from, who made them and how long they have travelled before they hit the store shelf.

Such people are aware that mass production of clothing negatively affects the natural environment, and people working in factories spend several hours a day there, often in difficult conditions. Therefore, before making the first fashion choice, you must take into account ecological and ethical aspects.

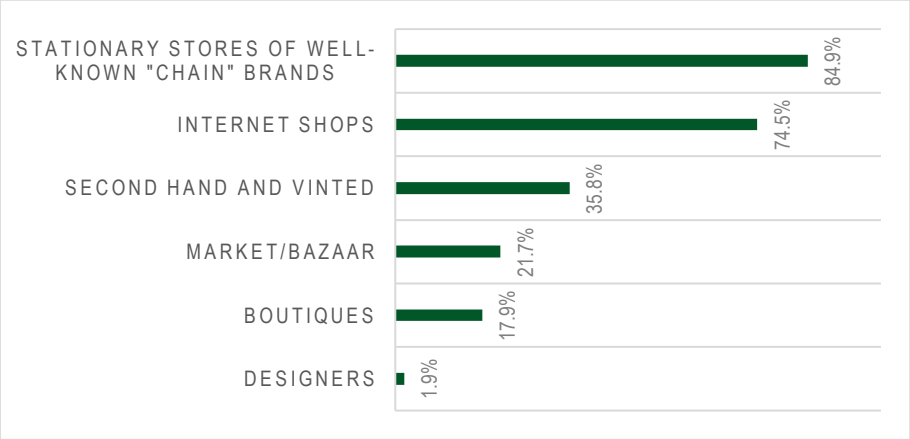
Research shows that 85% of consumers buy clothes in stationary stores of well-known brands, the so-called chain stores, the second place to buy clothes is the Internet. Importantly, every third respondent declares buying second-hand clothes - in stationary stores or on second-hand clothing websites (Figure 5.).

The overwhelming number of respondents, 81%, are aware that produced clothing affects the deterioration of the natural environment, 17 people, 16% say that it has nothing to do with it and does not affect the deterioration of the planet, the remaining part (3%) claims that has no opinion on this topic or has not been interested in this topic before.

The group of consumers who are starting to switch to buying used clothing is constantly growing. Instead of chain stores, they go to second-hand stores, where they hunt for both branded items and just those that they like. In recent years, on the wave of vintage fashion, many shopping platforms and applications have been created that allow you to buy and sell used products. Also, those platforms that previously specialized in selling new clothes, accessories and footwear have made a special place on their websites for second-hand products (Dudel 2022). The prices of these things can be very attractive - even in the case of products from luxury brands. They are made of high-quality materials, which means they can last much longer than a few seasons. Unfortunately, the same cannot be said about items from mid- and low-price brands that flood online second-hand stores. The low price is so tempting that consumers are not deterred even by the prospect of the item being quickly destroyed. Besides, sooner or later there will be a lot of products on the Internet that will successfully

replace the one that is no longer suitable for wearing. According to a report by the ThredUp shopping platform, the global second-hand clothing market is growing at three times the rate of the first-hand fashion market.

Figure 5. Places where respondents buy clothes



Source: Own study based on Dominika Jagiełło, Reverse logistics in waste management on the example of the fashion industry (Łódź, 2022)

Independent research by SecondHandy and LESS (2021 and 2022) shows that the most common reasons for buying in second-hand stores include the pursuit of savings (70-88% of consumers) and the possibility of lucrative purchase of branded or unique clothes (75%), as well as high-quality products (63%). A less important, but still important aspect for second-hand users is concern for the environment (54%), as they limit the waste of clothes. 73.6% of respondents claim that they do not throw away clothes, which is a very good behavior, but the rest throw away clothes. Of the people who throw away clothes, only 7% do it once every 3 years, 43% answered that they throw it away once a year, every third respondent throws it away once every six months, and the remaining part (15%) throws away their clothes when they notice that they are broken. or damaged and cannot be resold. The most common reasons why consumers decided to throw away clothes were spoilage or damage to the clothes - 79%, every tenth respondent claims that it was because the clothes were too large or small, and for another 10% the clothes had lost their attractiveness in their eyes and already you don't like it or it's out of fashion. 77.4% of respondents know institutions to which old clothes can be donated. These are entities such as Caritas, the Polish Red Cross, homes for single mothers and orphanages, a school boarding house for needy children, dog shelters, collections for war refugees, the needy and the poor, various types of foundations, social welfare centers, and the district family assistance center (Jagiełło 2022). There are many institutions to which you can donate clothes, you don't necessarily have to throw them away right away. It is important to give them a second life in this way and extend their life cycle.

Conclusions and Further Research

The fashion industry is developing very dynamically. The data presented above only prove the volume of clothing production around the world. Unfortunately, the production of clothing is accompanied by processes that are harmful to the environment and society, for example, the production of clothes generates a lot of various types of waste, including packaging waste, harmful substances are released into the atmosphere, many liters of water are used for the production and washing of clothes. In order to build a real green image without arousing suspicion and without losing consumer trust, the company should first of all become aware of its actual attitude towards environmental protection and social responsibility (Szydło and Potmalnik 2022).

It is impossible to build a credible image of an environmentally friendly company by selecting and emphasizing only certain features of products and services. Their pro-ecological nature should cover the entire life cycle of the product, from raw materials, through processing, distribution, until it is no longer needed by the consumer.

Consumers' pro-ecological awareness, and therefore the fashion for used products, especially clothing, has been growing for years. Consumers are making purchases more and more often, both in stationary stores and online. It is estimated that the value of the global second-hand market in 2023 will be USD 211 billion, which means an increase of 19% compared to 2022 (Ruben, 2023). We can observe upward trends not only on the global market, but also on the Polish market.

There are undoubtedly many benefits to purchasing second-hand clothing. First of all, these are economic benefits, because we can buy clothes at a very low price compared to store prices. It is worth adding here that selling unnecessary items is one of the ways to recover part of the capital and allocate it to our current or future needs. Moreover, in second-hand stores, both stationary and online, you can find original, unique and fashionable clothes that will help you stand out or create your own unique style. And what is very important, by buying second-hand clothes, customers support environmental protection and set an example of an ecological attitude.

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Credit Authorship Contribution Statement

The contribution of the author regards such actions as conceptualization, investigation, methodology, carrying out the formal analysis, writing original draft, data curation, writing, editing, visualization. The paper carried out the documentation analysis, but also very important was the application of the statistical, dynamics, and comparative analysis. The secondary data were used in the analyses. Reports, datasets, books, manuals, academic and commercial publications, and scholarly articles were used to compile the information for this study.

Declaration of Competing Interest

The author declares that it has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Assessment and Forecast of Atmospheric Air Quality at the Regional Level. Example of Central Kazakhstan

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Abstract. One of the main issues of environmental protection is the quality of atmospheric air. The reason for this is that all life on Earth, first of all, needs air, which affects all climatic and biological processes in general. Harmful and dangerous impurities can be transferred alongside the movement of air masses. These problems are especially acute in industrialized regions, where the level of anthropogenic impact is increasing. These regions include Central Kazakhstan.
When studying the issues of ecological and economic development of such regions, it is necessary to consider all possible consequences of anthropogenic impact that affect or may affect the atmospheric air. The main factor which plays a key role in this is strengthening the forecasting functions of environmental monitoring services, in our case, in relation to atmospheric air, and, when drawing up a plan for the infrastructure of the territories, taking into account the level of anthropogenic impact.

Keywords: air pollution; indicator; anthropogenic impact, environmental protection; the infrastructure; public health; concentration; pollutants; sulfur dioxide; particulate matter.

JEL Classification: Q53; Q52; I18; R11.

Introduction

One of the main issues of environmental protection is the quality of atmospheric air. The reason for this is that all life on Earth, first of all, needs air, which affects all climatic and biological processes in general. Harmful and dangerous impurities can be transferred alongside the movement of air masses. These problems are especially acute in industrialized regions, where the level of anthropogenic impact is increasing.

Rising levels of pollution, both indoors and outdoors, are the result of industrial growth and many other undesirable human activities. These contaminants are harmful for both humans and the environment. The constant release into the environment of numerous chemical pollutants such as NO_x, NH_3, C_2H_5OH, CO and fluorocarbons from industrial emissions, vehicle exhaust and household waste cause many problems (Deekshitha *et al.* 2021).

1. Literature Review

Air pollution affects public health and was responsible for an estimated 6.7 million deaths worldwide in 2019 and 197,000 deaths in the United States (Landrigan *et al.* 2022). The main source of it is the burning of fossil fuels. Mapping the health impact of air pollution at the community level using publicly available data and open source software will provide a reproducible strategy for pollution prevention. Research led by US scientists quantifies the impact of fine particulate (PM2.5) air pollution on disease, mortality, and child cognitive performance (IQ loss) in every city in Massachusetts. According to the researchers, air pollution-related illnesses, mortality, and IQ loss were most severe in low-income minority communities but were found in every city and town in Massachusetts, regardless of location, demographics, or average household income.

Air pollution is one of main causes of death worldwide and continues to have detrimental effects on our health. In the context of these impacts, researchers have developed statistical modeling approaches to better understand air pollution statistics. However, the time-varying statistics of different types of air pollutants is far from being fully studied. The observed probability density functions of concentrations are strongly dependent on the spatial position and on the pollutant.

In their article, European scientists analyzed a large amount of data from various monitoring points and showed that the concentrations of nitric oxide (NO), nitrogen dioxide (NO2) and particulate matter (PM10 and PM2.5) usually vary greatly for different spatial positions. For each substance there are different propagation models in the plane. They depend on the type of pollutants and environmental characteristics (urban/suburban/rural/transport/industrial/background).

Also, some data from foreign researchers have shown a relationship between exposure to air pollution and the development of interstitial lung diseases. The study aimed to evaluate the effect of long-term exposure to ambient air pollution on the rate of change in total lung capacity, residual volume, and diffusing capacity in the elderly, and showed that long-term exposure to atmospheric NO2 is associated with an accelerated decline in static lung volume and diffusive capacity in the elderly. Air pollution associated with NO2 may be a risk factor for restrictive lung diseases (Chen *et al.* 2022).

For developing countries such as Kazakhstan, where most of the industry is extractive, this issue is particularly acute. In different regions of Kazakhstan, due to the fact that different minerals, polluted with their own particular pollutants, are mined, the problems of atmospheric air in each region are also different. One of such regions contaminated specifically by stationary sources is Central Kazakhstan, which is one of the leading industrial regions of the republic, a territorial manufacturing complex with a developed heavy industry. These are the coal mining, metallurgical and chemical-engineering industries of the republic. All of the most important branches of heavy industry are associated primarily with the mining of coking coal, the processing of ores of non-ferrous, ferrous and rare metals and auxiliary types of raw materials necessary for metallurgy (Zhakataeva 2005). Therefore, the main factors of the negative impact on the atmospheric air of this region are the enterprises of the manufacturing industry and thermoelectric power engineering, which are among the most environmentally «dirty» industries in the world. In Central Kazakhstan, there has been a steady increase in the number of atmospheric emissions from about 1 million tons to 1.4 million tons from 1998 to 2004, and since 2005 - a decrease in emissions to 1.27 million tons.

Atmospheric air quality is understood as a set of atmospheric properties that determine the degree of impact of physical, chemical and biological factors on people, flora and fauna, as well as on materials, structures and the environment as a whole. The degree of impact depends on the quantitative characteristics of said factors and the duration of their impact (https://apps.who.int/iris/bitstream/handle/10665/276929/9789289056199-rus.pdf?sequence=5andisAllowed=y).

When studying the issues of ecological and economic development of such regions, it is necessary to consider all possible consequences of anthropogenic impact that affect or may affect the atmospheric air. The main factor which plays a key role in this is strengthening the forecasting functions of environmental monitoring services, in our case, in relation to atmospheric air, and, when drawing up a plan for the infrastructure of the territories, taking into account the level of anthropogenic impact

The purpose of the work is to assess the quality of atmospheric air in Central Kazakhstan (using the example of Astana, Karaganda and Zhezkazgan), to forecast changes in atmospheric air parameters, spread of pollutants and their impact on the environment and human health.

To assess the quality of atmospheric air, it is necessary to consider both environmental and social indicators. In this paper, among the environmental indicators, we will consider API (Atmospheric Pollution Index), indicators of the highest concentration, PM (suspended matter), SO2, CO2, NO2 levels; among social indicators, we will show the level of mortality by main classes of death causes by regions over the past 5 years.

Object of study and source of data. The study used information from the official statistics of the National Hydrometeorological Service of the Republic of Kazakhstan, the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan.

Using the ArcGIS program, ecological maps were made based on the analysis of pollutant emissions into the atmosphere, as well as indices for assessing the state of the environment by mapping on the maps of the Republic of Kazakhstan.

2. Method also Called Materials and Methods or Experimental Methods

Method of statistical analysis. In the process of studying the quality of atmospheric air at the regional level, various methods were used, including the method of statistical analysis, the mapping method, mathematical methods of data analysis and the method of correlation.

Statistical research and analysis of statistical information is carried out using the following common methods:

- Statistical observation
- Summary of materials, grouping of statistical observation data
- Relative or absolute statistics
- Variation rows
- Selection
- Analysis - correlative and regressive
- Dynamic series

Mapping method. Based on databases, material was collected for the analysis and cartographic presentation of information about the state of the human habitat and other biological species, i.e. about the ecological situation. The method of ecological mapping shows the analysis of the ecological situation and its dynamics, the identification of spatial and temporal variability of environmental factors affecting human health and the state of ecosystems. In our case, indicators of air pollution in the Republic of Kazakhstan were shown.

When studying the dynamics of pollutant emissions into the atmosphere throughout Kazakhstan, statistical observation and grouping methods were used via selection. Since among the environmental criteria such environmental indicators as the Atmospheric Pollution Index (API) were chosen - a complex index of atmospheric pollution that takes into account several impurities, the greatest repeatability (GR) - the greatest repeatability (%) of exceeding the MPC according to observations at one post for one impurity or at all posts of the district for all impurities per month or per year, below are the criteria for assessing the degree of atmospheric pollution (Table 1).

Table 1 Assessment of the atmospheric pollution degree

Degree		API	СИ	GR
Of gradation	Pollution of atmospheric air			
I	Low	from 0 to 4	from 0 to 1	0
II	Higher	from 5 to 6	from 2 to 4	from 1 to 19
III	High	from 7 to 13	from 5 to 10	from 20 to 49
IV	Very high	≥ 14	> 10	> 50

Note – The table was composed by the author based on the data https://www.kazhydromet.kz/ru/ecology/ezhemesyachnyy-informacionnyy-byulleten-o-sostoyanii-okruzhayuschey-sredy

One of the important environmental indicators is the level of pollutants in the air. In Table 1, we considered such indicators as the content of PM (2.5) dust in the atmospheric air and the presence of pollutants SO2, CO2, NO2 in the studied regions. This analysis was made using the method of statistical observation, sampling and comparison. Among the environmental criteria, we took the above-mentioned indicators of the greatest repeatability (GR), the atmospheric pollution index (API), as well as the content in the atmospheric air of such pollutants as PM (2.5) dust, the level of sulfur dioxide (SO2), nitrogen dioxide (NO2) and carbon monoxide (CO2), and the level of maximum permissible concentration (MPC). The analysis of contamination with certain substances was done by the ratio of the MPC level with the indicators of contamination (Table 2).

Table 2. Pollution indicators

Name of impurities	Indicators of API, mg/m^3		Hazard Class
	Maximum single concentration	Average daily	
Nitrogen dioxide	0,2	0,04	2
Nitric oxide	0,4	0,06	3
Suspended matter (particles)	0,5	0,15	3
Suspended matter of PM 10	0,3	0,06	-
Suspended matter of PM 2,5	0,16	0,035	-
Sulfur dioxide	0,5	0,05	3
Carbon monoxide	5,0	3	4

Note – «Hygienic standard for atmospheric air in urban and rural settlements» (SanRandN №168 of February 28, 2015)

Further, when analyzing the data, the standard deviation for the regions for 2017-2021 was calculated, methods of statistical analysis and the mathematical method of standard deviation were applied. The standard deviation method is the most common indicator of the dispersion of the values of a random variable relative to its mathematical expectation (an analogue of the arithmetic mean with an infinite number of outcomes). Usually, it means the square root of the dispersion of a random variable, but sometimes it can mean one or another variant of estimating this value.

Method of modelling – calculation of the Pearson correlation index.

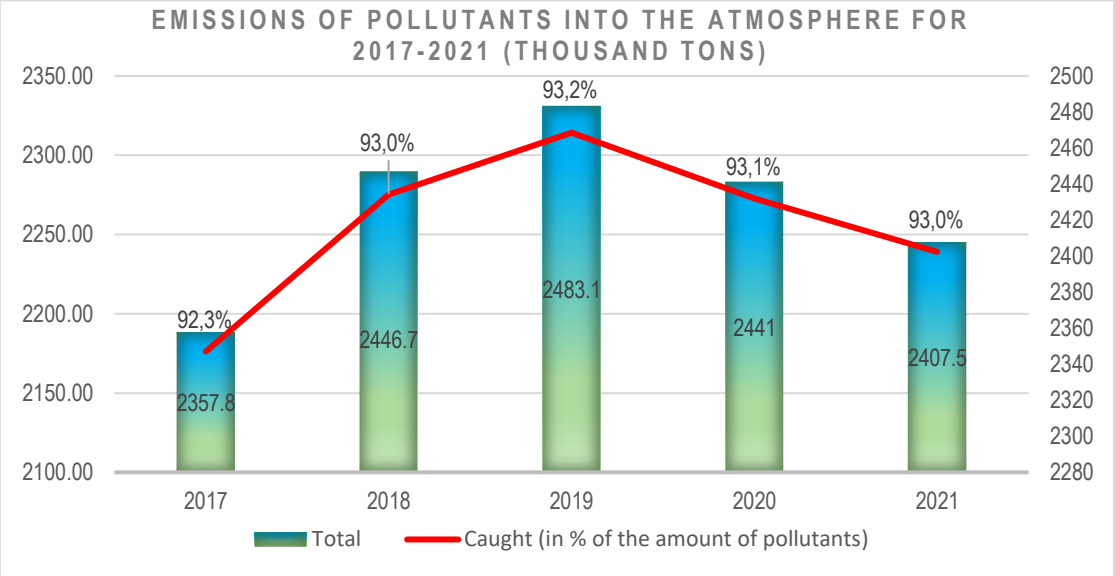
The indicators of the social development of the regions of the Republic of Kazakhstan were also analyzed using the method of statistical analysis, and among the criteria, such indicators as mortality of the population and the main classes of population death causes (malignant neoplasms, diseases of the circulatory system, respiratory diseases) were taken.

When assessing the quality of atmospheric air, it is necessary to take into account not only environmental, but also social indicators, therefore, in order to show the relationship between environmental and social indicators, a correlation analysis was made and a correlation matrix was compiled with the identification of the Pearson coefficient in Microsoft Excel.

3. Research Methodology

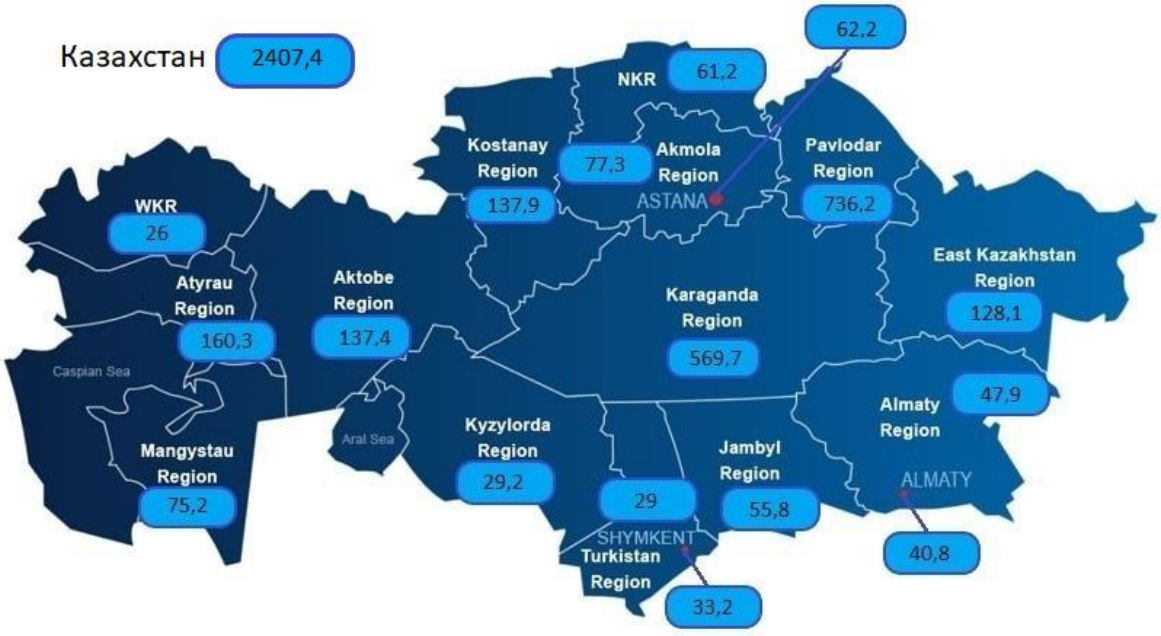
Analysis of atmospheric air pollution in Central Kazakhstan. To begin with, we will analyze the emissions of pollutants into the atmosphere throughout Kazakhstan (Fig. 1,2)

Figure 1. Emissions of pollutants into the atmosphere over the past 5 years in the Republic of Kazakhstan.



Note – The figure was composed by the author based on the data https://www.kazhydromet.kz/ru/ecology/ezhemesyachnyy-informacionnyy-byulleten-o-sostoyanii-okruzhayuschey-sredy

Figure 2. Emission of pollutants into the air in the regional breakdown(разрез) for 2021

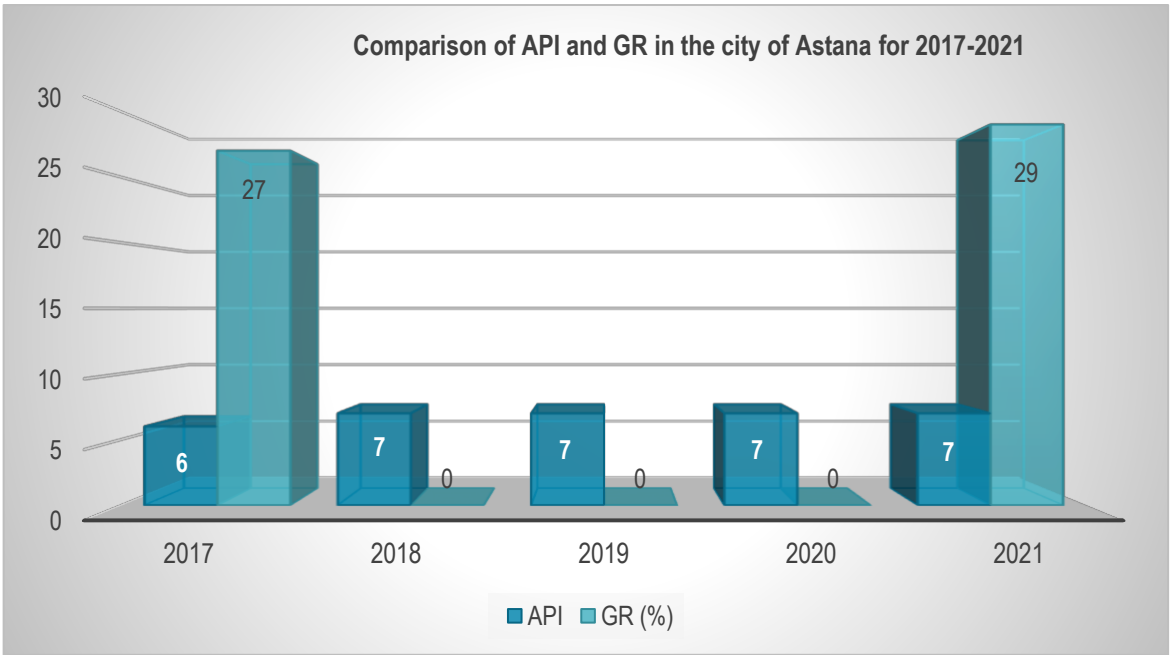


Note - The figure was composed by the author based on the data https://informburo.kz/novosti/v-kakix-regionax-kazaxstana-samyi-zagryaznyonnyi-vozdux

Figures 1 and 2 show that in 2021 the volume of pollutants from all stationary sources amounted to 34.3 million tons, of which 31.9 million tons (93%) were captured and neutralized. And the volume of pollutants emitted into the atmospheric air amounted to 2.4 million tons, which is 2% more than in 2017. From the data in the regional breakdown(разрез), it can be seen that one of the leaders in terms of pollutant emissions is the Central Kazakhstan region. Of the 2.4 million tons of emissions into the atmosphere, 2.1 million tons were generated by the industrial sector. At the same time, most of the emissions are in the heat and power supply segment - 945 thousand tons, followed by the manufacturing industry - 728 thousand tons, as well as mining and quarrying - 357 thousand tons. Sector of transportation and warehousing caused the emission of 114.4 thousand tons of pollutants into the atmosphere (https://informburo.kz/novosti/v-kakix-regionax-kazaxstana-samyi-zagryaznyonnyi-vozdux).

Analysis of data on API indicators for the Central Kazakhstan regions (Astana, Karaganda, Zhezkazgan) over the past 5 years (Fig. 3-5) showed that these regions belong to cities with a very high level of atmospheric pollution air.

Figure 3. Indicators of API and GR for the city of Astana for 2017-2021



According to figure 3 and the assessment of the air pollution degree in Astana for the period from 2017 to 2021, according to the criteria of API and GR, it belongs to the 3rd degree, that is, to a high level of air pollution. The main reason for this is the poor environmental situation in the region, i.e. emissions of pollutants into the atmosphere from numerous vehicles, the private sector, etc.

Analysis with other regions of Central Kazakhstan showed the deterioration of the atmospheric air.

Figure 4. Indicators of API and GR for the city of Karaganda for 2017-2021

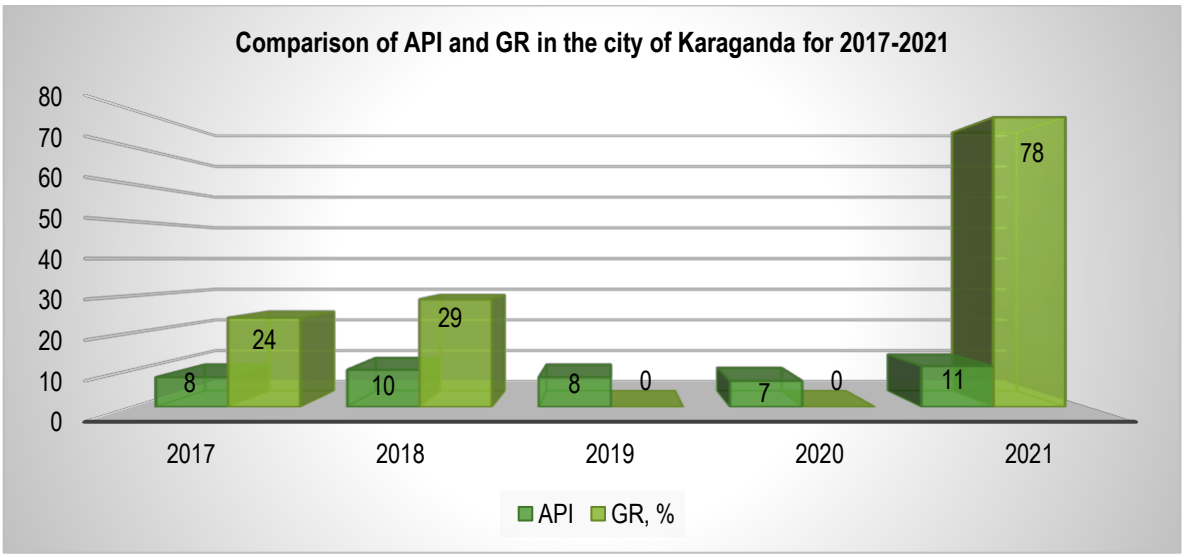


Figure 4 shows that the environmental situation in Karaganda is even worse than in the capital of the republic. Here, API and GR indicators tend to increase from 2017 to 2021. For example, API increased from 8 to 11, which, according to the assessment of air pollution, refers to high (class 3) pollution, and the GR indicator increased 3.25 times from 24 in 2017 to 78 in 2021. The reason for the poor environmental situation was the negative impact of industrial facilities on the environment and inefficient natural resource management policy in the region. The environmental indicators of another industrially developed region of Central Kazakhstan, the city of Zhezkazgan, showed that this city also has air pollution (Fig. 5).

Figure 5. Indicators of API and GR for the city of Zhezkazgan for 2017-2021

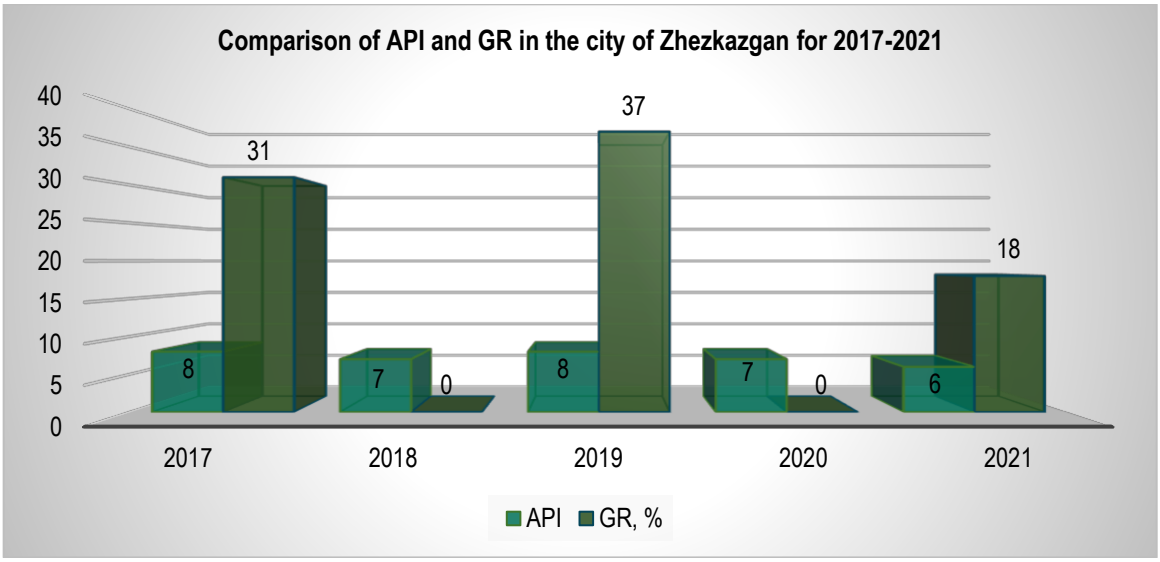


Figure 5 shows the analysis of API and GR indicators of Zhezkazgan for 2017-2021, which shows that the environmental indicators of atmospheric air are at a high level and, according to the assessment of atmospheric pollution, this region can be classified as class 3 in terms of pollution (the region with a high level of pollution). The main cause of environmental problems in this city is also a large industrial load and inefficient environmental protection measures.

One of the important environmental indicators is the level of pollutants in the air. We considered such indicators as PM (2.5) dust and the presence of SO2, CO2, NO2 pollutants in the atmosphere of the mentioned regions for 2017-2021. (Table 3).

Table 3. The content of pollutants in atmospheric air for 2017-2021 in the context of the regions of Central Kazakhstan (mg/m^3)

Regions	Indicators	API	2017	2018	2019	2020	2021	Average value
Astana	PM (2,5)	0,16	0,7	0,88	1,27	3,17	1,394	1,4828
	SO_2	0,5	0,931	1,15	2,0	0,26	2,0	1,2682
	CO_2	5,0	10	12,92	35,03	45,19	30,994	26,8268
	NO_2	0,2	1,74	1,68	1,29	0,19	0,996	1,1792
Karaganda	PM (2,5)	0,16	2,5	3,320	3,163	1,53	3,284	2,7594
	SO_2	0,5	0,466	0,303	0,14	3,26	0,420	0,9178
	CO_2	5,0	72	27,252	19,0	36,09	13,60	33,5884
	NO_2	0,2	0,46	0,304	0,313	1,09	0,375	0,5084
Zhezkazgan	PM (2,5)	0,5	1,0	1,100	0,084	1,0	0,50	0,7368
	SO_2	0,5	2,120	4,310	0,995	2,52	1,12	2,213
	CO_2	5,0	20	13,0	7,7	17,0	10	13,54
	NO_2	0,2	0,57	0,340	0,45	0,53	0,11	0,4

Note – composed by the author according to https://www.kazhydromet.kz/ru/ecology/ezhemesyachnyy-informacionnyy-byulleten-o-sostoyanii-okruzhayuschey-sredy

From the data of Table 1, as well as according to the maximum permissible concentrations (MPC) of pollutants in the air of populated areas, we see that almost all indicators in the studied regions are several times higher than the MPC level, for example, in 2017, indicators of PM (2.5) in Astana exceeded the maximum permissible concentration level by 4.4 times and showed 0.7 mg/m3, and in 2020, this figure was 3.17 mg/m3, which is 19.8 times higher than the MPC. As for the content of other pollutants in the atmospheric air in Astana, we also see indicators that are many times higher than the MPC, for example, the content of sulfur dioxide (SO2) in the atmospheric air in 2017 amounted to 0.931 mg/m3, which is 1.9 times above MPC, in 2018-2021 this indicator also exceeds the maximum permissible concentration level. For nitrogen dioxide (NO2) and carbon

monoxide (CO2) in Astana for 2017-2021 there is also an excess of the MPC level by several times: in 2017, the NO2 indicator was 1.74 mg/m3, which is 8.7 times higher than the MPC, and the CO2 indicator exceeded the MPC level by 9 times and amounting to 45.19 mg/m3.

From the data of table 1 for other studied regions, it is also clear that the indicators are several times higher than the MPC, for example, in Karaganda, the PM (2.5) indicator in 2017 was 2.5 mg/m3, and in 2021 3.284 mg/m3, which is 15.92 and 20.526 times higher than the MPC mg/m3, respectively. As for the indicator of sulfur dioxide (SO2) in Karaganda, the highest level was registered in 2020, which exceeded the MPC by 6.5 times and amounted to 3.26 mg/m3. An analysis of the level of nitrogen dioxide (NO2) in this region showed that the highest indicator was also in 2020, which amounted to 1.09 mg/m3 (5.5 times higher than the MPC level), the indicator of carbon monoxide (CO2) for 2017 and 2020 exceeded the MPC level by 14.5 and 7.2 times and amounted to 72 mg/m3 and 36.09 mg/m3, respectively.

In Zhezkazgan, the highest PM (2.5) was registered in 2017. It amounted to 1.0 mg/m3, which exceeded the MPC by 6.2 times. For other indicators, the analysis determined the highest levels of pollution in 2018 for sulfur dioxide (SO2), which amounted to 4.13 mg/m3 (8.62 times higher than the MPC), for nitrogen dioxide (NO2) in 2017 - 0, 57 mg/m3 (2.9 times higher than the MPC), for carbon monoxide (CO2) the highest rate was in 2017 - 20 mg/m3, which was 4 times higher than the MPC level.

Further, for clarity, we will convert the data of the above-mentioned table into a diagram, in particular, the average values of PM (2.5) dust. Using the mapping method, we will continue to analyze the dynamics of the level of PM (2.5) and the standard deviation by region for the analyzed period (Fig. 6).

Figure 6. Dynamics of the PM (2.5) level and standard deviation by region for 2017-2021

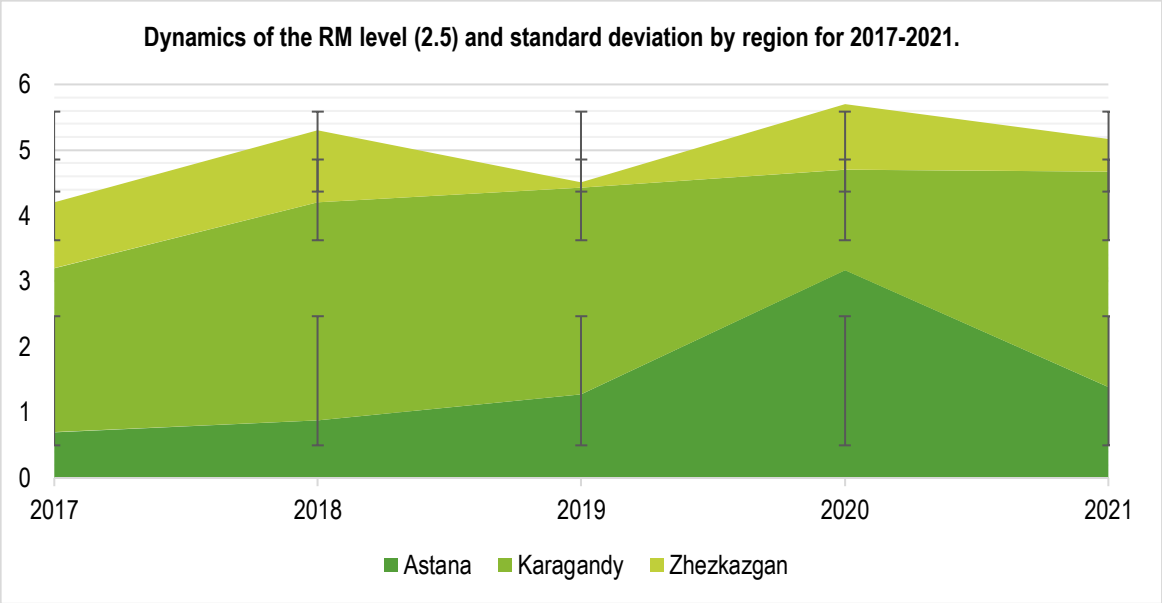


Figure 6 shows that the dynamics of the PM(2.5) indicator in Astana for 2017-2021 ranged from 0.7 mg/m3 to 3.17 mg/m3, and the standard deviation was 0.984. In Karaganda, the dynamics ranged from 1.52 mg / m3 to 3.32 mg / m3, the standard deviation was 0.762, and in Zhezkazgan, this indicator PM (2.5) ranged from 0.08 to 1.1 mg / m3 with a standard deviation of 0.435.

The mortality rates of the population by main classes of death causes for 2017-2021 by region are given in Table 4.

Analysis of population mortality rates by main classes of death causes for 2017-2020 in a regional breakdown. Thus, in the Republic of Kazakhstan, the mortality rate in 2017 was 715.22, and in 2020 it increased by 20.2% and amounted to 860.24. When analyzing the causes of mortality of the population, diseases associated with the negative impact of the environment were selected, thus, having examined the mortality rates from malignant neoplasms, we note that in general in the Republic of Kazakhstan from 2017 to 2020 the trend is declining, yet in the Karaganda region, on the contrary, this indicator in 2017 was 957.34, and in 2020 it increased by 8.7% and amounted to 94.67. In Astana, this indicator also tends to decrease.

Table 4. Mortality rates of the population by main classes of death causes per 100,000 people for 2017-2020 in a regional breakdown

	Total mortality rate				
	2017	*2018*	*2019*	*2020*	*2020 to 2017 in %*
Republic of Kazakhstan	715,22	713,75	719,08	860,24	20,3%
Karaganda region	957,34	968,15	973,65	1124,58	17,5%
Astana	389,56	395,74	391,05	532,18	36,6%
	Malignant neoplasms				
Republic of Kazakhstan	83,90	80,81	79,30	78,66	-6,2%
Karaganda region.	87,07	92,35	89,79	94,67	8,7%
Astana	82,27	86,39	79,20	70,84	-13,9%
	Circulatory system diseases				
Republic of Kazakhstan	174,83	167,28	163,14	193,79	10,8%
Karaganda region.	314,27	321,34	325,47	351,86	12%
Astana	123,10	124,80	115,87	129,19	5%
	Respiratory diseases				
Republic of Kazakhstan	92,22	86,92	87,89	122,88	33,2%
Karaganda region.	101,33	94,02	90,22	98,15	-3,1%
Astana	31,25	30,44	31,07	52,57	68,2%
Note – composed by the authors					

In 2017, the indicator was 82.27, which is 13.9% higher than in 2020 (70.84). The dynamics of mortality from diseases of the circulatory system, which tends to increase, was also taken into consideration. In the Republic of Kazakhstan from 2017 to 2020 indicators increased by 10.8% from 174.8 to 193.7. In the Karaganda region and Astana, this indicator also tends to increase by 12% and 5%, respectively, from 314.27 to 351.86 in the Karaganda region and from 123.10 to 129.19 in Astana.

Assessment of atmospheric air quality and the interrelationship of environmental and social indicators for 2017-2021 on the example of Astana is reflected in table 5.

Table 5. Correlation matrix of ecological and social indicators for the city of Astana for 2017-2021

	GR	API	PM(2,5)	SO2	NO2	CO2	Mortality	Malignant neoplasms	Circulatory system diseases	Respiratory diseases
GR	1									
API	1	1								
PM(2,5)	1	0,445	1							
SO_2	1	0,474	0,004	1						
NO_2	-1	-0,497	-0,974	-0,225	1					
CO_2	1	0,628	0,854	0,389	-0,911	1				
Mortality	-	0,357	0,977	-0,101	-0,958	0,752	1			
Malignant neo-plasms	-	-0,263	-0,931	-0,222	0,952	-0,898	-0,881	1		
Circulatory system diseases	-	0,017	0,571	-0,717	-0,502	0,104	0,727	-0,356	1	
Respiratory diseases	-	0,313	0,977	-0,094	-0,962	0,761	0,998	-0,905	0,705	1

Note – composed by authors

From the tables we see a strong connection between studied indicators. Thus, the interrelationship between environmental and social indicators in the city of Astana is very high. The matrix shows that there is a direct correlation between mortality and atmospheric air pollution with carbon dioxide (the Pearson index is 0.75), and there is also a very large dependence of mortality on pollution with PM 2.5 particles (the Pearson index is 0.97). And further analysis shows a direct correspondence between mortality and respiratory diseases (Pearson's

index is 0.98), which may be precisely due to the state of atmospheric air in the city. It is also seen that mortality is correlated with circulatory diseases (Pearson's index is 0.72).

There is a very strong correlation between malignant neoplasm rates in the city of Astana and nitrogen dioxide pollution (Pearson's index is 0.95). When it enters the human body in the form of a gas, the dissolution of nitrogen dioxide occurs inside the lungs, which is why nitrogen dioxide negatively affects the mucous membranes of the respiratory system and causes burns. It has been proven that constant inhalation of contaminated air leads to oncological diseases.

There is also a relation between pollution with dust particles PM 2.5 and respiratory diseases (Pearson's index is 0.97), which can be the influence of pollutants on the health of the population in this nosological group.

Conclusions and Further Research

In Kazakhstan, the main causes of air pollution are transport and warehousing. Analysis of data on indicators of the Atmospheric Pollution Index for the Central Kazakhstan regions (Astana, Karaganda, Zhezkazgan) over the past 5 years prove that these regions are cities with a very high level of air pollution. The main reason for this is the poor environmental situation in the region, in other words, emissions of pollutants into the atmosphere from numerous vehicles, the private sector, etc.

In Zhezkazgan, the environmental indicators of atmospheric air are at a high level and, according to the assessment of atmospheric pollution, this region can be classified as class 3 in terms of pollution (the region with a high level of pollution).

In Astana, social indicators of development showed the dependence of morbidity on environmental pollution, atmospheric air. The dynamics of mortality from diseases of the circulatory system is increasing across Central Kazakhstan and Kazakhstan in general. In the city of Astana, this indicator also tends to increase.

From the matrix of dependence of morbidity and mortality on the state of atmospheric air, it can be seen that there is a direct correspondence between mortality and atmospheric air pollution with carbon dioxide and PM 2.5 particles. There is a correlation between indicators of malignant neoplasms in the city of Astana and nitrogen dioxide pollution. There is also a relationship between contamination with PM 2.5 dust particles and respiratory diseases. Preventing disease and death from pollution will require tightening of the EPA's air quality standards. Robust prevention will require a government-driven transition to renewable energy sources, combined with a phase-out of subsidies and tax credits for fossil fuels. Highly localized information about the health effects of air pollution can catalyze pollution prevention.

Credit Authorship Contribution Statement

The authors contributed equally to this study.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Sustainable Energy Systems and Green Hotel Practices in Hotels in Tamale Metropolis, Ghana

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Abstract: The hotel sector, along with numerous other tourism-related industries, significantly poses a threat to the environment through its extensive consumption of resources like water, energy, and non-durable items. The hotel industry is also well known for its large-scale discharge of raw and solid waste in varying proportions. As a result, numerous hotels have begun implementing innovative approaches to enhance the sustainability of their operations in efforts to alleviate their environmental impact while also addressing the increasing environmental concerns expressed by customers. Employing a cross-sectional design and quantitative approach and using both descriptive and inferential analysis, we assess sustainable energy systems and green hotel practices in the Tamale metropolis, Ghana. We find that majority of hotels in the Tamale metropolis have written green management policy. We also find that cost and customers understanding of green policies are the main challenges hindering their adaptation and implementation of sustainable energy systems. The study establishes a significant relationship between level of education and use of green energy practices. Again, the study finds staff strength to be highly inter-linked with the existence of green management policy. To this end, we recommend that operators should implement training programs for staff, replace fossil fuels with renewable energy sources and educating the citizens to foster increased awareness and trust in renewable energy systems, as well as to provide proper training for their effective utilization.

Keywords: green hotel practices; hospitality industry; tourism industry; sustainable energy systems.

JEL Classification: L83; Q40; Z32.

Introduction

The hospitality industry is one of the fastest and rapidly growing industries globally, with the hotel industry being one of its most dynamic and valuable sub-sectors (Ozturkoglu, Sari, and Saygili 2021, 39; Pandey, Sahu, and Joshi 2022, 1). The hotel industry, for instance, generates income, employment and business opportunities which accounts for a significant portion of both national and local income worldwide (Dimitrić, Tomas Žiković, and Arbula Blecich 2019). In an attempt to provide levels of luxury, entertainment, attraction, comfort and varieties of desired products and services, the hospitality industry consumes (and wastes) large amounts of energy (Bohdanowicz, Churie-Kallhauge, and Martinac 2001, 2). Globally, the largest proportion of the energy used in the hospitality industry is based on fossil fuels (Rauf *et al.* 2021). This leads to excessive emission of greenhouse gases (GHG)

as well as other pollutants that significantly contribute to local, national and even global environmental degradation (Shen *et al.* 2020).

The tourism industry is multifaceted and multidisciplinary with far-reaching impacts in terms of sustainable development (Kuklina *et al.* 2021, 8042). The number of international tourist arrivals has surged from 25 million in 1950 to approximately 1.5 billion in 2019 (UNWTO 2019, 23). Moreover, there is an anticipation of annual growth in arrivals at a rate of 3.3% from 2010 to 2030, with a projected total reaching 1.8 billion as per the long-term forecast by UNWTO (UNWTO 2019). These trends in terms of tourist arrivals raise concerns about energy efficiency and clean energy demand.

Sustainable tourism in recent years has been advanced as a concept focused on reducing the adverse impacts of tourism on the environment. According to the UNWTO, sustainable tourism is defined as tourism that comprehensively considers its present and future economic, social, and environmental consequences, while also addressing the needs of tourists, the tourism industry, the environment, and local communities (Jorba 2021). The hospitality industry has the potential to become one of the most effective drivers for sustainable development. Many developing countries promote tourism because it serves as a platform for job creation, increasing community income and maximizing both government revenues and foreign exchange earnings (Havi and Enu 2013).

The hospitality industry was once considered to be a lot safer and less environmentally harmful as compared to other industries such as mining and manufacturing industries (Khan *et al.* 2020). But this idea is currently far from the truth as the hospitality industry generates more adverse environmental impact than most industries (Schoffstall 2013). The hospitality industry consumes an enormous amount of energy and water and also emit a very large amount of carbon dioxide contributing to global warming (Bohdanowicz 2006, 663). Research has shown that whilst energy demand and consumption in the hospitality industry is significantly increasing, a large chunk of it is mostly wasted (Adedoyin and Bekun 2020). For instance, about 42% of the energy used to heat and cool spaces in hotels is typically wasted. The primary sources of this wastage are malfunctioning or ineffective systems, along with the behavior and actions of both guests and staff members (Petrevska, Cingoski, and Serafimova 2016; Ishmael Mensah 2013). Also, it has been revealed that guests waste energy by leaving the television, lights, fans and air conditions on when leaving their rooms (Vaidya, Chatterjee, and Bhopatkar 2022).

The energy-saving potential in the tourism and hospitality industry is very significant (Parpairi 2017). To satisfy the goals outlined in the Paris Climate Agreement, the hotel industry must reduce its annual greenhouse gas emissions per room by 66% by 2030 and by 90% by 2050 (HOTREC 2018). Globally, countries are taking and adopting measures to advance sustainable tourism. The EU directives regarding the energy efficiency of buildings have established a requirement for all newly constructed buildings, including hotels, to achieve Nearly Zero Energy Building (NZEB) status by the year 2020 (HOTREC 2018). It is paramount for the hospitality industry to adopt energy-saving practices to minimize the emissions of GHG's.

A study by Kuuder *et al.* (2013, 2), revealed that the hospitality industry, especially hotels use a vast amount of electrical energy (electricity) and energy from fossil fuels in its diverse departments. Due to this, energy saving has been deemed very significant in the hotel industry as a way of minimizing environmental impact and improving environmental management. According McLeish (2007), United State Environmental Protection Agency indicated in their report that, minimizing the use of energy by ten per cent (10%) across the hospitality sector would save approximately $285 million. Another study carried out by Bohdanowicz (2006) revealed that green practices have a promising potential for energy saving in the accommodation and hospitality sector. The study further indicated that green practices such as the replacement of light bulbs with energy saving bulbs or energy efficient bulb, depending on the size and age of the firm, would save up to ten to twenty-five percent (10-25%) energy. As indicated by Deraman *et al.* (2017), green practices that the hospitality industry could adopt to save energy and minimize pollution includes, the implementation of renewable energy systems and programs that are sustainable. Examples are, wind power, solar power, adoption of energy control systems, power from river run-offs, employing the use of thermostat that are digital to regulate guestroom energy consumption, energy-efficient laundry equipment installation, installing sensors that automatically turns of lights when the guest goes out of the room, implementing smoke-free policies in order to reduce air circulating equipment, installing a triple –glazed windows or even more effectively, using reflective glass can result in energy savings that can be allocated to heating and cooling needs. The hospitality industry predominantly expends energy on space heating, ventilation, cooling, hot water, laundry, lighting, recreational facilities, kitchen operations, and various other purposes.

Energy consumption of the hospitality industry varies across the globe (Thommandru *et al.* 2023). This means that, energy consumption patterns may vary significantly depending on some factors such as location and available energy. The hospitality industry in Europe, particularly hotels, consumes approximately, 39 billion

kilowatts of energy annually, mostly in the form of electrical energy (Dascalaki and Balaras 2004). New Zealand uses about 75% of electricity as their energy source, although there are other energy sources such as coal, Liquefied Petroleum Gas (LPG), petroleum fuel and other natural gas and wood (Grové 2017). The use various energy forms in the hospitality industry have led to the emission of toxic gases such as carbon dioxide (CO_2) into the atmosphere which results in the enhancement of air pollution and even global warming (Bohdanowicz 2006). Analyzing the various patterns of energy consumption, it is evident that, the hospitality industry, including hotels, restaurants, bars and tourism destinations can bring about a vast and significant contribution to environmental safety and health by putting in place, measures and practices (green practices) to minimize energy consumption (and waste).

Kapiki (2010), opines that innovative energy management systems that are new and optimal could reduce emissions and energy costs by 65%. It was indicated in the study by Kapiki (2010) that, most of the five (5) star rated hospitality firms as compared to four (4) star hospitality firms, implemented green practices and installed energy saving systems and appliances as well as had obtained green certification. However, such initiatives are hardly implemented in developing countries. This may be as a result of low awareness on the impacts of not adopting green practices as well as inability to incur the cost associated with the implementation of sustainable energy systems such as solar energy and other clean renewable energies.

Globally, the importance of energy efficiency, especially in the tourism and hospitality sectors has been extensively researched. However, in countries like Ghana, there is a seeming lack of evidenced based data on the current state of sustainable energy systems, operational and technological innovations being adopted in the tourism and hospitality industry. Literature is clear on green practices and sustainable energy systems installation by hotels in North America, Europe and Asia (Ishmael Mensah 2013). Also, similar number of studies has been done in other developing parts of world like country as indicated in a study done by Dief and Font (2010). However, green energy practices and efficient sustainable energy systems by the hospitality industry in Ghana, have not been given research attention. Hence it is prudent to ascertain the extent to which the hospitality firms in Tamale metropolis are installing efficient sustainable energy systems and implementing green energy practices to mitigate negative impacts of their doings on the environment, and how these systems contribute to or hinder productivity and profitability.

This study's distinctive contribution lies in examining green initiatives within hotels to support environmental sustainability, particularly in economically disadvantaged regions. With limited empirical research on how green hotel practices affect Sustainable Development Goals (SDGs), especially in economically challenged nations, our study addresses this gap. We investigate how hotels contribute to gaols such as clean water and sanitation (SDG 6), clean energy (SDG 7), responsible consumption and production (SDG 12), and climate action (SDG 13). By shedding light on the practical efforts and outcomes of green practices in the hospitality sector within the Tamale Metropolis, our research provides valuable insights for the global conversation on sustainable development and the role of businesses in advancing these critical goals. Specifically, the study seeks to firstly, assess the efficient sustainable energy policies of hospitality sector operators in the Tamale Metropolis. Second, to identify energy conservation practices (green practices) adopted by the hospitality firms in the Tamale Metropolis, thirdly to assess the challenges in adopting efficient sustainable energy systems by the hospitality industry operators in Tamale Metropolis, and finally, to examine the relationship between categories of operators and the adoption of sustainable energy systems.

1. Literature Review

1.1. Conceptualizing and Defining Sustainable Energy Systems and Green Hotel Practices

Essentially, green hotels refer to hotels that strive to enhance their energy efficiency, water, and materials without it having a negative effect on the quality of service provided (Prakash *et al.* 2023). The many benefits that hoteliers stand to reap from implementing green practices are already known. These advantages encompass enhanced brand value, fostering a positive guest perception, cost and liability reduction, and an augmentation of profits. Moreover, numerous hotels have initiated Corporate Social Responsibility (CSR) initiatives and adopted social programs. Hotel proprietors recognize their role in contributing to environmental harm and feel a moral obligation to make amend (Im, Chung, and Qin 2023). In 2008, the Intercontinental Hotel Group (IHG) pioneered the concept of eco-friendly hotels and became the world's inaugural one hundred percent environmentally-conscious hotel (Deraman *et al.* 2017). Their eco-friendly initiatives encompassed charitable donations of non-perishable food, rooftop installation of solar panels, a rainwater harvesting system for toilet water supply, wind power-generated electricity, and the utilization of recycled materials for windows, furniture, and fixtures.

1.2. Cost and Energy Use in the Hospitality Sector

In an average hotel, the costs of energy forms about 6-8% of total turnover. The energy cost of an energy friendly business is always around 2-3 % of total turnover (Abdou, Hassan, and El Dief 2020). Given their significant impact on controllable expense, operators must exercise prudence and efficiency when managing energy consumption to achieve profitability (López-Gamero *et al.* 2023). T In temperate regions, a hotel's energy usage can be divided into several components: approximately 30% for heating, around 17% for water heating, roughly 15% for cooling, 12% for lighting, and about 5% for cooking (Borowski *et al.* 2020). The overall energy profile is still influenced by various factors, including hotel size, the number of rooms and buildings, classification, restaurant capacity, wellness area size, target clientele (business or leisure), location (urban or rural), climate zone, occupancy rates, and the range of services and amenities offered in guest rooms (Koščak and O'Rourke 2023).

Furthermore, it is also important to notice the most important areas where the use of energy is intense. Hotels can be categorized into three distinct zones, each serving unique functions: the guest room area (comprising bedrooms and bathrooms), the public area (encompassing the reception area, lobby, bars, restaurants, wellness facilities, meeting rooms, floors, and elevators), and the service area (encompassing the kitchen, offices, laundry, staff facilities, and technical sector). Due to the considerable disparity in energy dynamics within these three primary zones, hotels must establish transparency in cost tracking and remain vigilant about managing energy expenses in a manner that aligns with the specific energy needs of each area. The guest room area operates with varying energy demands, contingent upon factors such as room layout, including extensive glazing, for instance. Conversely, the service area typically consumes a substantial amount of energy, particularly for cooling, ventilation, and technical equipment heating, making it an energy-intensive zone (Koščak and O'Rourke 2023).

It is believed by many hotel operators that are adopting green practices and sustainable energy systems often perceive it as a significant hindrance due to the associated extra expenses. This belief aligns with previous environmental studies conducted on lodging, small enterprises, and corporate entities, all of which identified a need for increased expenditure (Khatter *et al.* 2021). Earlier studies by Martínez Ceseña, Good, and Mancarella (2015) revealed that most business wanted to receive a payback within the shortest possible time. Huq and Stevenson (2020) believe that some cost related factors are part of the reasons why some managers are reluctant in implementing green practices. The other factors include environmental auditing, certification fees and facilities improvement (Deraman *et al.* 2017).

On the contrary, Tanveer, Yusliza, and Fawehinmi (2023) reported that as much as hotel managers see green practices as a burden, it is not, but indeed, transitioning into an eco-conscious enterprise can lead to lowered operational expenses and heightened revenue generation. Yusof and Jamaludin (2013) report that, many hotel managers in Malaysia are hesitant to adopt green practices due to their assertion that such implementations come with high costs. However, the research findings indicate that chain-affiliated hotels typically benefit from robust financial backing from their parent companies, in contrast to non-chain-affiliated resorts. This financial discrepancy leaves the latter with limited capital capacity, leading to their reluctance to pursue energy-efficient initiatives.

1.3. State of Sustainability in the Hotel Industry

Many hospitality firms are currently on the pursuit of sustainability which is currently deemed crucial for the development of hospitality firms (Shen *et al.* 2020). The growth of the hotel sector makes a substantial contribution to environmental harm on a global scale, primarily due to energy and water-intensive processes like heating, cooling, and lighting, which have adverse environmental repercussions. Some hotels have chosen to implement measures that seek to protect the environment while improving on the lives of people (Abdel-Maksoud, Kamel, and Elbanna 2016; Dimara, Manganari, and Skuras 2017)

In an attempt to address the issues of sustainability in the hospitality industry from different perspectives, studies such as Kapera (2018),Han *et al.* (2018) and Jauhari (2014) have assessed the hotel industry's capacity for putting sustainable development principles into action, examining the hurdles and current status of their implementation, exploring the impact of guest perceptions on water conservation and waste reduction practices, and how this shapes guest willingness to engage in eco-friendly initiatives and build loyalty. Additionally, investigating the design strategies for eco-conscious hotels, strategies for lowering energy consumption, and the role of modern technology in advancing sustainability efforts. Eugenia Ruiz-Molina, Gil-Saura, and Šerić (2013) demonstrated that the utilization of information and communication technologies has the potential to lower energy consumption. Various research studies have also illustrated that the adoption of environmentally-friendly practices

in hotels can result in decreased operational expenditures and enhanced profitability. Simultaneously, these practices improve guest satisfaction, foster loyalty, support environmental preservation, and confer a competitive edge (Alipour, Safaeimanesh, and Soosan 2019; Prakash *et al.* 2023; Barakagira and Paapa 2023). However, there has been limited empirical research into how green hotel practices contribute to the attainment of sustainable development objectives, particularly in economically disadvantaged nations. Consequently, the recent study seeks to investigate the eco-friendly initiatives implemented by hotels to support environmental sustainability goals, specifically those associated with access to clean water and sanitation (SDG 6), affordable and clean energy (SDG 7), responsible consumption and production (SDG 12), and climate action (SDG 13).

From a tourism industry standpoint, various initiatives are underway to address inconsistencies in benchmarking energy efficiency. The International Tourism Partnership (ITP) and the World Travel and Tourism Council (WTTC) are working to coordinate the endeavors of hotel companies in measuring carbon emissions and conveying this data using a standardized methodology based on GHG protocol standards. This standardization aims to facilitate better comparisons of energy efficiency across the industry. Additionally, sustainability reporting standards have seen enhancements through the Global Reporting Initiative (GRI), which encompasses a standardized reporting framework for hotel organizations. This framework covers social, environmental, economic, and governance aspects. It is crucial to take decisive steps toward the disclosure of sustainability information, as it holds hotel organizations accountable for their actions (Martínez García de Leaniz, Herrero Crespo, and Gómez López 2018).

1.4. Green Energy Initiatives and Conservation Practices in the Hotel Industry

Green energy endeavors encompass projects involving renewable energy sources and energy conservation practices (Liu *et al.* 2022). In essence, renewable energy technology provides a solution that uses energy from nature (that is, the sun, wind, etc. in the broadest sense) to generate energy and reduce its reliance on fossil fuels. On the other hand, energy-saving measures, including energy-efficient technologies, reduce energy consumption (Abdou, Hassan, and El Dief 2020). Abdou, Hassan, and El Dief (2020) revealed in their study that green hotel practices encompass energy conservation, effective water management, and efficient waste management.

Efforts related to water management and conservation are frequently employed as a vital strategy for environmentally conscious management in the hotel industry (Wyngaard and de Lange 2013; Gabarda-Mallorquí *et al.* 2021). The hotel uses a large amount of water in its daily work (Cruz-Pérez *et al.* 2022). The volume of water utilized in the hotel sector is contingent upon factors such as the hotel's size, capacity, occupancy rates, and the range and quality of services and amenities provided (Zhang *et al.* 2023). Water-saving measures adopted in the hotel sector include the installation of water-saving devices and equipment (for example, early morning and late-night plants, reclaimed water (from washing vegetables and fruits) to limit evaporation (Abdou, Hassan, and El Dief 2020). Others include monitoring grass irrigation and water usage in order to avoid water wastage (H. Han *et al.* 2018). Regarding waste management, the hospitality sector generates a significant quantity of both organic waste, which includes items like garden waste, food waste, and cooking oil waste, as well as non-organic waste, which includes materials such as linen, paper, and other solid waste (Tansel, Yeshenkulova, and Nurmanova 2021). Hotel operator’s separate hotel waste by collecting recyclable items using clearly labelled trash cans and colored containers, purchase recycled content products, and effective collection of organic kitchen waste (Tansel, Yeshenkulova, and Nurmanova 2021). Hotel operators can use a variety of practices aimed at reducing hotel waste, such as collecting individual garbage, buy bulk foods and cleaning agents that doesn’t have toxic substances, adopts a donation programs, where food and linen are given to charitable organizations, and the repurposing of leftover guest soaps as laundry detergent, are among the sustainable practices employed (Han *et al.* 2018).

1.5. Landscape of the Tourism and Hospitality Industry in Ghana

The hospitality sector plays a pivotal role in Ghana's economy (Thams *et al.* 2020). This sector in Ghana comprises a diverse range of fields, including restaurants, transportation, lodging, hotels, guest houses, and various others (Ampofo 2020). Among these, the hotel and accommodation sector stand out as one of the most significant and indispensable components of the hospitality industry. This prominence is attributed to the fact that a substantial portion of hospitality services, as mentioned earlier, is primarily offered by standard hotels, rendering it the most vital sector within Ghana's hospitality industry (Ampofo 2020). To foster the growth of the hospitality industry in Ghana, the Ministry of Tourism Arts and Culture was established in 1993, underscoring the government's dedication to the hotel sector (Amoako *et al.* 2019).

As noted by Kuuder *et al.* (2013), several factors, including investor confidence, a remarkable political stability when compared to neighboring countries, and recent oil discoveries, offer a more detailed explanation for the recent upswing in Ghana's hospitality sector. Moreover, Mensah and Blankson (2014) have suggested that the hospitality industry is currently experiencing substantial growth, driven by government efforts to encourage investment and a consistent influx of tourists. Furthermore, the implementation of the Ghana Investment Promotion Centre Act (Law 478) in 1994, which offered incentives such as tax refunds, profit reimbursements, import exemptions, and other attractive investment perks, played a significant role in attracting foreign investment into the hotel industry (Teye 2008). The hospitality sector accounts for approximately 5.9% of all domestic employment opportunities and stands as the fourth most significant contributor to foreign currency earnings, following cocoa, gold, and foreign exchange (Mensah-Ansah, Martin, and Egan 2011; Havi and Enu 2013). In 2020, the hospitality industry in Ghana made a contribution of roughly 3.9 billion Ghanaian Cedis (GHS) (Ragasa, Amewu, and Asante 2021). The growth of tourists coming into the country is projected to increase rapidly and therefore require more hotels (Geoffrey Deladem *et al.* 2021). Interestingly, the distribution of hotels across the region was not uniform (Ishmael Mensah 2007). Greater Accra has about 40% of all registered hotels (Ishmael Mensah and Blankson 2014). A hotel has more than 10 rooms and the guest house has 4-9 rooms. Hotels in Ghana are rated on a star basis (according to international standards), depending on the facilities and services provided. Budget hotels and hotels without ratings do not meet international standards. The number of hotels and licensed accommodation in Ghana as of 2017 were 2,723 which increased to 3,538 in 2020 (Doris 2022).

1.6. Forms of Energy Consumption Systems in the Hospitality Industry in Ghana

Energy ranks as the second most substantial expenditure category for hotels, trailing only employment costs. It typically accounts for approximately 3 to 6% of a hotel's operating expenses and contributes to around 60% of its overall carbon dioxide (CO2) emissions (Koiwanit and Filimonau 2021). The consumption of energy within hotels is subject to a complex interplay of technical, architectural, local, and managerial factors. These factors can lead to substantial variations in energy usage, making it challenging to establish and predict energy targets within the hospitality sector, given the unique characteristics of each hotel (Strielkowski *et al.* 2021). Hotels typically allocate their energy consumption to various purposes, including ventilation systems, water heating, kitchen operations, space heating, cooling, lighting, laundry, recreational facilities, and other miscellaneous uses (Kuuder *et al.* 2013).

2. Materials and Methods

The study was conducted in the Tamale Metropolis, Northern Region of Ghana, known as the fourth-largest city and capital of the region. The vibrant hospitality industry in Tamale Metropolis comprises 123 registered establishments, including 22 hotels, 13 restaurants, 40 guest houses, 32 lodges, and 16 miscellaneous firms. The study employed a quantitative research approach with a cross-sectional design, utilizing well-structured paper-based questionnaires for data collection. The study population consisted of managers and owners of registered hospitality firms under the Ghana Tourism Authority (GTA), totalling 123 registered accommodation outlets in the metropolis. Non-probability sampling was used, with all registered hotels considered, and a list of outlets obtained from the GTA Regional Office. Primary data, collected through questionnaires, was supplemented with secondary information from GTA reports, online databases, and Ghana Statistical Service reports. Data underwent cleaning and error-checking in Microsoft Excel, followed by statistical analysis in SPSS version 20, encompassing descriptive and inferential methods. Descriptive analyses included examining respondents' characteristics, while cross tabulations and statistical tests were used to explore relationships between the existence of a green policy and various facility attributes, all at a 5% significance level. These methods aimed to provide a clear and precise presentation of data and establish significant relationships within the dataset (Moore, Notz, and Fligner 2013).

3. Research Methodology

3.1. Survey Design

A research design is a general approach a researcher takes to combine different parameters of the research into a meaningful and coherent way to address the research problem. It involves the collection, measurement and analysis of data (Palinkas *et al.* 2011). A quantitative research approach was chosen using a cross-sectional study design. This study design was chosen because, it is less costly, less time consuming and very effective for analyzing data from a population at a single point in time (Setia 2016). Well-structured paper-based questionnaires were administered to collect primary data.

3.2 Sampling

The study population were managers and or owners of the registered hospitality firms (accommodation and restaurant) under Ghana Tourism Authority (GTA) in Tamale Metropolis. Thus, a total of one hundred and twenty-three (123) registered accommodation outlets under GTA were considered for the study. A non-probability sampling technique was adopted for the study since all registered hotels in the Metropolis were considered. A list of all registered outlets was obtained from the Regional Office of the Ghana Tourism Authority.

2.4 Data Collection

Primary data collection was done by administering a well-structured questionnaire to the operators of the registered hospitality firms in the Tamale metropolis. A total of 110 questionnaires were returned and deemed fit for analysis. Secondary information was collected from reports from the Ghana Tourism Authority (GTA) and articles from online databases and reports from Ghana statistical service.

2.5 Data Analysis

The collected data underwent a process of cleaning and error-checking within Microsoft Excel.

5. Research Results

This section presents results from the analysis on data gathered from hotel managers and or operators within the Tamale metropolis.

5.1. Profile of Respondents

Table 1. Profile of the Respondents

Biodata	Frequency (*f*)	Percentage (%)
Age		
18-25	10	9.1
26-30	19	17.3
31-39	41	37.3
40-49	32	9.1
50-50	5	4.5
60+	3	2.7
Sex		
Male	87	79.1
Female	23	20.9
Education Level		
JHS/GCE O LEVEL	4	3.6
SHS/GCE A LEVEL	27	24.5
Diploma	27	24.5
Degree	48	43.6
Post Graduate	4	3.6
Years of Work at the Facility		
1-5	55	50.0
6-10	41	37.0
11-15	9	8.2
21-25	2	1.8
26-30	2	1.8
30+	1	0.9
Age of Facility		
5 or less	30	27.3
6-10	44	40.0
11-15	10	9.1
16+	26	23.6
Ratings of Accommodation Facility		
Guest House	12	10.9
Budget Hotel	73	66.4
1-star	10	9.1
2-star	15	13.6
Total	**110**	**100.0**

Source: Field Survey, 2022

Subsequently, statistical analyses were conducted using SPSS version 20, encompassing both descriptive and inferential methods. Descriptive analyses involved examining the frequencies of respondents' characteristics, such as gender, age, education level, tenure at the hospitality or accommodation facility, age of the facility, facility rating, and other demographic attributes. These descriptive analyses were employed to facilitate the presentation and visualization of the acquired data in a manner that enhances its clarity and precision, thereby simplifying and improving the interpretation of the data.

Cross tabulations were used to determine a relationship between the existence of a green policy against (age of facility, category of facility, rating, staff strength against management/ownership). Also, statistical associations were tested using correlations and Chi-square test to establish a relationship between the existence of a green policy and age of hotel, rating, management/ownership, category of facility, staff strength).

A significant level at 5% (two-tailed test) was used. Cross-tabulation analysis serves to minimize potential errors and unveils more insightful insights from the gathered data by examining relationships between variables, identifying frequencies of observations that exhibit multiple characteristics. Additionally, the Chi-square test was utilized to ascertain the statistical significance and relationships between the observed and expected data (Moore, Notz, and Fligner 2013).

A total of 110 managers and or owners from the Tamale metropolis took part in the questionnaire survey of which about 79% were males and 21% females. Out of this, 37% representing majority belonged to the age group of 31-39 years. A larger number of the respondents (44%) were degree holders with few (4%) holding post graduate degrees. About 50%, representing majority of the respondents have worked from 1-5 years in their facilities, 37.3% have worked from 6-10 years while just a few worked for 30 years and above. Considering the age of the facility, majority (40%) are 6-10 years old. Majority (66%) indicated budget hotel as the rating to their accommodation facility (see Table 1).

5.2 Green Management Policy/Rules

Table 2. Existence of Green Management Policy

Variable	Frequency (*f*)	Percentage (%)
Do you have a written Green organizational management policy/rule?		
Yes	98	89.1
No	12	10.9
Total	110	100.0

Source: Field Survey, 2022

Respondents were probed whether they have a written policy for green organizational management that outlines responsibilities and sequences of tasks or activities required to achieve both environmental sustainability and effective service delivery. As depicted on table 2, majority (89.1%) chose 'Yes', implying that they have written green management policies in their respective facilities. A few (10.9%) of participants on the other hand, chose 'No' indicating they have no written green management policies in their respective accommodation facilities.

Table 3. Respondents feedback on main focus of Green Policy in Accommodation facilities

Aim	Frequency (*f*)	Percentage (%)
Reduce costs of environment hazards.	33	33.7
Sustain the environment	6	6.1
Quality service in a clean environment	23	23.5
Clean and fresh vegetation	3	3.1
Safe and healthy environment	8	8.2
Clean environment/ sanitation	24	24.5
Avoid pollution	1	1.0
Total	**98**	**100.0**

Source: Field Survey, 2022

Respondents were further asked what the main focus of their Green Policy was. Out of the 110 respondents, majority (33.7%) highlighted that the main focus of their green management policy is to reduce costs of environmental hazards. About 25% suggested that maintaining a clean environment/sanitation is the main focus of the green management policy. Again, 24% held the position that quality service in a clear environment is the main focus of the green management policies in their facilities. Safe and healthy environment was also identified by 8% of respondents as the focus of green policy. About 6% indicated that green policy focus is to sustain the environment. While 3% highlighted clean and fresh vegetation as the focus of green policy, only 1 respondent posited avoidance of pollution as the focus of green policy. Each factor above was analysed individually with respect to the 110 responses. This is because each respondent was allowed to choose more than one option (see Table 3).

5.3 Energy Conservation Practices (Green Practices) Adopted by the Hospitality Firms

Respondents were asked to demonstrate the extent to which they implement or use common green conservation practices in their hotels, based on a four-point Likert scale; Always, Sometimes, Never and Yet to Start (Table 4).

Table 4. Respondents feedback on the efficient Conservation Practices adopted

Statements	Always (%)	Sometimes (%)	Yet to Start (%)	Never (%)	M	SD
Implements and depends largely on renewable energy programmes (*e.g.*, use of wind or solar power) than the national grid	5 (4.5%)	9 (8.2%)	17 (15.5%)	79 (71.8%)	**3.02**	**0.60**
Reduces general lighting during daytime and makes sure that exterior lighting is switched on only at night	97 (88.2%)	6 (5.5%)	0 (0%)	7 (6.4%)	**1.15**	**0.48**
Install energy-efficient light bulbs with a lifespan 12 times greater than that of common incandescent bulbs'	96 (87.3%)	5 (4.5%)	3 (2.7%)	6 (5.5%)	**1.26**	**0.71**
Repairs or replaces faulty equipment's with more efficient and economical alternatives	47 (42.7%)	31 (28.2%)	2 (1.8%)	30 (27.3%)	**1.97**	**0.89**
Installs occupancy sensors or key card control systems in guest rooms to reduce in-room energy consumption	15 (13.6%)	2 (1.8%)	14 (12.7%)	79 (71.8%)	**2.87**	**0.81**
Uses solar panels to heat water for the guest rooms	4 (3.6%)	2 (1.8%)	12 (10.9%)	92 (83.6%)	**3.05**	**0.48**
Harvest the heat generated by the refrigeration units in order to heat the water for guest rooms or the laundry	0 (0%)	3 (2.7%)	1 (0.9%)	106 (96.4%)	**2.99**	**0.17**
Chooses thermostats that allow you to programme maximum and minimum temperatures (and so prevent guests excessively heating or cooling their rooms)	1 (0.9%)	5 (4.5%)	3 (2.7%)	101 (91.8%)	**2.98**	**0.30**
Installs shade windows that limit sunrays hence limiting air conditioning demands (by means of awnings, curtains, blinds, screens, heat-reflecting sheets, etc.)	71 (64.5%)	3 (2.7%)	5 (4.5%)	31 (28.2%)	**1.78**	**1.03**
Invests in high-performance cooking units when replacing equipment	18 (16.4%)	16 (14.5%)	7 (6.4%)	69 (62.7%)	**2.63**	**0.83**
Defrosts refrigerators and clean the door seals monthly	22 (20.0%)	37 (33.6%)	1 (0.9%)	50 (45.4%)	**2.34**	**0.78**
Uses equipment's during periods of	24 (21.8%)	33 (30.0%)	1 (0.9%)	52 (47.3%)	**2.31**	**0.81**

Statements	Always (%)	Sometimes (%)	Yet to Start (%)	Never (%)	M	SD
low consumption (off-peak hours)						
Makes sure the lights are switched off in unoccupied rooms (magnetic cards automatically turn off the room's power when the guest leaves the room)	71 (64.5%)	5 (4.5%)	1 (0.9%)	33 (30.0%)	**1.70**	**0.95**
Installs an air conditioning system that automatically switches off when the windows are open	2 (1.8%)	5 (4.5%)	12 (10.9%)	91 (82.7%)	**3.04**	**0.47**
Avoids leaving computers switched on when taking breaks longer than 30 minutes	39 (35.5%)	22 (20.0%)	3 (2.7%)	46 (41.8%)	**2.14**	**0.92**
Train staff to do the right things, and invite guests to get involved	67 (60.9%)	25 (22.7%)	1 (0.9%)	17 (15.5%)	**1.56**	**0.77**
Distribute brochures and flyers, or paste stickers and posters, inviting guests to save energy	31 (28.2%)	21 (19.1%)	13 (11.8%)	45 (40.9%)	**2.40**	**1.03**

Source: Field Survey, 2022

M = Mean and SD = Standard Deviation

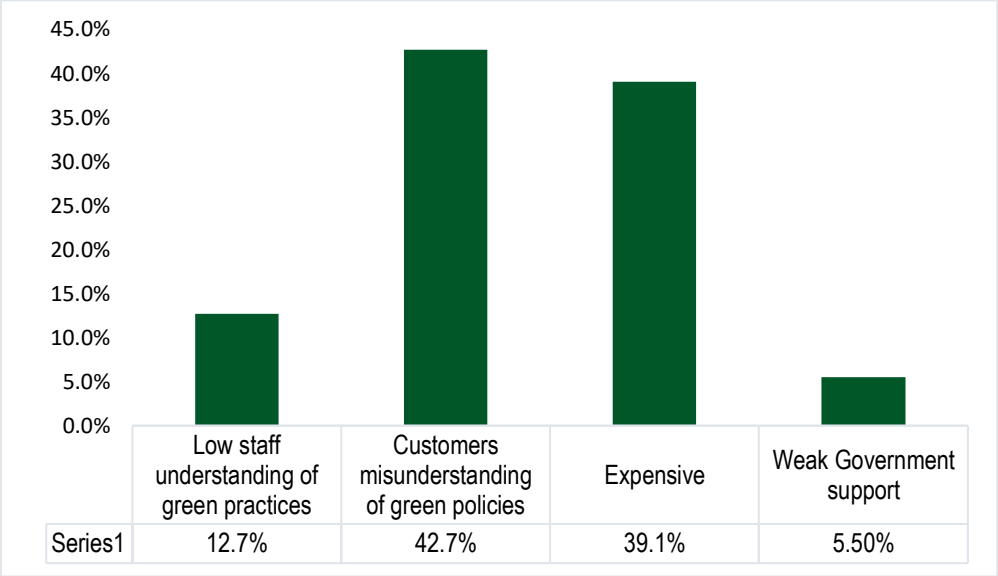
Responding to the statements about energy efficiency and economy, as shown in table 4, majority (71.8%) noted that they do not implement and depend largely on renewable energy programmes. Only a few indicated they either use or implement renewable energy always, sometimes and some are yet to start its usage. Again, 88.2% mentioned that they reduce the use of general lighting during the daytime and ensure that exterior lighting is only active during nighttime. 87% of participants also reported that they consistently employ energy-efficient light bulbs with a lifespan twelve times longer than standard incandescent bulbs as part of their green practices within their facilities. Another green practice is the repair or replacement of faulty equipment with more efficient and cost-effective alternatives, with majority (42.7%) stating they always practice. However, a fair proportion (28.2%) of respondents also maintained that they sometimes practice or implements this procedure, 27.3% noted they never practice it whereas only few (1.8%) noted they are yet to start practicing it. A significant proportion of participants again indicated installation of shade windows as a green practice they use or implement in their facilities. Also, 64.5% constituting majority stated that they ensure that lights are turned off in vacant rooms, with magnetic cards automatically cutting off the room's power when guests exit the room. Furthermore, staff training and guests' invitation to get involved in green practices was as well highlighted by majority of respondents as a green practice implemented and utilized in their facilities.

Albeit the fact that respondents highlighted the use and implementation of some green practices in their facilities, it was apparent from the descriptive statistics that, only implementing occupancy sensors or key card control systems in guest rooms, utilizing solar panels to heat water for guest rooms, capturing heat generated by refrigeration units to warm water for guest rooms or laundry, utilizing thermostats, investing in high-efficiency cooking equipment, performing regular defrosting of refrigerators and monthly cleaning of door seals, installing automatic air conditioning systems that deactivate when windows are open, and disseminating brochures, flyers, or affixing stickers and posters to encourage guests to conserve energy. Contrary to this, a significant proportion of the majority indicated not using these green practices whereas some stated they are yet to start using these green energy practices in their facilities (See Table 4).

5.4 Challenges in Adopting Efficient Sustainable Energy Systems by the Hospitality Industry Operators

The respondents were asked to highlight the challenges they confront when trying to implement green/environmentally friendly management practices in their respective hotels (See Figure 1).

Figure 1. Operators' feedback on the challenges in adopting efficient sustainable energy systems



Source: Field Survey, 2022

Forty-three (43%) of the 110 operators surveyed indicated that customers misunderstanding of green policies is a challenge. Also, 39% of the respondents indicated that it is expensive adopting and implementing sustainable energy systems, 13% maintained a low staff understanding of green practices is challenge. Moreover, 6% noted that weak government support to operators in adopting and implementing green practices as a challenge (Figure 1).

5.5 Relationship between Categories of Operators and the Adoption of Sustainable Energy Systems

To establish the relationship between categories of operators and the adoption of sustainable energy systems, a correlation between some demographic variables (ownership/management, age of facility, staff strength, educational level) and green practices was determined. The analysis focused only on strength and significance of relationship. The results are presented in Table 5.

Table 5. Correlation between ownership/management, age of facility, staff strength, educational level and green practices

		Install energy-efficient light bulbs	Makes sure the lights are switched off in unoccupied rooms
Education Level	Pearson's Corr.	-.248[a]	.208[a]
	Sig. (2 tailed)	.009	.030
	N	110	110
		Makes sure the lights are switched off in unoccupied rooms	Train staff to do the right things, and invite guests to get involved
Staff Strength	Pearson's Corr.	-.259[a]	-.254[a]
	Sig. (2 tailed)	.007	.009
	N	110	110

Source: Field Survey, 2022

With respect to the correlations between the above variables, results from the analysis indicated that there was no strong or significant relationship between age of facility, ownership and green practices adopted or implemented in hospitality firms. However, Pearson product correlation of education level and energy-efficient light bulbs as a green practice was found to be low positively/correlated and statistically significant (r = -.248, p < .009).

Similarly, Pearson's correlation found a significant relationship (r = .208, p < .030) between education level and the practice of switching off lights in hospitality firms by operators, as a green practice (See Table 5).

Furthermore, Pearson product correlation between staff strength and making sure the lights are switched off in unoccupied rooms was found to be negatively correlated and statistically significant ($r = -.259$, $p < .007$).

In like manner, staff strength and training staff to do the right things, and invite guests to get involved, was found to be low positive/negatively correlated yet has a significant or strong relationship ($r = -.254$, $p < .009$).

5.5.1 Relationship between the Existence of a Green Policy and Age of Facility, Rating, Staff Strength

Information gathered the existence of green management policy and some socio-demographic data (age of facility, rating of facility, staff strength) was used to establish the relationship. A step-by-step procedure in tandem with cross-tabulation were applied to clearly establish the relationship (See Table 6). Also, Chi-Square has been calculated, it is compared to the critical value from the Asymptotic Significance with degree of freedom (*df*) and the level of significance selected (of which 0.05 was chosen for the study). Hence, when the critical value is less than the selected significance level (0.05), then there is a significant relationship.

Table 6. Cross tabulation between existence of green management policy and age of facility, rating of facility, Staff strength and Management/Ownership Arrangement

Characteristics	Existence of Green Management Policy	
	Yes (%)	**No** (%)
Age of facility		
5 or less	27 (24.5%)	3 (2.7%)
6-10	39 (35.5%)	5 (4.5%)
11-15	9 (8.2%)	1 (0.9%)
16+	23 (20.9%)	3 (2.7%)
How is your property rated?		
Guest House	12 (10.9%)	0 (0%)
Budget Hotel	64 (58.2%)	9 (8.2%)
1 Star	7 (6.4%)	3 (2.7%)
2 Star	15 (13.6%)	0 (0%)
Staff Strength of the facility		
1-10	81 (73.6%)	11 (10.0%)
11-20	3 (2.7%)	0 (0%)
21-30	10 (9.1%)	0 (0%)
31-40	4 (3.6%)	0 (0%)
41-50	0 (0%)	1 (0.9%)
Management Ownership Arrangement		
Independently owned, Self-managed	44 (40.0%)	7 (6.4%)
Limited liability company, hired management with no contract	5 (4.5%)	0 (0%)
Independently owned, managed by a management contract	45 (40.9%)	5 (4.5%)
Chain owned, managed by the chain	4 (3.6%)	0 (0%)
Total	**98 (89.1%)**	**12 (10.9%)**

Source: Field Survey, 2022

The results show that majority (35%) of respondents that stated they have written Green organizational management policy/rule noted that their facility has been in operations for 6-10 years, 24% indicated their facility age is 5 years or less, 21% indicated 16+ years whereas only 8% indicated 11-15 years of operation of their facilities. Contrarily, 5% representing majority of the sampled population that indicated they have no written green organizational management policy/rule however noted their facilities have been operation for 6-10 years, 3% indicated 5-10 years and 16+ years respectively while only 1% noted 11-15 years of operation. Also, 58% of respondents that stated they have a green policy noted budget hotel as the rating of their facilities, 14% noted 2-star, 11% indicated Guest House while only 6% indicated 1 star as their facility rating. On the other hand, 9% of respondents that stated they have no green policy/rule noted Budget Hostel as their facility rating while 3% indicated 1 star. Considering staff strength of the facility and existence of green policy, a greater proportion (73.6%) of the participants that indicated their facilities have written green policy indicated 1-10 people as their staff strength, 9% indicated their staff strength to be 21-30 people, 4% indicated 31-40 people whereas 3% noted 11-20 persons as their staff strength. With respect to ownership arrangement and existence of green policy, 41% constituting majority of respondents that stated they have written green policy indicated the ownership arrangement to be independently owned or managed by a management contract, 40% stated independently

owned or self-managed, 5% indicated limited liability company while 3.6% indicated chain owned as management or ownership arrangement. Contrary to this, 6% of respondents that stated they have no written green policy identified their management or ownership to be self-managed while only 5% indicated their ownership arrangement as Managed by a management contract (see table 6).

Table 7. Chi-Square Tests

	Green Policy against Age of facility	Green Policy against Property rating	Green Policy against staff strength	Green Policy against ownership
Pearson **Chi-Square**	.054[a]	7.208[a]	10.352[a]	1.561[a]
df	3	3	4	3
Asymp.sig (2 sided)	.997	.066	.035	.668

Source: Field Survey, 2022

From the summary table (Table 7), the Chi-Square test values for green policy against age; property rating; staff strength and ownership arrangement are .054[a], 7.208[a], 10.352[a], and 1.561[a] respectively. Table 4.5 shows that the Asymptotic Significance values for existence of green policy against; age of facility, property rating, staff strength and ownership arrangement are (0.997, 0.066 and 0.668), which are far greater than the level of significance (0.05), thus, based on this it can be concluded that there is no significant relationship between Age of facility, Property rating, ownership arrangement and existence of green management policies.

However, the Asymptotic Significance value for existence of green management policy against staff strength is 0.035, which is lesser than the significance level (0.05). It can therefore be concluded that there is enough proof to support the claim that there exists a relationship between staff strength and the existence of green policy (see Table 7).

6. Discussions

6.1 Existence of Green Management Policy in Accommodation Facilities

The analysis revealed that the majority of Tamale's hospitality facilities have a documented green organizational management policy or guideline that outlines roles and prioritizes duties for the implementation of a sound environmental or service delivery. However, it can be inferred that hotel owners are aware of the negative effects of their actions and are prepared to make amends, as it was previously revealed in a study by Tzschentke, Kirk, and Lynch (2008) that hotel owners believe they have caused significant environmental harm and by doing this they feel all this is the right thing to give back to nature. This may not truly be the case, as it was shown in previous research of a similar kind by Kapiki (2010) that majority of the hotels with five stars (vs. hotels with four stars) had adopted green practices, installed energy-saving systems and appliances, and attained green certification. However, underdeveloped nations like Ghana do not completely implement such efforts.

The analysis from the current study reveals that the major focus of green policy in hospitality facilities in Tamale metropolitan is on reducing expenses associated with environmental dangers, preserving quality in a clean environment, and maintaining a clean environment or sanitation. Inferentially, it should be emphasized that each goal of the green strategy these institutions have chosen aims to maximize benefits for the facilities. However, it should be mentioned that preventing pollution, maintaining the environment, creating a safe and healthy environment, and maintaining clean and fresh vegetation did not receive much attention as these may only increase operational cost but not benefiting the institution directly. This study's conclusion conflicts with that of other earlier studies by Abdel-Maksoud, Kamel, and Elbanna (2016) and Dimara, Manganari, and Skuras (2017), who found that certain hotels have made the decision to apply practices that aimed to improve people's lives while simultaneously protecting the environment. However, the results of this study show that Tamale Metropolis hoteliers' attention is mostly on maximizing profits than pursuing green policies. This is supported by research by Lanjewar (2015); hotels are already aware of the numerous advantages that come with adopting green techniques. These advantages include a rise in brand value, the development of a positive visitor experience, cost and liability reductions, and an increase in earnings, there my selecting the green policies that will favour them.

6.2 Energy Conservation Practices (Green Practices) Adopted by the Hospitality Firms

dimming general lighting during daylight hours and restricting the use of exterior lighting to nighttime; incorporating energy-efficient light bulbs with a lifespan 12 times longer than traditional incandescent bulbs; installing shaded windows to reduce sunlight exposure and subsequently decrease the need for air conditioning;

and restricting lighting usage to nighttime hours. This is congruent with the findings of a similar research done by Liu *et al.* (2022), who stated that green energy efforts include renewable energy projects and energy saving strategies. Furthermore, the current research's findings are corroborated by Abdou, Hassan, and El Dief (2020), who indicated in his study that green hotel practices include energy saving, effective water management, and waste management.

Additionally, although the present study emphasizes the usage and implementation of specific green practices in their facilities, it should be emphasized that respondents surveyed, indicated not using or are yet to start adopting or utilizing the following green energy practices as stated by the study. They include installing occupancy sensors or key card control systems in guest rooms for minimizing in-room energy usage; incorporating solar panels for heating guest room water; harnessing heat from refrigeration units to warm water for guest rooms or laundry; employing thermostats; opting for high-efficiency cooking units when upgrading equipment; performing monthly defrosting and door seal cleaning for refrigerators; and installing automatic air conditioning systems.

However, it should be emphasized that the use of solar panels to heat water is a sustainable kind of energy and is widely recommended for usage in the face of sustainability, despite the fact that it is not being used efficiently in Tamale city, as evidenced by this study. As demonstrated by Hoegh-Guldberg, Ove; Jacob, Daniela; Taylor (2018) Renewable energy technologies such as solar heat and solar PV outperform other technologies in terms of promoting the adoption of renewable energy sources.

6.3 Challenges in Adopting Efficient Sustainable Energy Systems by the Hospitality Industry Operators

The study's analysis revealed that the expense of establishing sustainable energy systems and consumers' ignorance of green policies are the most commonly mentioned issues impeding the adoption and implementation of sustainable energy systems. The study's findings support previous literature in the field, such as the work of Vernon *et al.* (2003), Kirk (1998), and Tzschentke, Kirk, and Lynch (2008), who indicated that many hotel operators who adopted green practices and sustainable energy systems would require additional cost and seen as a major obstacle. Other considerations include environmental auditing, certification costs, and facility enhancement. All of the aforementioned characteristics are capital intensive, which would be disruptive to hoteliers, particularly during an economic crisis.

The study also mentioned that inadequate government backing and a lack of employee understanding of green policies were other difficult concerns. Government assistance is essential for the adoption and implementation of green management practices, not just financially but also legally, though not emphasized by the present study. The results of Mensah (2009) showed that the macroeconomic environment's elements have an immediate but indirect impact on the hotel industry and business settings, which in turn affect hotel revenues and profitability as a whole. As a result, business fundamentals go out of balance, which has a detrimental effect on the viability of hotel building projects.

6.4 Relationship between Categories of Operators and the Adoption of Sustainable Energy Systems

The quantitative analysis of this study indicated that, being educated will lead to the adoption and implementation of sound and efficient green practice such as usage of energy-efficient light bulbs and the practice of switching off lights. Similarly, the study found that staff strength and training staff to do the right things, and invite guests to get involved are found to be effective measures in implementing green management practices efficiently and effectively. Since these will enlighten both staff and guests on the need to maintain green management practices at the facility. Education here is key as level of education to some point depicts the level of comprehension of issues and policies by individuals.

In conclusion, it can be deduced rationally from the preceding that hospitality facilities in Tamale Metropolis have some level of adherence to green management policies, as the majority of the facilities have an organizational written green management policy and have adopted some of the green management practices to their capacities. It should also be noted that the cost element and some guests' ignorance are major barriers to the adoption and implementation of green management methods. The level of knowledge, personnel strength, and quality were shown to be extremely beneficial in the adoption of green practices.

6.4.1 Relationship between the Existence of a Green Policy and Age of facility, Rating, Staff Strength

The statistical analysis of the current study found no statistically significant correlation between the age of the facility, the property rating, the ownership structure, and the presence of green management strategies. On the other hand, there is evidence of a very substantial correlation between staff size and the existence of a green policy. These findings run counter to those of a related study which found that many hotel managers in Malaysia

are not amenable to the implementation of green practices because they believe it would be very expensive. For the same reason as earlier, resort center administrators accepted the high expense of implementing green measures. However, the survey suggests that resorts that are not chain related typically receive little financial backing from their parent firm, leaving them with limited capital capability and leading them to reject the effort (Yusof and Jamaludin 2013). From the foregoing, it can be concluded that green management policies can be influenced by the kind of ownership. The fact that the facility is small (size, limited services, and simple technologies) and has fewer negative environmental effects on the environment or requires fewer resources to implement green policies may account for the significant relationship between staff strength and green management policies. Upadhyay and Vadam (2014) come to the conclusion that the larger the building, the more energy is required. The energy efficiency of a hotel will be higher than that of a collection of separate properties. Less energy will be used by a hotel with fewer amenities and services than by a hotel with many of them.

Conclusions and Further Research

The hotel industry, among various tourism-related sectors, presents a significant environmental threat due to its extensive consumption of resources such as water, energy, and disposable items, along with its substantial discharge of raw and solid waste in diverse quantities. Multiple factors, including heightened customer awareness about the environment, the need to mitigate negative environmental impacts, brand enhancement, and financial benefits, have driven the hotel sector to adopt a more environmentally conscious approach (Verma and Chandra 2016; Han and Chan 2013).

Consequently, numerous hotels are embracing innovative strategies to enhance the eco-friendliness of their operations, aiming to alleviate environmental pressures and address customer concerns about sustainability (Manaktola and Jauhari 2007; Merli *et al.* 2019).

In this respect, the study sought to uncover the sustainable energy systems and green hotel practices in the hospitality industry. The study concludes that hospitality firms in the Tamale metropolis have a written Green organizational management policy/rule and the main driver for adopting green policy is to reduce costs of environmental hazards; maintain quality in a clean environment; and keeping a clean environment or sanitation. Regarding the common green conservation practices implemented or used in hotels, findings from the study indicate that the surveyed hotels make diverse contributions towards enhancing energy efficiency. Contrastingly, the findings of this study highlight that the utilization of renewable energy systems such as solar and wind energy remains relatively uncommon among the majority of hotels, with only a few having initiated their adoption. Overall, the study found cost of implementing sustainable energy systems and customers misunderstanding of green policies as the main challenges hindering their adoption and implementation of sustainable energy systems. The study also discovered significant relationship between level of education against use of energy efficient light bulbs and the practice of switching off lights in hospitality firms. Moreover, staff strength was found to be highly inter-linked with the existence of green management policy in hospitality firms.

Thus, operators of hospitality firms should exhibit a more robust dedication to attaining environmental sustainability. This can be accomplished through the implementation of focused training initiatives aimed at enhancing staff awareness of environmental concerns and motivating guests to actively contribute to reducing the hotel's ecological footprint. Incorporating green practices into their marketing strategies would further enhance the hotel's environmental commitment. Also, operators should prioritize the substitution of fossil fuels with renewable energy sources, particularly in light of escalating fuel costs. Extensive and intensive public education should be regularly conducted to educate the citizens to enhance their awareness of, and trust in, renewable energy systems, and provide training to ensure their proper utilization. Lastly, Government should reduce taxes on hospitality firms to support hotel operators to be more committed to sustaining natural resources.

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Credit Authorship Contribution Statement

Patricia Animah Appiah: The first author played a pivotal role in the research, leading conceptualization and methodology, while also actively contributing to writing the original draft and meticulously curating the data;
Raymond Adongo: The second author provided crucial contributions by supervising the project, validating the findings, and diligently reviewing and editing the content to enhance its quality;
Abdul- Rafiw Safo: The third author significantly contributed by developing and utilizing the necessary software, conducting formal analysis, and creating clear and insightful visualizations to enhance the research.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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The Legal Framework Governing the Offence of Environmental Pollution in Jordan and the Sultanate of Oman

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Abstract: The focus of this study pertains to the legal regulations governing environmental pollution offences, as stipulated by the Environmental Protection Law No. 6 of 2017 and its subsequent revisions. Initially, the study examined the definitions of environmental pollution in accordance with the methodology employed by Jordanian lawmakers and international conferences. Subsequently, an analysis was conducted on the Environmental Protection Law No. 6 of 2017 and its subsequent amendments. This was followed by a determination of the fundamental components upon which the criminal offence is predicated. Additionally, a review of select cases that were brought before the Jordanian judiciary was undertaken. The environmental policy in Oman legislation underscores adopting a multifaceted approach, sometimes emphasizing obligatory measures and resorting to prohibitive or unrestricted policies. It is apparent that the responsibility for safeguarding the environment from pollution is not solely vested in the state but is a collective responsibility shared among individuals and society as a whole, as reinforced by the provisions of Article 6. This underscores the importance of environmental protection as an effective means to combat wrongdoing, thus the enactment of Law No. 26 for Environmental Protection and Pollution Control, which establishes specific legal principles to define criminal behaviour and prescribes penalties, adhering to the fundamental legal principle that "there is no crime and no punishment except by law."

Keywords: environmental protection law; environmental pollution; environmental pollution crime; Jordanian law; Oman law.

JEL Classification: K32; Q56; R11.

Introduction

Each historical period is characterised by a particular concern that emerges and captures the attention of intellectuals. Currently, a pressing concern is the matter of environmental pollution and its consequential impact on the environment, posing a threat to humanity. The environment is widely recognised as a crucial medium for the existence of living organisms, encompassing humans, animals, and plants. Human beings have endeavoured to exploit the natural resources of the environment and manipulate it to suit their needs, often exceeding the boundaries of sustainability. The current state of environmental degradation is a grave concern, as it poses significant challenges to the restoration of the damaged ecosystems. The issue of global warming serves as a

representative instance. The phenomenon of living amidst threats that pose a potential risk to the sustainability of our planet has become a pressing concern. The issue at hand pertains to a human predicament, particularly in light of the significant advancements in technology that humanity has achieved and the ensuing revolution. The industrial sector has played a significant role in the progress of humanity, albeit with some negative impacts on the environment (Al-Hasban 2011).

The subject of environmental conservation and the imperative to safeguard it, along with strategies to address the ramifications of the Infection, is a matter of great significance for both global accords and domestic laws. It has garnered considerable attention from legal experts across various fields, with numerous studies conducted by scholars from diverse backgrounds (Ahmed 2000).

In light of the emergence of this phenomenon and the gravity of environmental issues, nations have undertaken measures to mitigate deleterious practises and activities that compromise the environment. Consequently, international conventions on environmental sustainability have been convened, including the Stockholm Conference of 1972 and the third Rio, Brazil Conference of 1993. According to Soleimani (2016), it is imperative for nations to implement appropriate legal measures to safeguard and conserve the environment. In this regard, the Jordanian legislative body has enacted Environmental Protection Law No. 6 of 2017, along with its subsequent amendments, to mitigate detrimental practises and activities that pose a threat to the environment.

The legislative framework in Jordan establishes legal regulations to ensure the protection of the environment and combat any activities that disrupt the balance of the ecosystem. Additionally, it outlines measures to address the issue of ocean pollution. The crucial domain encompasses the aquatic, terrestrial, and aquatic components, and it also establishes legal mechanisms to oversee these activities. It is imperative to ensure that perpetrators of environmental violations are held accountable and subjected to appropriate penalties as stipulated in Environmental Protection Law No. 6 of 2017 and its subsequent amendments.

The present study was structured into four distinct sections. The initial section pertains to the fundamental notion of environmental pollution as a criminal offence. The subsequent section delves into the various components that constitute the crime. The third section is dedicated to the legal consequences that are associated with the commission of this offence. Finally, the fourth section provides a suitable conclusion to this study.

Methodology

In this research, an analytical approach will be employed to examine the legal articles relevant to the study. This will help us assess the strengths and weaknesses of different jurisprudential, legal, and judicial trends, as well as the degree to which they are applied. Our aim is to identify the content, implications, and objectives of these trends, and to offer constructive criticism and commentary. The study requires the utilization of multiple approaches due to its complex nature, bridging legislation, opinions, and jurisprudence trends.

1. What Constitutes an Environmental Pollution Crime?

The examination of environmental pollution as a criminal offence from a legal perspective necessitates the establishment of a clear definition of the term "environment." of analysis, pertains to the notion that pollution is not uniformly distributed across currencies. This presents a significant challenge in conducting an accurate assessment of the impact of pollution on a particular currency. Research endeavours involve ascertaining the precise connotation of the term "environment" in addition to the concept of pollution.

1.1 The Concept of the Environment

The Jordanian legislature has provided a definition of the environment in accordance with Environmental Protection Law No. 6 of 2017 and its subsequent amendments. The environment is described as a medium that encompasses both living and non-living organisms, as well as the materials that are present within it. Additionally, the environment includes the air, water, and soil that surround it, as well as the interactions that occur between any of these elements. Furthermore, the environment encompasses any facilities or activities that are established by humans within it.

According to the Jordanian definition, the environment is composed of two elements. (1) The natural element is a product of divine creation and is embodied in the various natural resources, including water, air, soil, plants, and animals, which are crucial for the sustenance of life. Preservation of these elements is imperative for the perpetuation of life. The industrial component pertains to the human-made tools and means created primarily to fulfil their needs and demands.

The present discourse pertains to the delineation of the environment in international conferences. The Stockholm-based Human Environment Conference of 1972 aimed to provide a comprehensive definition of the

environment, which encompasses all elements that surround human beings, including those that are naturally occurring or those that are created by human activities. Regarding the Belgrade Conference held in 1975, it was declared that there exists a correlation within the realm of the natural world. Furthermore, the relationship between the biophysicist and the socio-political realm pertains to the genesis of humankind (Al-Khawaldah, M.H.A., Rshdan, A.A.M.H., Al Makhmari, M.R.A., ...Al Haf, R.A., Alsharqawi, A.H. 2022).

The term "environment" is a broad term that is not necessary to include in a comprehensive definition, and all we can say is that the environment has constituent elements. One is natural, and the other is artificial.

1.2 The Concept of Pollution.

In order to ascertain the legal parameters of environmental pollution in Jordan, it is necessary to first examine the definition of pollution and its various classifications. The issue of environmental pollution is a central focus of environmental studies, given its status as a primary concern and the most hazardous factor in environmental conservation. It has been widely recognised among scholars that pollution represents a significant challenge in this field. The sole entity that experiences adverse effects due to the surrounding ecological conditions.

According to the Environmental Protection Law No. 12 of 1995 in Jordan, pollution is defined in Article Two as any detrimental alteration to any component of the environment that surpasses the Ministry's approved environmental standards and specifications, either directly or indirectly, or that causes such an alteration. This alteration may occur to a tangible or intangible extent, and may result in the restriction of the use of these components, a decrease in their economic, aesthetic, or social value, or their partial or complete elimination. Additionally, pollution may impact the normal life of living organisms and disrupt their natural equilibrium.

In accordance with Article Two of the Environmental Protection Law No. 6 of 2017 and its subsequent amendments, pollution has been defined by the Jordanian legislator. The environmental components encompass both biotic and abiotic factors, including but not limited to the natural resources of water, air, and soil, as well as the diverse array of living organisms and their genetic origins that inhabit the environment.

The fundamental components necessary for the manifestation of pollution are as follows: Article 2 explicitly refers to an alteration in the surroundings. The second point is that human activities are responsible for the change, as instances of pollution can lead to legal consequences if the responsible parties are deemed to have committed a crime. Human activity is responsible for pollution, whereas pollution resulting from natural causes is not a contributing factor. Certainly, I will include the definition. The incidence of environmental damage is a matter of concern, as it results in adverse effects on the health of the general public, flora, fauna, and various environmental components such as air, water, and land.

The 1982 United Nations Convention on the Law of the Sea established a definition for marine pollution as the act of introducing substances or energy into the marine environment, including estuaries, by human activities, either directly or indirectly, which may cause harmful effects such as damage to living matter and life. The marine environment poses a significant threat to human health and safety, as well as to legitimate activities such as fishing. Additionally, the quality of seawater is deteriorating, further exacerbating these risks. For both practical and leisure purposes. (Ouinas 2007).

1.3 Types of Environmental Pollution

The categorization of pollution is based on various criteria, such as the type of pollutant, the nature of the pollution event, the source of pollution, and the resultant impacts. (El-Refaie, A.M., Alsharqawi, A.H. 2022).

A. The Categorization of Pollution Based on Its Origin: (1) Natural pollution refers to the environmental degradation that arises from natural phenomena, such as volcanic eruptions and earthquakes, which can have detrimental effects on human livelihoods. Unlike anthropogenic pollution, natural pollution is not subject to legal protection. Industrial pollution refers to the contamination of the environment resulting from human activities related to industry. The category of pollution that falls under the ambit of legal safeguard is the one being referred to.

B. The Categorization of Pollution Based on Geographical Extent: Pollution is categorised into two types based on its geographical extent: limited pollution and unlimited pollution. (1) Limited pollution refers to the type of pollution that does not surpass the territorial boundaries of its origin, thereby confining its effects within the said borders. Unlimited pollution refers to the presence of organic sources of pollution within a region that falls under the jurisdiction of a particular nation, even if such sources are only partially present. Additionally, if any antiquities are discovered within a region that falls under the jurisdiction of another country, it also falls under the purview of unlimited pollution.

C. One category of pollution is deemed reasonable due to its limited impact on the environment and lack of disruption to the ecological equilibrium. The category of pollution referred to as "dangerous" occurs when the

amount and composition of pollutants surpass the established environmental threshold, thereby posing a risk to the natural, industrial, and human components of the environment. This disturbance to the environmental equilibrium is prevalent in industrialised nations. Destructive pollution is widely regarded as the most perilous form of pollution due to its ability to surpass the threshold of environmental security and reach lethal levels. It has the capacity to devastate ecosystems and disrupt the delicate balance of the environment. This encompasses the detrimental impact on both the natural environment and human population resulting from incidents such as oil spills and the deployment of nuclear armaments.

D. The categorization of pollution based on the environment in which it takes place. Pollution can be classified into two categories based on the environment in which it occurs, namely air pollution and water pollution. In addition, soil pollution encompasses various forms of pollution. (Abdellaoui 2004).

2. The Elements of Environmental Pollution Crime.

The Jordanian legislative body has demonstrated a significant commitment to environmental preservation and protection (ALKSEILAT; ABU ISSA; AL-REFOU 2020). This is evidenced by the enactment of laws aimed at safeguarding the environment and preventing pollution, which poses a threat to all components of the ecosystem, including humans, animals, and plants. The Environmental Protection Law No. (6) of 2017, along with its subsequent amendments, serves as a crucial legislative tool for environmental protection. Article Two of the Environmental Protection Law No. 6 of 2017, as amended, outlines the definition of environmental crimes as any action that causes harm to the components of the environment, as well as any breach of the terms, conditions, regulations, instructions, and specifications that have been established. This definition has been established by the Jordanian legislator. Regulations and determinations of a technical nature have been promulgated for this objective.

In the Sultanate of Oman environmental crimes, like any other crimes, require the presence of both material and moral elements. The material element is manifested in the behaviour within the environment, such as the criminal outcome, and establishes a causal link between that outcome and the action or conduct of the perpetrator. The perpetrator's activity needs to be the cause of the criminal outcome. Additionally, the moral element, represented by the criminal intent, is required in intentional crimes that contravene environmental protection regulations and result in harm. It should be noted that liability can also be attributed to negligence when harm occurs unintentionally without the perpetrator intending to cause the criminal outcome.

2.1. The Legal Pillar

The legal foundation for classifying an action as a criminal offence and ascertaining its corresponding punishment. The concept comprises of three fundamental components: Firstly, the presence of a legal provision that renders the act a criminal offence. Secondly, the existence of a written statement outlining the punishment or preventive measures for the said offence. Lastly, the act in question must not fall under any of the legal justifications specified by the law (Muqadas, 2019). The legal framework pertaining to this matter is embodied in Articles 6, 7, 8, 9, and 10 of the Environmental Protection Law No. 6 of 2017. Article 6 specifically outlines the prohibition or restriction of hazardous materials in the Kingdom for environmental reasons, as determined by a regulation issued. In the event that hazardous materials that are prohibited or restricted from entry, import, storage, circulation, or use are introduced into the Kingdom in accordance with the provisions outlined in Paragraph (a) of this Article, the Ministry, in collaboration with pertinent authorities, shall repatriate the hazardous materials to their origin at the expense of the offending party. Additionally, the Ministry shall assume responsibility for any fines, expenses, or losses incurred, without prejudice to any penalties specified in this legislation or any other legal provisions, as well as any other compensation or penalties arising from the incident.

As per the regulations outlined in Article 7, it is strictly forbidden to introduce any form of hazardous waste into the Kingdom's jurisdiction. This includes but is not limited to the act of importing, storing, handling, utilising, disposing of, or discarding such waste. The classification of hazardous waste is determined in accordance with a dedicated system established for this specific purpose. The entity in question is liable for any fines, expenses, and losses that it may have caused, in addition to any penalties outlined in this law or other relevant legislation, as well as any other forms of compensation or penalties that may arise from the incident. Furthermore, as per Article 8, it is strictly forbidden to engage in the collection, transportation, sorting, treatment, incineration, exhumation, tampering with, disposal, or any other means of disposing of waste, debris, solid or liquid waste in contravention of the conditions, procedures, and sites sanctioned by the Ministry.

As per the regulations outlined in Article 9, it is strictly forbidden to discard any materials, devices, or equipment in water sources, water basins, or marine environments, or within their safe limits. This prohibition extends to any materials that may cause pollution or environmental damage to these sources due to their

physical, chemical, or biological properties, or any other cause that may result in a change to their natural properties, temperature, or harm to live organisms. In addition, it is impermissible to dispose of any wastewater that arises from industrial or household activities, or to release, pour, or accumulate it in contravention of the criteria and benchmarks established by the Ministry, or in locations other than those designated by the Ministry in collaboration with the pertinent agencies. Article 10 stipulates that the utilisation of machines, engines, vehicles, or any other sources must not surpass the permissible thresholds for noise and vibration as outlined in the authorised technical specifications, rules, and instructions designated for this objective.

2.2. Actus Rea

The term denotes illicit conduct, comprising three essential components: the unlawful actions, the resulting criminal consequences, and the causal nexus between them. Furthermore, the aforementioned outcome was attributed to the unlawful conduct, thereby establishing a causal relationship (Muhammad 2019).

Criminal behaviour refers to any physical action or series of actions executed by an offender that results in harm to protected interests or places them at risk. The act of polluting the environment involves the introduction of substances, which constitutes a criminal behaviour. Within a specific ecological context, pollution is attained through the introduction, disposal, or seepage of various substances.

Criminal Consequence: The commission of a criminal act may result in a tangible outcome that serves to fulfil the material objective of the offence. In the context of environmental pollution, the legislator has the authority to establish that the commission of an unlawful act is contingent upon the occurrence of a specific criminal conduct.

The causal relationship pertaining to the commission of environmental pollution offences: Causal relationship is the third component that is incorporated into criminal behaviour and its outcome. Criminality For the crime of environmental pollution to be established and the material dependence of the crime to be fully realised, it is necessary to establish a causal link between the criminal conduct and the resulting harm. The commission of said behaviour may result in criminal consequences, as there exists no causal link between the nouns of pure conduct, or verbal pronouns, and said consequences as per legal standards. The occurrence of a result is necessary.

2.3. Mens Rea

Article 63 of the Penal Code in Jordan provides a definition of criminal intent as "the volition to commit an act that is considered a crime according to the legal framework." The establishment of criminal intent requires that the perpetrator consciously and deliberately directs their will towards committing the crime in accordance with the legal specifications. This entails a directed will towards fulfilling all the elements, circumstances, and conditions of the crime, with the perpetrator possessing knowledge of these matters (COMITI 2000).

Merely committing a material act that is punishable by law is not adequate to constitute a crime; rather, it must be accompanied by an element of intent. The Mens Rea is a legal term that refers to the mental state or intention of the offender in relation to the material action. It pertains to the will of the offender and the relationship between the material action and the active one. The Mens Rea, or the mental element of a crime, refers to the culpable mental state of the offender who committed the offence with the requisite intent. The Hungarian government enacted legislation that aimed to suppress criminal activity and provided justification for such measures.

The legal framework pertaining to environmental matters may incorporate the concepts of jealousy or ambiguity. Introducing a novel initiative may pose challenges for the general populace to take notice of it. Consequently, criminal culpability may be absolved if the perpetrator can demonstrate that their actions were based on a misapprehension of the law rather than an intentional violation thereof. It is advisable to take measures to prevent such occurrences, and it is imperative to differentiate between individuals who are not affiliated with the facility, those who operate it, those who manage it, and those who are employed by it. The speaker asserts that the addressee's communication is exempt from the principles of ambiguity and generation in legal interpretation, as the speaker is the intended recipient of said communication. It is presumed that individuals possess knowledge of the law (Al-Dlabeeh, A., Alsharqawi, A.H., Al Kloub, R., Karabsheh, A.-K.O. 2022.).

3. The Penalties of the Crime in Jordan

The Environmental Protection Law No. 6 of 2017 and its subsequent amendments have established penalties for environmental crimes in articles 17-27. According to article 18, facilities that have obtained environmental approval are subject to fines ranging from five hundred to one thousand dinars if they violate the conditions, specifications, and technical rules that are applicable to their respective activities. In the event that an

establishment fails to obtain environmental approval and violates the conditions, specifications, and technical rules designated for its activity, it shall be subject to a penalty ranging from one thousand dinars to three thousand dinars. Individuals who breach the conditions of the environmental permit will be subject to a penalty ranging from a minimum of three thousand dinars to a maximum of five thousand dinars. Engaging in high-risk environmental activities without obtaining the necessary environmental licence, as stipulated by this law and its accompanying regulations, may result in a penalty ranging from twenty thousand to one hundred thousand dinars, as well as the closure of the facility until the issue is rectified. According to the environmental permit regulations, individuals who fail to comply with the terms of the permit or neglect to renew it will be subject to a monetary penalty ranging from one thousand dinars to three thousand dinars. According to the regulation, individuals who engage in any activity without acquiring an environmental permit shall be subject to a monetary penalty ranging from five hundred to one thousand dinars. Additionally, the facility in question will be required to cease operations until the issue is resolved.

The aforementioned legal provision, which is Article 19/C of the Environmental Protection Law No. 6 of 2017 and its amendments, stipulates that individuals who contravene the regulations outlined in Article 8 of the aforementioned law shall be subject to punitive measures. These measures may include imprisonment for a minimum of six months and a maximum of one year, a fine ranging from five hundred dinars to two thousand dinars, or both penalties. Furthermore, the court is authorised to seize any materials, tools, or machinery used in the commission of the violation, in accordance with the provisions of this law. In the event that any of the aforementioned materials or tools serve as a mode of transportation, the court may opt to grant their release in exchange for a supplementary fine amounting to fifty percent of the total value of the fines and compensations imposed in the case.

According to Article 20 of the Environmental Protection Law, No. 6 of 2017 and its subsequent amendments, individuals who unintentionally contribute to water pollution may face legal consequences. Such individuals may be subject to a minimum of six months and a maximum of two years of imprisonment, or a fine ranging from one thousand to five thousand dinars.

According to the law, an individual who deliberately contaminates any water source in a non-serious manner shall be subject to a minimum of five years and a maximum of ten years of imprisonment, as well as a fine ranging from twenty thousand dinars to fifty thousand dinars.

According to the law, individuals who deliberately cause significant pollution to a water source, resulting in the prevention of pollution removal or negative impact on its components, will be subject to a penalty of temporary hard labour for a minimum of five years and a maximum of fifteen years. Additionally, a fine ranging from one hundred thousand dinars to one million dinars will be imposed. (Manasra, M.W., Mamari, S.A., Gharibeh, A. Younes, A.S., Alsharqawi, A.H. 2022.)

According to Article 21 of the Environmental Protection Law No. 6 of 2017 and its subsequent amendments, the act of discarding, releasing, spilling, or discharging any substance that poses a significant threat to the marine ecosystem is considered a punishable offence.

According to Article 22 of the Environmental Protection Law No. 6 of 2017 and its subsequent amendments, the act of disposing, releasing, spilling, or discharging any hazardous substance into the natural reserve, its surrounding areas, or the area under special protection is considered a criminal offence.

According to Article 25 of the Environmental Protection Law No. 6 of 2017 and its subsequent amendments, the following actions are considered criminal offences: the removal of coral and shells from their natural habitat in the sea, the act of fishing for marine life, engaging in the trade of any of these items, and causing harm or damage to them.

According to the ruling of Judgement No. 1706 of 2021 by the South Amman Magistrates court, it has been determined that the defendant has been charged with the act of burning asphalt, which resulted in the release of harmful environmental pollutants. It has been established that this particular crime, similar to other criminal offences, necessitates the presence of certain elements.

The initial aspect to consider is the legal foundation. The legal foundation for classifying an action as a criminal offence and ascertaining its corresponding punishment. The legal criminalization of an act is contingent upon three factors: the presence of a textual provision within the law, which outlines the act as a criminal offence; the existence of a corresponding provision that defines the penalty or precautionary measures for the offence; and the absence of any justification for the act as stipulated by the law. The legal foundation in question is embodied by the verbiage of article (8) within the Environmental Protection Law No. (6) of 2017.

The second element of criminal liability is Actus Rea, which refers to the criminal conduct that comprises three essential components: the criminal behaviour, the criminal outcome, and the causal connection between them. Moreover, it posed a threat to the ecosystem. Regarding the criminal ramifications, environmental crimes

are characterised by the detrimental alteration of environmental components and elements, commonly referred to as environmental pollution. This outcome is attributed to criminal conduct, thereby establishing a causal relationship between the behaviour and its effects.

The concept of Mens Rea is defined by the Jordanian legislator in Article 63 of the Penal Code as the intention to commit a crime as prescribed by law. The establishment of criminal intent necessitates that the perpetrator consciously directs their volition towards committing the crime in accordance with the legal specifications. This entails the volition being directed towards fulfilling all the requisite pillars, elements, circumstances, and conditions of the crime, with the perpetrator possessing knowledge of all these aspects.

Based on the evidence presented in the case, it is evident that the defendant knowingly engaged in the act of burning plastic to extract copper, resulting in the emission of environmental pollutants in the surrounding area. Despite being aware of the legal provisions prohibiting such actions, the defendant willfully directed the execution of this activity. The facts of the case, as well as the evidence presented by the investigating authorities, support this conclusion. The contextual factors and the unequivocal admission of guilt by the accused in relation to the alleged offence, underscore the imperative to find him guilty and impose the appropriate statutory sanction.

Consequently, and in light of the aforementioned, the court renders a verdict: Pursuant to the stipulations of Article [177] of the Code of Criminal Procedure, the defendant is found guilty of breaching Article (8) of the Environmental Protection Law, which pertains to the discharge of environmental contaminants, in contravention of Articles [8 and 19/c] of the Environmental Protection Law. Pursuant to the stipulations outlined in Article (19/C) of the aforementioned legislation, the individual in question was subjected to a monetary penalty of 500 dinars, in addition to associated charges.

4. The Penalties of the Crime in Sultanate of Oman

The Oman legislator has stipulated in Article 31 of the Environmental Protection and Pollution Control Law the penalties for violating the specific regulations aimed at safeguarding the environment outlined in Articles 7, 9, 11, 12, 13, 15, 16, and 19. This law imposes sanctions on those who contravene or fail to comply with the legal provisions or violate the prohibitions set by the law, whether absolute or relative. The penalty for such violations is a fine, which shall not be less than 100 Jordanian Dinars and not exceeding 1,777 Jordanian Dinars. It's important to note that the fine increases by 27% daily starting from the fourth day after notifying the violator of the offense's discovery.

The legislator also emphasizes that the penalty will be more severe if the violation persists for more than a month, urging the offender to either cease the unlawful activity or remove the violation.

The legislature has introduced various prohibitions and penalties in the Environmental Protection and Pollution Control Law. For example, in Article 7, it is prohibited to use the Omani environment for the disposal of environmental pollutants in any form or quantity that may lead to pollution. The legislature has also stipulated penalties for violations of these prohibitions, as outlined in Article 30, regarding the disposal of pollutants in natural environmental systems without the necessary permits.

Furthermore, the law includes provisions such as Article 9, which prohibits establishing a source or work area without obtaining an environmental permit to ensure compliance with pollution criteria and discharge specifications, as determined by the minister. Article 11 addresses actions leading to environmental pollution exceeding environmental safety standards, while Article 12 prohibits the discharge of environmental pollutants at the final points of discharge within the source area or work area under specified conditions.

In exceptional cases involving emergency situations due to equipment malfunctions at the source or work area, Article 32 requires immediate notification to the Ministry. Additionally, Article 13 obligates property owners to promptly report any non-compliance with the law's provisions, as well as any incidents resulting in environmental pollution or violations.

Moreover, the legislator has mandated, in Article 14, the establishment of a safety zone for the site chosen for establishing the source or work area to ensure that pollution limits are not exceeded. The pollution should not exceed the permitted limits according to regulations and decisions.

Article 15 requires the adoption of precautionary measures specified by regulations and laws before undertaking construction or the transportation of materials that may produce environmental pollutants. Finally, in Article 16, the legislator obliges the owner of any source or work area with the potential for causing environmental damage to provide an environmental impact study demonstrating that the benefits of granting licenses for activities causing environmental harm outweigh the potential risks.

Additionally, Article 19 prohibits the trading, handling, or disposal of hazardous materials and wastes in the Omani environment without permission from the Ministry.

Conclusion

The present study focuses on the legal framework governing the offence of environmental pollution in Jordan, as stipulated by the Environmental Protection Law No. 6 of 2017 and its subsequent amendments. Environmental pollution is recognised as a significant issue that requires urgent attention. The remarkable advancements that have been made in recent times have posed a significant threat to the security and safety of mankind. The impact of human behaviour on the environment has been widely acknowledged, particularly in relation to the legal entities responsible for implementing measures to reduce pollution. Our study is specifically focused on this aspect, which is a contemporary topic and falls within the scope of environmental protection.

Based on the aforementioned research, the following findings were obtained:

Defining the environment is a complex task, as there is no universally accepted definition. However, it is commonly agreed upon that the environment is comprised of two distinct elements: natural and artificial.

The Jordanian legislative body recognises the dual culpability of both legal entities and individuals for environmental pollution. Holding a legal entity partially responsible does not exonerate individuals. As per the provisions outlined in Articles 15-17 of the Environmental Protection Law, No. 6 of 2017 and its subsequent amendments, individuals who hold responsibility for the management of natural resources may be held accountable for criminal offences committed in this regard. The legal representative, as well as the facility manager or the manager acting in an official capacity, may be subject to punishment as either a principal or accomplice in a crime. Additionally, they may be held responsible for any presumed involvement in the crimes committed. The responsibility for the crime, whether committed intentionally or negligently, ultimately rests with the leader and not the follower. Demonstration of a strong dedication to overseeing and managing individuals under one's authority.

The Sultanate of Oman has demonstrated a commitment to environmental protection and pollution control as part of its constitutional duty to achieve environmental security. To this end, it has enacted various laws, ministerial decisions, and regulations to ensure compliance.

Oman's legislative framework for environmental protection encompasses a combination of obligatory and prohibitive measures aimed at mitigating environmental damage while sustaining developmental progress.

The legislative efforts in Oman encompass a diverse range of penalties, including fines, imprisonment, and activity suspension, designed to establish both general and specific deterrence against environmental violations.

The Omani legislative approach strives to strike a balance between the roles of administrative authorities and individual responsibility in protecting the Omani environment. It does so by granting administrative permits while addressing the issue of environmental pollution, which arises from economic development. The legislative policy generally seeks to regulate rather than entirely prohibit industrial progress, thus preventing the exacerbation of pollution problems and minimizing their impact.

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Credit Authorship Contribution Statement

Ashraf Mohamad Gharibeh, his contribution in Methodology, Writing – original draft; Writing – review and editing; Data curation, and Supervision.
Mohammed Rashid Ahmed Al Makhmari, his contribution to methodology, writing, review and editing, data curation, and supervision.
Radwan Ahmad Al Haf, his contribution in Methodology, Writing – original draft; Writing – review and editing, and investigation.
Mohammad Njim Ibrahim Elayat, his contribution in Methodology, Writing – original draft; Writing – review and editing; and Data curation.
Ahmad Hussein Alsharqawi, his contribution in Methodology, Writing – original draft; Writing – review and editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Exploring Ecological Justice in the Regulatory Framework of Land Ownership, Utilization, Control, and Inventory in Indonesia

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Abstract: The aim of this study is to provide a comprehensive analysis of environmental justice elements in land inventory, tenure, ownership, use and use (IP4T) management, as described in TAP MPR IX/2001 and Government Regulation No. 16. 2004 on land administration. This study uses a standard legal research method integrating both a legal and conceptual approach. The author's study indicates that environmental justice is included in the IP4T law, as stated in TAP MPR IX/2001, as well as in Government Law No. 16 on Spatial Planning. According to Article 23 of Government Regulation No. 16/2004, IP4T maps must be taken into account for all spatial and regional planning. These maps contain more than just information on land ownership, use, and use. In addition, the IP4T dataset includes assessments of land capacity and valuation, so environmental dimensions associated with land are examined. The definition of environmental justice can be derived from Section 3, Section 5 and Section 6, Paragraph (2) of TAP MPR IX/2001. However, in practice, many inconsistencies remain and undermine basic principles of environmental justice. These irregularities are particularly widespread in the context of the implementation of IP4T (Integration Policy for Transition) within the mining industry.

Keywords: ecological justice; land ownership; regulations; inventory; utilization.

JEL Classification: G31; Q15; Q57; R52.

Introduction

Efforts towards land law reform in Indonesia have been present since the inception of the UUPA. However, these efforts have yet to keep pace with the evolving needs of the dynamic community, resulting in a lack of tangible positive legal norms (ius constitutum). Nonetheless, land law reform persists through the issuance of legislative instruments pertaining to the UUPA (Minulyo 2007). Following the demise of the New Order regime, the People's Consultative Assembly Enacted Decree No. IX/2001, which pertained to the Agrarian Reform and Natural Resource Management reform, with a specific focus on the UUPA (Alting 2011). Several essential causes are associated with the issuance of this MPR directive. These reasons are as follows: agrarian resources and natural resources, encompassing the earth, water, space, and their contents, are considered a divine boon bestowed upon the Indonesian nation. These resources are seen as national assets that should be acknowledged with gratitude. Hence, it is imperative to effectively manage and utilize these resources to achieve equity and prosperity for current and future generations. Additionally, the Constitutional mandate of the MPR entails

establishing the trajectory and foundation for national development that can effectively address issues such as poverty, inequality, socio-economic injustice, and environmental degradation.

Furthermore, the existing management of agrarian and natural resources has deteriorated environmental quality, disparities in control, ownership, and utilization, and the emergence of numerous conflicts. The legislation on the governance of agrarian and natural resources exhibits instances of overlap and contradiction. Implementing equitable, sustainable, and ecologically responsible practices for managing agrarian and natural resources necessitates a cohesive and integrated approach. This approach should include the evolving nature of these resources, the goals of the community, and their active involvement. Additionally, it should address disputes that may arise in the process. In order to actualize the noble aspirations of the Indonesian nation, as articulated in the preamble of the 1945 Constitution of the Republic of Indonesia, it is imperative to establish a solid political dedication that serves as the foundation and guidance for the implementation of agrarian reform and the management of natural resources. This commitment should prioritize principles of fairness, sustainability, and environmental consciousness.

To ensure the actualization of these goals, agrarian reform and natural resource management must incorporate several concepts, including but not limited to: 1. Upholding and safeguarding the integrity of the Unitary State of the Republic of Indonesia. 2. It is imperative to demonstrate reverence for and safeguard human rights. 3. It is essential to exhibit deference for the rule of law by embracing the inclusion of many perspectives in legal harmonization. 4. Enhance the populace's well-being, particularly by enhancing the caliber of human capital in Indonesia. The objectives include the advancement of democratic principles, adherence to legal frameworks, promoting transparency, and enhancing community engagement. 6. Ensuring justice, specifically gender equality, in managing, possessing, utilizing, and maintaining agrarian and natural resources. 7. Upholding sustainability to achieve maximum advantages for current and future generations while considering the environmental and carrying capacity. The objective is to incorporate social, sustainability, and ecological functions in alignment with the specific socio-cultural characteristics of the local context. One potential area for enhancement involves facilitating integration and coordination among various development sectors and regions in the execution of agrarian resource reform and management. 10. It is imperative to acknowledge, uphold, and safeguard the rights of customary law communities and the nation's cultural religion about agrarian and natural resources. 11. Pursuing a harmonious equilibrium between the rights and responsibilities of the state, government entities (central, provincial, district/city, and village or equivalent), communities, and individuals is imperative. 12. The adoption of decentralization measures should involve the distribution of authority across various levels, namely national, provincial, district/city, and village or equivalent, about allocating and administering agrarian and natural resources.

Given the significant impact on numerous individuals, it is imperative to establish a comprehensive agrarian reform policy framework. This framework should encompass several vital aspects, including:

- It thoroughly examines existing legislation and regulations on agrarian affairs to ensure coherence and alignment across various sectors.
- Implementing a fair redistribution of land tenure, ownership, use, and utilization, with particular attention to providing land ownership opportunities for the general populace.
- Facilitating the systematic and comprehensive collection of land data through inventory and registration processes is essential for effective land reform initiatives.
- Resolving conflicts arising from agrarian resources and proactively anticipating potential conflicts.
- Enhancing the capacity and effectiveness of land institutions to ensure their robust functioning. The resolution of conflicts on agrarian resources, along with the anticipation of future conflicts, requires the strengthening of institutions and authorities involved in implementing agrarian reform.
- Additionally, there is a need to actively pursue financial resources to implement the agrarian reform program successfully.

The provisions above pertain to the legal aspects of agrarian reform, which have been regarded as national ideals since the inception of independence. Furthermore, these provisions serve as the legal foundation that obligates the government to conduct an inventory of land tenure, ownership, use, and utilization (from now on referred to as IP4T) activities. The inventory of tenure, ownership, use, and utilization of land (IP4T) is a requirement outlined in TAP MPR IX/2001 on Agrarian Reform and Natural Resource Management. This regulation, specifically Article 6 Paragraph 1c, emphasizes the need to conduct a comprehensive and systematic inventory and registration of land tenure, ownership, use, and utilization. The purpose of this inventory is to gather land data to formulate the Policy Direction of Agrarian Reform and facilitate the implementation of land reform (Atmanto 2022).

Furthermore, IP4T activities have been incorporated into the National Priority activities to support agrarian reform. The successful implementation of IP4T activities must be ensured to achieve this objective. The IP4T operations constitute a crucial component in pursuing Goal V outlined in the Nawa Cita Vision and Mission of the Jokowi-JK Government. This goal entails the successful implementation of agrarian reform spanning 9 million hectares, primarily benefiting peasants and farm workers (Bakri 1970).

1. Literature Review

The Land Structuring Division/Section executes the IP4T activities in the various regions (Chamdani 2021). The IP4T activity entails a comprehensive assessment of P4T within a specific village, employing a participatory mapping approach (Earlene and Djaja 2023). In this instance, participatory mapping refers to a mapping endeavor that engages the community in data collecting for IP4T (Ginting 2011). The outcomes of IP4T endeavors encompass valuable data for strategic land planning and the development of technological policies. In order to enhance comprehension and application, presented below are several definitions on IP4T activities, specifically (Handoko 2019):

- According to Government Regulation No. 24/1997, a land parcel refers to a distinct and finite portion of the Earth's surface.
- Land tenure refers to the legal association between an individual, a collective of individuals, or a legal body and a piece of land, as stipulated in Law No. 5 of 1960 (GR No. 16 of 2004).
- Land ownership refers to the legal association between persons, groups of individuals, or legal entities who possess evidence of ownership, which can be in the form of registered land rights certificates or unregistered documentation.
- Land use refers to the utilization and occupation of the Earth's surface, encompassing both naturally occurring and human-made formations, as Government Regulation No. 16/2004 defines.
- Land utilization refers to acquiring more value from land use without altering its physical shape, as stated in Government Regulation 16/2004.
- The Land Parcel Sketch refers to the physical representation of land parcels in the field, typically depicting their rough boundaries. It provides a minimum geographic reference of 1 TDT.

The execution of IP4T operations involves utilizing an Android-based application called Smart PTSL. The Smart PTSL application is a mobile Geographic Information System (GIS) application designed specifically for Android devices. It offers a range of capabilities that have been tailored to meet the requirements of IP4T and PTSL (Helmi 2019). The Smart PTSL application serves as a platform for disseminating measurement data from various sources such as meet bands, Aerial Photo Interpretation, and external GNSS connections. It is important to note that the application does not function as a measuring tool. The Smart PTSL program encompasses various features, including the distance correction of delineation data obtained from satellite images, UAVs, and drone photos. The convergence of physical and legal data: The study incorporates various forms of supporting data, including a Base Map obtained through UAV/Drone and CSRT technologies. Additionally, spatial data of land parcels is utilized as shapefiles (*shp) to create a working map. Textual data on land parcels, such as subject, object, control, ownership, legal relationship, list of entries, and statement letter of physical control, is also included. Furthermore, external GNSS data and geotagged photos of subjects and objects are incorporated. Finally, the study involves exporting measuring images and maps of measurement results as shapefiles (Ismail *et al.* 2010).

Based on the provided description, it can be inferred that the implementation of IP4T (Indigenous Peoples' Rights to Territory) in the context of national agrarian law is primarily grounded in the provisions outlined in TAP MPR IX/2001 on Agrarian Reform and Natural Resource Management. This legislation comprises nine articles, with Article 6 specifically addressing the regulation of IP4T. The regulation on this matter can be found in Article 22 in conjunction with Article 23 of Government Regulation No. 16/2004 on Land Administration. The inquiry at hand pertains to the extent of comprehensiveness in regulating IP4T within TAP MPR IX/2001 on Agrarian Reform and Natural Resource Management, particularly when scrutinized through ecological justice. Additionally, it raises the question of whether the formation of TAP MPR IX/2001 on Agrarian Reform and Natural Resource Management has been grounded in ecological justice (N. Ismail *et al.* 2012).

The evidence demonstrates that there are issues in the execution of IP4T that neglect ecological sustainability, particularly in mining licensing. The situation observed in Kalimantan Island, renowned for its mining activities and the issuance of mining concession licenses on smaller islands gives rise to apprehensions over the long-term ecological viability. Based solely on the data collected for the mining industry, with the exclusion of plantations, the cumulative extent of mining licenses granted up until 2007 amounted to 228,556.25 hectares. In the meantime, the total extent of mining excavations expanded to 8,810.22 hectares, while the area

that underwent reclamation efforts amounted to 6,239.57 hectares. However, it is worth noting that the environmental conditions in South Kalimantan have witnessed a notable deterioration in terms of ecological quality.

According to research by Puspitasari S, South Kalimantan (Kalsel) is ranked 26th out of 28 provinces in Indonesia, placing it third from the bottom. The evaluation focuses on the water quality in the presence of various substances, such as dissolved oxygen (DO), total suspended solids (TSS), and chemical oxygen demand (COD). In the context of South Kalimantan, it is seen that these parameters fail to fulfill the prescribed standards for water quality. Furthermore, it can be observed that the air quality indicators, specifically the levels of SO2 and NO2, fail to fulfill the established air pollution standard index. Furthermore, the woodland region has a substantial amount of land cover resulting from previous excavations. The cumulative valuation of water quality is 8.40, while the assessment for air quality stands at 97.11. The land cover also attained a value of 39.24 (Baxter and Greenlaw 2005).

Mining licenses contribute to the adverse ecological consequences associated with mining activities. As exemplified by Puspitasari S, the mining licensing on Sebuku Island conducted by PT BCS yields an annual production of 3,000,000 tons of coal readily available for internal consumption and exportation. According to the BCS Profile (2005), the nations of interest in migration include Japan, India, Thailand, the Philippines, China, and Malaysia. The exploitation license for BCS was acquired in 1993 through a second-generation Contract of Work (CCoW). During that period, there was a notable rise in the utilization of Coal Contracts of Work (CCoW) by mining firms. This increase was facilitated by introducing Generation II Coal Contracts, as Presidential Decree No. 21/1993 outlined. This decree involved five companies: PT BCS, Bantala CM, Antang Gunung Meratus, Jorong Barutama, and Borneo Indobara. In 1997, the BCS firm initiated its presence on Sebuku Island by commencing exploration activities under the aforementioned operational strategy. PT BCS is a domestically owned company involved in the mining sector, with operational management overseen by Straits Resources Limited. The shareholding distribution in this context is characterized by a 20% ownership stake held by Indonesia, while Singapore holds the remaining 80%. In the Mining sector, it is observed that of 19 firms operating in South Kalimantan, 12 are owned by foreign capital, while the remaining seven companies are domestically owned (PMDN).

Subsequently, in 2004, the forestry minister granted consent for using forest land PT BCS by issuing a letter with the reference number S.430/Menhut-VII/2004, dated 15 October 2004. Moreover, an additional Decree No.316/Menhut/II/2009 was promulgated in 2009 on the utilization of 744.68 hectares of forest land by borrowing. In the interim, the extraction of iron ore on Sebuku Island was conducted by PT SILO under the authority of a permit letter identified as S. 709/Menhut-VII/2006 and Decree No. 399/Menhut-II/2008. This correspondence announces the issuance of licenses for borrowing-to-use in permanent production forest areas and convertible production forest areas. Nevertheless, the commencement of exploitation by PT SILO occurred in 2004, resulting in a production output of 2.5 million metric tonnes. This production was achieved within an area with a borrow-to-use status of 1,731.61 hectares. According to the findings derived from comprehensive interviews with local inhabitants and available information, the converted forest area serves several purposes, encompassing productive forest, protected forest, and nature reserves.

Ecological justice is a recently emerged topic within the field of law, particularly in the domains of environmental law and administrative law. It posits that justice should not solely be extended to human beings as legal subjects but should also encompass the natural environment. In essence, ecological justice challenges the prevailing belief in human superiority over nature and the inclination to exert dominance over it. This concept forms the foundation of interspecies justice, a pivotal aspect of environmental ethics (Karjoko *et al.* 2022). Hence, this scholarly research, presented as a qualifying paper, aims to examine the issue of ecological justice within the context of the IP4T arrangement. This analysis will focus on various aspects of ecological justice, irrespective of its application, grounded in numerous empirical realities. It is worth noting that there are still numerous assertions regarding ecological justice that warrant further exploration. Given the contextual information provided on the issues above, the present study aims to explore and investigate how ecological justice is integrated into the IP4T framework in Indonesia.

2. Results and Discussion

The present study constitutes normative legal research, focusing on "positive legal norms within the legislative system" (Liliyani, Nugroho, and Andari 2020). This study has substantiated that the methodology employed in this legal research combines a statute approach and a conceptual approach (Mahfiana 2016b). The research methodology employed in this study involves document analysis as the primary data collection tool. Document analysis is a research method employed to gather secondary data from various scholarly sources, such as legal

statutes, regulations, international treaties, books, academic journals, articles, reports authored by previous researchers, and other pertinent documents pertaining to the subject matter under investigation.

2.1 Review of MPR Decree No. IX/MPR/2001 on Agrarian Reform and Natural Resource Management

From a normative standpoint, it is ideal that the control and utilization of agrarian resources adhere to a legal framework, specifically the legal system governing the control and management of such resources. The legislative framework governing the management and utilization of agrarian resources has been established by implementing the Basic Agrarian Law. Law No. 5/1960, titled "The Fundamental Regulation of Agrarian Principles," has been enacted to set the primary norms governing the management and utilization of agrarian resources. These resources encompass the land, water, space, and associated natural resources, such as forests, mines, biological resources, and others (Karjoko, Handayani, and Hanum 2022).

However, the agrarian politics that have prevailed, characterized by a spirit of exploitation, have led to the issuance of various sectoral laws since the New Order era. These laws have tended to operate independently and establish their legal frameworks. Examples of such laws include Law No. 5 of 1967, later replaced by Law No. 41 of 1999 in forestry. Similarly, the mining sector is governed by Law No. 11 of 1967, replaced by Law No. 4 of 2009 on Mineral and Coal Mining and Law No. 22 of 2001 on Oil and Natural Gas. The field of water resources is regulated by Law No. 7 of 2004, while plantations are governed by Law No. 18 of 2007. Lastly, coastal areas and small islands are subject to the provisions of Law No. 27 of 2007. Given the prevailing orientation or dominance of the spirit of exploitation inherent in these sectoral laws and regulations, it is justifiable to assert that the equilibrium, effectively regulated in the UUPA, has become imbalanced. Economic interests have taken precedence over other concerns, such as ecological interests and human rights.

This discrepancy or disharmony has been explicitly stated in MPR Decree No. IX/ MPR/2001 concerning Agrarian Reform and Natural Resource Management. Vertical disharmony or inconsistency within the land sector is not an anomaly in the rule of law. Within the framework of TAP MPR No.IX/ MPR/2001, there exist certain fundamental concepts that ought to serve as the foundation for the development of land legislation norms. This implies that the regulations and laws on the land sector should provide a detailed explanation of the legal principles outlined in the MPR Decree. Each standard within land legislation must be linked to one of the legal principles outlined in the MPR Decree. The principles encompassed in MPR Decree No. IX/MPR/2001 comprise:

- The principle of social and ecological functionality

The social and ecological functions of land rights pertain to land utilization in a manner that fosters a harmonious relationship between the interests of individual landowners and those of society, as well as a balance between the objectives of land productivity and land preservation (Nugroho 2020). According to the definition above, there are three distinct components or elements encompassed within it. Firstly, the definition highlights the significance of the social and ecological functions associated with land rights, explicitly emphasizing the process of land utilization that yields economic, social, and ecological benefits. Secondly, it underscores the importance of striking a balance between the interests of individual land rights holders and the interests of the community, which is considered a fundamental objective in any land rights utilization endeavor. Thirdly, it is crucial to balance the pursuit of optimal production outcomes and the preservation of land resources.

- The Principle of Integration and Coordination

These two concepts pertain to the performance of institutions that have authority in the land sector and the outcomes of their performance. In policy, law, and regulation, "integration" refers to merging or harmonizing the underlying principles and content of policies, laws, and regulations. This unification is driven by the need to establish a consistent and equitable approach towards considering the rationale for integration and the substance of these policies, laws, and regulations. Coordination is a procedural aspect of institutional functioning within harmonizing, merging, or aligning perspectives or ideas. Hence, the coordination process is executed by engaging multiple institutions, wherein their respective responsibilities and powers are interconnected (Betsill, Hochstetler, and Stevis 2014). Based on the explication above of integration and coordination, it becomes feasible to discern the constituent parts inherent in these two legal principles as the factual components that give rise to their existence. The notion of "integration" encompasses a series of facts or phenomena. Firstly, it involves shared reasoning in conjunction with other interconnected fields. Secondly, it entails the presence of a shared substance or spirit that aligns with other interconnected fields. The rules or laws governing associated domains must exhibit substantive and conceptual similarities. Additionally, a shared interest serves as the guiding principle. Integration is commonly associated with constructing a system wherein a specific aspect of interest is the objective.

- The principle of balancing rights and obligations.

According to Article 5 letter k of MPR Decree IX/MPR/2001, the principles of agricultural reform encompass the pursuit of a harmonious equilibrium between the rights and responsibilities of many entities, including the State, government bodies at different levels (central, provincial, district/city, and village or equivalent), communities, and individuals. This principle encompasses a fundamental concept, precisely the equilibrium between rights and obligations. This equilibrium pertains to the rights and obligations of the State towards its citizens, as well as the rights and obligations of each individual as a constituent of the community towards the State (Rejekiningsih 2016). The rights and obligations mentioned are often delineated in various legal instruments that are valid within the respective jurisdiction. In essence, it is imperative to establish a harmonious equilibrium between individual rights and corresponding responsibilities. According to the British philosopher Jeremy Bentham, the ultimate objective of law and legislation is attaining happiness. The principle encompasses the elements of Rights and Obligations.

- The Principles of Justice and Gender Equality

Moreover, according to Article 5, letter f of MPR Tap IX/ MPR/2001, the principles of agricultural reform encompass the achievement of justice, including gender equality, to the control, ownership, usage, utilization, and maintenance of agrarian and natural resources. The notion outlined in the UUPA has been included in Article 9 (paragraph 2), which asserts that all Indonesian citizens, regardless of gender, are entitled to equal opportunities in acquiring land rights. This entitlement aims to facilitate personal and familial benefits and outcomes (Suratma and Azis 2017).

- The Principle of Decentralisation

Decentralization refers to transferring operational responsibilities to local governments, whereas decentralization signifies the delegation or devolution of decision-making powers to lower tiers of government. Thus, decentralization serves as a mechanism to empower regional and local communities. The characteristics or indicators of decentralization encompass two key aspects. Firstly, decentralization is primarily directed towards regions rather than people. Secondly, it involves devolving governmental responsibilities and decision-making processes to local or regional authorities. Thirdly, decentralizing government matters transfers authority and responsibility from central governing bodies to local government entities (Suhattanto *et al.* 2021).

- The Principle of Sustainability

The concept of sustainability, as defined in Article 3 of Law Number 23 of 1997 on Environmental Management, posits that individuals are obligated to assume responsibilities not only towards future generations but also towards their contemporaries. The principle of sustainability encompasses several vital elements. Firstly, economic welfare is a fundamental aspect, as the objective of any development is to achieve economic prosperity. Secondly, the effective management of human resources is crucial as it enables individuals to meet their needs. Lastly, the preservation and rejuvenation of the environment is essential, as the pursuit of economic and social welfare must be accompanied by a sense of responsibility towards the environment. Ensuring the equitable access and utilization of existing resources by future generations is paramount (Sukirno 2016).

- The principle of participation

The principle of participation is the active engagement of the community in the processes of formulating, implementing, overseeing, and/or regulating a legal framework. In this particular instance, given the normative nature of the study, its focus will be limited to examining the implementation, supervision, and/or control mechanisms of the regulations outlined in a legal framework. This phenomenon can be attributed to its connection with the philosophical underpinnings of democracy, wherein governance is derived from and executed by the populace, with the ultimate aim of serving their interests (Sulaiman 2021). According to the description above, there is a single component or element encompassed within it. Specifically, it pertains to a rule concerning the land rights of community members, wherein they are engaged in the execution, oversight, and/or regulation of an activity.

- The Principle of Pluralism in Legal Unification

This principle encompasses three core principles, precisely: Firstly, upholding and protecting the sovereignty of the Republic of Indonesia; Secondly, adhering to the rule of law by embracing the inclusion of diverse legal systems; and thirdly, acknowledging and honoring the rights of indigenous communities and the nation's cultural variety to natural resources (Swastika 2010).

- The Principle of Transparency

According to the interpretation of Article 2 of Government Regulation No. 24/1997, the principle of transparency or openness entails providing access to land registration data to the public. This access is facilitated through the availability of a general register, excluding name registers, at the Land Office. The definition above encompasses two distinct components or elements. Firstly, it entails the public's ability to access data on land

rights at government offices, specifically the Land Office. Secondly, it encompasses the public's capacity to obtain information regarding government policies established on land rights (Yurista *et al.* 2019).

2.2 Review of IP4T Regulations in Government Regulation of the Republic of Indonesia No. 16 of 2004 on Land Stewardship

The regulation on IP4T in the Government Regulation of the Republic of Indonesia No. 16 of 2004 on Land Stewardship (from now on referred to as GR No. 16 of 2004) can be located in Article 22 Paragraph (1) in conjunction with Article 23 of the abovementioned regulation. These articles specifically address the execution of IP4T by the government. As an illustration, Article 22 of Government Regulation No. 16/2004 stipulates that the establishment of land stewardship, as mentioned in Article 23, involves the implementation of many actions, namely: a. The task involves conducting an inventory of land tenure, use, and utilization. b. It is necessary to determine the equilibrium between the availability and requirements of land tenure, use, and utilization based on regional functions. c. The objective is to ascertain the pattern of adjustment of land tenure, use, and utilization in alignment with the Regional Spatial Plan.

According to Article 23 of Government Regulation No. 16 Year 2004, there is a provision that affirms the execution of IP4T. This provision explicitly specifies that:

- The implementation of the inventory of land tenure, usage, and utilization, as mentioned in Article 22 paragraph (1) letter a, encompasses: a. The collection and processing of data on land tenure, usage, and utilization, as well as land capability, evaluation, and associated data. b. The presentation of data through maps and information regarding land tenure, usage, and utilization, as well as land capability, evaluation, and supporting data. c. Data services encompass maps and information on land tenure, usage, and utilization, as well as land capability, evaluation, and supporting data.
- The utilization of land sector data and information, as mentioned in paragraph (1) letter b, serves as essential input material for the development and modification of the Regional Spatial Plan.
- Activities aimed at assessing the equilibrium between the accessibility and requirements of control, utilization, and utilization of land by the designated function of the area as stipulated in Article 22, paragraph (1), letter b, encompass the following: a. demonstration of the equilibrium of alterations in the utilization and utilization of land in the Regional Spatial Plan; b. demonstration of the equilibrium of appropriateness in the utilization and utilization of land in the Regional Spatial Plan; c. demonstration and establishment of priorities for land availability in the Regional Spatial Plan.

Drawing upon the legal provisions outlined in Article 22 in conjunction with Article 23 of Presidential Regulation No. 16 of 2004, it becomes evident that the IP4T outcomes, encompassing maps and information on land ownership, usage and exploitation, land capacity, land assessment, and supplementary data, serve as a fundamental resource for conducting research in the development of a Regional Spatial Plan within a given area. Consequently, the authoritative IP4T findings assume a critical role in ensuring that the Regional Spatial Plan of a region consistently adheres to the principles of sustainable environmental regulations.

2.3 Aspects of Ecological Justice in IP4T Arrangements

The author has indicated in the introductory section of the text that the regulation of IP4T under the national land legislation is governed by TAP MPR IX/2001 in conjunction with Government Regulation Number 16 of 2004 on Land Administration. Upon conceptual examination, it becomes apparent that both legal products have incorporated elements of environmental justice and ecological justice. Various regulations within these legal frameworks can observe this. By the provisions outlined in Article 3 of TAP MPR IX/2001, it is explicitly stated that:

- The management of natural resources contained in land, sea, and space is carried out optimally, fairly, sustainably, and environmentally friendly.

The provision above can be located in Article 5, letter g of TAP MPR IX/2001. It stipulates that the execution of agrarian reform and natural resource management should adhere to sustainability principles, ensuring maximum benefits for current and future generations while considering the environmental capacity and carrying capacity. The presence of ecological justice in TAP MPR IX/2001 can also be observed in Article 6 Paragraph (2) letter c, wherein it is stipulated that: "The policy objectives in the realm of natural resource management encompass the broadening of community access to information regarding the potential of natural resources within the region, as well as the promotion of social responsibility in adopting environmentally sustainable technologies, including traditional methods."

- What is quite fundamental in TAP MPR IX/2001, which discusses aspects of ecological justice, can also be found in the preamble of TAP MPR IX/2001, which states that:

- Letter e: that fair, sustainable, and environmentally friendly management of agrarian and natural resources must be carried out in a coordinated, integrated manner that accommodates the dynamics, aspirations, and participation of the community and resolves conflicts;
- Letter f: In order to realize the noble ideals of the Indonesian nation as set out in the preamble of the 1945 Constitution, a serious political commitment is needed to provide the basis and direction for agrarian reform and natural resource management that is just, sustainable and environmentally friendly.

According to the perspective put forth by I Gusti Ayu Ketut Rachmi Handayani, it is argued that ecological justice and sustainability are inherently interconnected and cannot be disentangled from the well-being of both current and future generations. Sustainable development also encompasses the pursuit of fair and impartial justice for both current and future generations. Hence, the TAP MPR IX/2001 incorporates an ecological justice framework in its regulatory provisions, wherein the environment and sustainability are established as fundamental principles within the legal framework.

In the context of W. Pedersen's perspective, three elements of Ecological justice are identified: the precautionary and preventative principles, the polluter pays principle, and the sustainable development principle. Hence, according to Pedersen, the norms outlined in TAP MPR IX/2001 have successfully addressed two key aspects. Firstly, they aim to prevent environmentally irresponsible exploitation. Secondly, they address exploitation in the context of sustainable development, emphasizing the importance of responsible practices and instilling a sense of moral responsibility in the exploitation process.

The second legal basis for the IP4T arrangement is Government Regulation No. 16 of 2004 on Land Administration. The IP4T arrangement is outlined explicitly in Article 22 in conjunction with Article 23 of this Government Regulation. Article 23 of Government Regulation No. 16 of 2004 confirms the implementation of IP4T. It states the following: (1) The implementation of the inventory of land tenure, use, and utilization, as mentioned in Article 22 paragraph (1) letter a, includes the following activities: a. collection and processing of data on land tenure, use, and utilization, land capability, land evaluation, and supporting data; b. presentation of data in the form of maps and information on land tenure, use, and utilization, land capability, land evaluation, and supporting data; c. provision and service of data in the form of maps and information on land tenure, use, and utilization, land capability, land evaluation, and supporting data. The utilization of land sector data and information, as mentioned in paragraph (1) letter b, serves as essential input material for the development and modification of the Regional Spatial Plan.

The IP4T law, as stipulated in Article 23 of Government Law No. 16/2004, mandates that all Spatial and Regional Plans must incorporate the IP4T map. This map encompasses more than just information on property title, utilization, and use. In addition, the IP4T dataset encompasses assessments on land evaluation and capabilities, hence encompassing the examination of ecological facets associated with the land. Hence, the Spatial and Regional Plan of a given area must consider the comprehensive dataset provided by IP4T. This dataset encompasses crucial information on land tenure, use, usage, evaluation, and capabilities.

According to Baxter (2005), the arguments advocating for ecological justice and addressing the problem of ecological extinction should serve as a wake-up call for individuals to consider the potential existence of a worldview that can rationalize these moral concerns. This perspective strives to offer a comprehensive moral doctrine beyond imposing limitations on ethical considerations and factors to be considered solely for specific categories within the realm of organic existence. One of the objectives of ecological justice theory should be to make a meaningful contribution towards preventing significant extinctions.

Conclusion

The authors' research indicates that the inclusion of ecological justice has been incorporated into the IP4T structure outlined in TAP MPR IX/2001, in conjunction with Government Regulation Number 16 of 2004, which pertains to Land Administration. The presence of ecological justice and sustainable development, as well as the prevention of ecological damage, can be observed in the rules outlined in the two legal documents. According to Article 23 of Government Regulation No. 16/2004, it is required that all Spatial and Regional Plans take into account the IP4T map. This map encompasses more than just information on property ownership, utilization, and usage. In addition, the IP4T dataset encompasses assessments of land capability and evaluation, encompassing the examination of ecological factors on the land. Hence, the Spatial and Regional Plan of a specific region must exclude data provided by IP4T, which encompasses information on land tenure, utilization, usage, assessment, and capacity. The concept of ecological justice can be elucidated by referring to Article 3, Article 5, and Article 6 Paragraph (2) of the TAP MPR IX/2001. Nevertheless, within the realm of practical application, numerous

inconsistencies persist that undermine the fundamental principles of ecological justice. These irregularities are particularly prevalent in implementing IP4T within the mining industry.

Credit Authorship Contribution Statement

The authors contributed equally to this study.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Cultural Aspects of Waste Management in Poland and China

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Abstract: The main aim of this article was to present differences in the social determinants of waste management and environmental protection in Poland and People's Republic of China. A research gap was identified related to the small number of studies comparing China and Poland in the field of waste management. A systematic review of the literature on waste management and society's approach to environmental protection was conducted, with particular emphasis on municipal waste. The article uses data from local databases, i.e. the Central Statistical Office (GUS) in Poland and The Ministry of Ecology and Environment of the People's Republic of China, as well as data from the World Bank and OECD. The method of comparative analysis and Hofstede's tool were used for selected aspects of the social approach to waste management in Poland and the People's Republic of China. Empirical research was conducted in August 2023. Literature review based on key groups of social factors that differ in the analysed countries. These include those related to purity, religious beliefs, respect for nature, responsibility and ecology. Chinese citizens approach the power supply in their environment in a more collective way than in Poland. The European Union's recommendations has positively affected management of municipal waste in Poland, while in People's Republic of China legislation is constantly updated. In the authors' opinion, in subsequent studies it is worth focusing on comparing other countries in terms of their social approach to environmental protection, as well as conducting surveys.

Keywords: waste management; municipal solid waste; social factors; cultural aspects of waste management; culture; Poland; People's Republic of China.

JEL Classification: A14; M14; Q53; Q58; Z13.

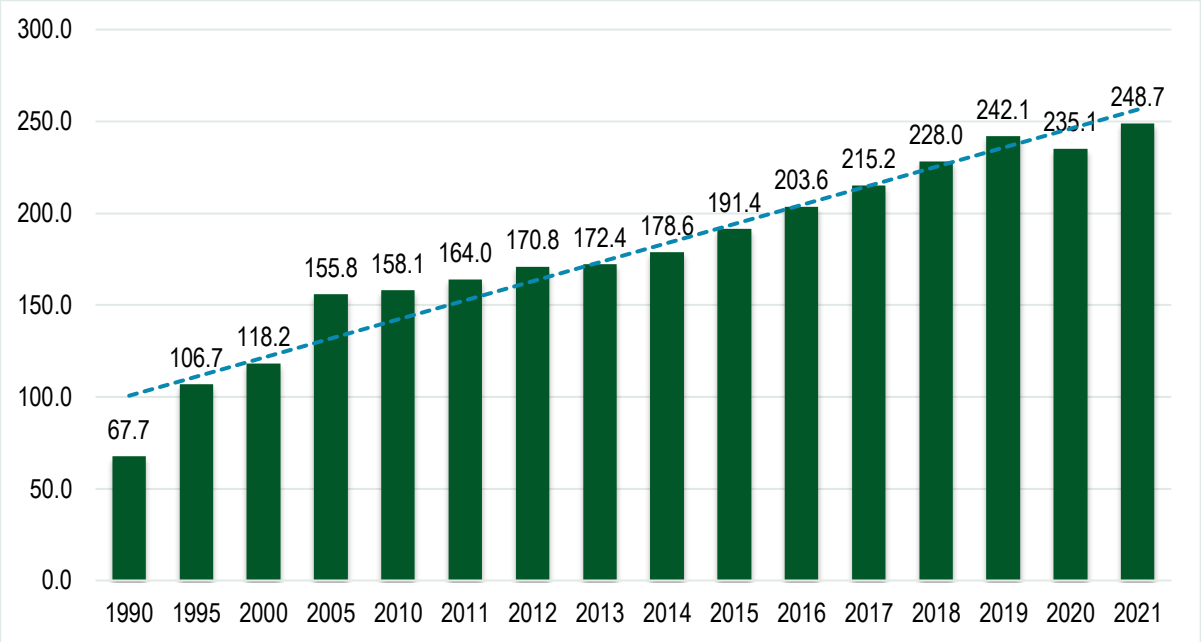
Introduction

Nowadays, the issue of environmental protection and the rational utilization of natural resources is increasingly addressed. Environmental protection as a field has emerged as a result of a shift in human approach towards the utilization of the natural environment (Prandecki 2010). Technological and industrial development have negatively impacted the state of the natural environment. Significant issues have been raised concerning water and air pollution as well as the loss of biological diversity, both at the local and global levels (European Commission 2021). The adverse effects of industrial development have been observed worldwide, including in Europe and Asia (Kucinski 2009). Urbanization and population growth can also lead to intensified environmental degradation, increased waste production, and a deterioration in air quality (Brundtland 1987). Robin Leichenko and Karen O'Brien (2008) emphasized the role of globalization and industrialization in shaping contemporary environmental protection, using climate change as an example. These were not instances of local fluctuations or anomalies but rather incidents with global repercussions, most likely resulting from human expansion into natural resources.

One of the components of environmental protection has become efficient waste management (Marshall 2013). According to reports from the EPA (2023), the EEA (2016), and the World Bank (2018), current consumption patterns and the increasing volume of waste generation can lead to the intensification of atmospheric phenomena and a decline in urban living quality. Reports from East Asian countries (China, South

Korea, and Japan) also emphasize the importance of waste management as one of the crucial aspects of environmental protection (Enviliance Asia 2020, Kurniawan 2022, Municipal Solid Waste 2022) and indicate a rising quantity of waste (Figure 1) (Statista 2021). Since the late 20th century, the amount of stored waste in the People's Republic of China (China) has increased from 67.7 million tons (1990) to 248.7 million tons (2021).

Figure 2. Amount of Disposed Waste in China 1990--2021 (in million tons)



Source: Own elaboration based on https://www.statista.com/statistics/279117/amount-of-disposed-garbage-in-china/.

One of the significant elements of waste management is the individual consumer's approach to waste disposal. Differences in the perception of sustainable development or the necessity of environmental protection can be observed even at the local level (Sebastian Jr 1972, Kountouris 2022). Due to cultural differences, the broader European community may perceive environmental protection differently than the inhabitants of East Asian countries such as China, Japan, and South Korea (Lee, 2020). At the same time, there is a lack of studies addressing the impact of cultural and social factors on the quality of environmental protection in specific groups of countries.

The aim of this article was to present differences in the social determinants of waste management and environmental protection in Poland and China. It identifies the main social factors in waste management and compares recommendations and the general approach to environmental protection within society.

The first part of the article provides a literature review on waste management in European countries (Poland) and East Asian countries (China) as well as the social determinants of environmental protection. Additionally, it introduces waste management concepts, taking into account various waste disposal methods.

The second, empirical part of the work is associated with presenting research results using a comparative analysis. The article concludes with a summary that includes conclusions and recommendations for further research directions concerning the social aspects of waste management.

1. Research Background

Contemporary waste management regulations in European and Asian countries appear to share common goals (Baskiewicz 2021). In many cases, they shape people's and organizations' approaches to waste management. For instance, Rachel Salas (2021) has addressed the issue of education and training in the field of medical waste management to minimize waste generation. Meanwhile, Sobczyk and Kowalska (2020) emphasize that one way to improve waste management in society is through the implementation of comprehensive "[...] educational campaigns on waste segregation principles, the location of selective waste collection points, and the handling of hazardous waste.".

In the literature, there are studies on local environmental protection policies (Zhu 2008, Adebayo 2010), changes related to waste management (Malmir 2016), and the impact of specific factors on environmental consciousness in society (Assuah 2023). There are also articles that utilize comparative analysis to compare countries with similar characteristics (e.g., located on the same continent) (Luna Juarez 1996, Ivanova 2022).

There is a research gap regarding the comparison of Polish waste management standards with corresponding legal acts in East Asian countries such as China.

Comparing Poland and China in the field of waste management can take place on several levels. One of these areas is the group of social factors in waste management (Table 1). Various publications, both by Polish and foreign authors, have commonly cited examples of such factors.

Table 13. Selected Social Factors of Waste Management in the Literature

Factor	Publication	Description
Cleanliness of property	Assuah (2023)	A clean property indicates a good, responsible approach by the host.
Respect for nature	Assuah (2023) Ezeah (2013) Roberts (2017)	Respect for natural resources and the surrounding space, derived from social traditions.
Minimalization of generated waste	Assuah (2023) Milea (2009)	The desire to reduce the amount of waste generated is perceived positively by other community members.
Environmental awareness	Assuah (2023), Sobczyk (2020) Al-Khatib *et al.* (2009)	Recognizing the positive effects of proper waste management and improving the quality of life "in harmony with nature".
Propensity to consume	Mintz *et al.* (2019) Papamichael et. al (2022)	A diversified approach to the consumption of goods and the management of post-consumer waste.
Cleanliness culture	McAllister (2015) Mintz *et al.* (2019)	Depending on the region, a standardized approach to maintaining the cleanliness of spaces, e.g. streets, properties, means of communication.
Social responsibility	Mintz *et al.* (2019) Al-Khatib *et al.* (2009) McAllister (2015) Mosler *et al.* (2008)	Participation in pro-environmental initiatives resulting from community pressure. It often has a positive impact on improving the quality of waste management.
Religious beliefs	Mintz *et al.* (2019) Ezeah (2013) Roberts (2017)	Specific aspects of religion related to waste management and waste perception.
Perception of waste	McAllister (2015) O'Connel (2011)	Perceiving waste differently: in developing countries as a resource or as a way to generate income in a limited labor market. In developed countries, waste is perceived as a challenge and a problem that must be addressed.
Availability of waste containers	McAllister (2015) Henry et al., (2006) Al-Khatib *et al.* (2009)	Availability of waste bins and waste collection points (selected classes).
The level of waste litter in the area	McAllister (2015) Henry *et al.* (2006)	A high level of littering may have a negative impact on the perception of waste by residents and may lead to the repetition of inappropriate waste management patterns.
Waste labeling	McAllister (2015) Henry *et al.* (2006)	Proper, legible marking of garbage bins, streets and selective waste collection points can have a positive impact on the quality of waste management in society.
Waste management habits	Yousif and Scott (2007) Mrayyan and Hamdi (2006)	Despite the changes introduced in waste management, people do not change their habits.

Source: Own elaboration.

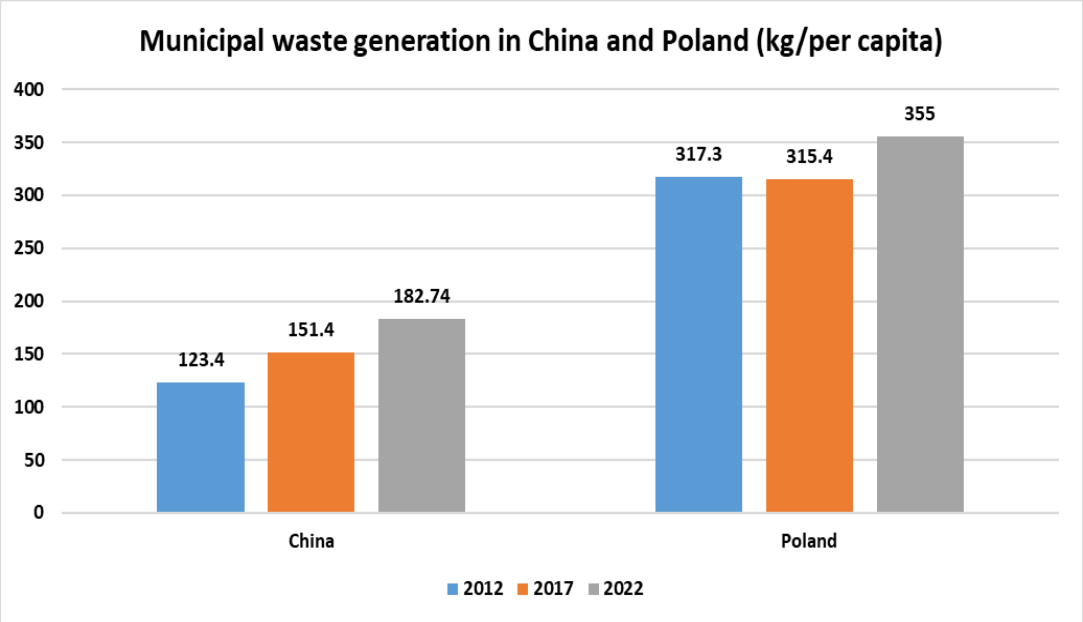
In the context of the comparative analysis of Polish and Chinese waste management approaches, the article selected 13 factors primarily related to differences stemming from culture, religion, and the level of waste management system development. Articles addressing local environmental protection aspects and country or regional comparisons typically mention municipal waste (Luna Juarez 1996, Chifari 2017, Mintz *et al.* 2019). This is because this type of waste is generated by households. Consequently, people have to deal with municipal waste more frequently than other types of waste, such as hazardous waste, electronic waste, etc. (Lee 2020). Therefore, the comparison of people's behavior and approaches to waste management in Poland and China focused on municipal solid waste. From a legal standpoint, the term "waste" refers to any substance or object of

which the possessor disposes, intends to dispose of, or is obligated to remove (Waste Act 2012). European Directive 2008/98/EC defines "waste" as "any substance or object of which the holder disposes or intends to dispose of" (European Directive 2008). In Chinese legal acts, "waste" is defined as "solid waste generated in daily life or in connection with services, and solid waste that is identified as household waste in accordance with laws and regulations" (Law of the People's 2004).

In the literature, a few social factors that can influence people's local approach to waste management can be found. In some Asian countries that are producers of inexpensive clothing imported to Europe, the desire for profit often outweighs the environmental consequences of manufacturing processes (Papamichael 2022). However, it is challenging to establish a clear hierarchy of social factors. As a result, publications on the social determinants of waste management approach the issue of prioritizing factors in various ways. Nikoleta Jones (2010) highlighted the significant impact of social factors, alongside economic and legal factors, on waste management in Greece. According to the author, during the analyzed period, Greece faced challenges related to the environmental awareness of its residents.

Between 2014 and 2022, Europe witnessed an increase in municipal waste generation per capita. During the same period, Poland saw an increase from 272 kg per person to 355 kg per person, marking an almost 33% rise. According to the U.S. Environmental Protection Agency (EPA) report, over the last 40 years, the total annual production of municipal waste in the United States increased by 77% to 292.4 million tons annually (EPA 2020). Both China and Poland have observed an increase in the volume of waste generated. In the years 2012—2022, the amount of waste per capita in China increased by 48.08%, from 123.4 kg to 182.74 kg (Figure 2). However, it is important to note that according to World Bank data (2023), China's population is 37 times larger than that of Poland, which significantly contributes to a much higher overall quantity of generated waste.

Figure 2. Municipal Waste Generation in China and Poland (2012-2022)



Source: Own elaboration based on https://data.oecd.org/waste/municipal-waste.htm; https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/table?lang=en; EEC: 中华人民共和国生态环境部, Ecological Environment in the People's Republic of China, Ministry of Ecological Environment, 2022.

By 2030, the European Union's action plan for waste management aims to achieve a level of 65% recycling and reuse of municipal waste, 75% recycling and reuse of packaging waste, reduce landfilling of municipal waste to 10%, and eliminate the landfilling of segregated waste (Jastrzebska 2017). In 2019, Poland adopted and initiated a transformation towards a circular economy. Achieving these goals requires long-term commitment at various levels, from national authorities to businesses and citizens. Until December 31, 2021, Poland followed the regulations outlined in the Waste Act of December 14, 2012. Starting from January 1, 2022, new rules and regulations specified in the Act of November 17, 2021, amending the Waste Act and some other acts, came into effect (Ustawa o odpadach 2012, Ustawa o zmianie... 2021).

Due to the dynamic socio-economic development, the increasing volume of generated municipal waste, and the growing population, China's waste management system faces a significant and globally relevant challenge. According to a 2005 World Bank report, Chinese authorities should prioritize changing the waste

management hierarchy, focusing more on waste reduction, reuse, recycling, and recovery methods such as composting and fermentation. This strategic approach aims to substantially reduce the amount of waste requiring disposal or landfilling (World Bank 2005).

The first legal regulations concerning waste management and environmental protection in China were introduced through the "Environmental Protection Law" in 1979. In 1995, the first detailed law addressing solid waste pollution, known as the "Law on the Prevention and Control of Environmental Pollution by Solid Wastes," was enacted. This law establishes legal obligations for entities emitting pollutants. Since its introduction, the law has undergone revisions in 2004, 2013, 2015, 2016, and 2020 (Enviliance 2022). In line with global trends and international recommendations, China's waste management system is moving towards a circular economy (Lee 2020). The management of solid waste in China has evolved from recycling to harmless processing, resource utilization, and source pollution reduction (Guo 2021).

2. Method

The research materials used for this study were of a secondary nature. Within the article, a literature review was conducted on waste management, with a specific focus on social factors. Data was collected using the following sources:

- Statistical data from the World Bank
- Statistical data from the OECD
- Statistical data from the Central Statistical Office (GUS) in Poland
- Statistical data from the 中华人民共和国生态环境部 (The Ministry of Ecology and Environment of the People's Republic of China)
- Bibliometric data from the Web of Science database

The sources employed included literature, online resources, and legal acts. Empirical research was conducted in August 2023. The analysis utilized Hofstede's analysis and the method of comparative analysis of the social determinants of waste management in Poland and China. Descriptive, graphical, and tabular methods were applied to present the research results. Additionally, the main social factors influencing waste management were identified as part of a systematic review of the literature in the Web of Science database.

Initially, 487 articles were considered for analysis, from which social factors were selected for the comparative analysis. The analysis included articles available in the Web of Science database based on the following criteria:

- Scientific articles in the English language
- Published between 1994 and 2023
- Containing the keywords: "social factors", "municipal", and "waste"

The keywords were chosen based on a review of previous research in the field of bibliometric analysis of literature in the area of municipal waste management.

3. Research Results

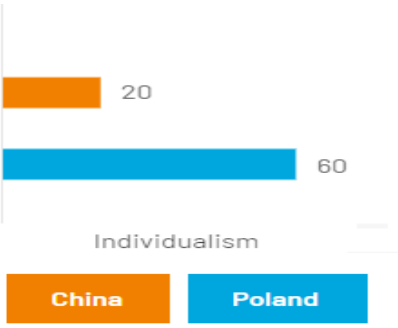
Cultural values have a decisive influence on interpersonal communication and, as a result, the definition of cultural differences (Bond 1996, Bouvier 2003, Hsu and Huang 2016). The division between Chinese and Western cultures is clearly delineated (Li 2001). At the same time, it is acknowledged that certain Chinese cultural values are in opposition to Western cultural values and vice versa (Bouvier 2003). In contemporary China, cultural values are constantly evolving (Hsu and Huang 2016). Similar transformations characterize Poland after its accession to the European Union (EU): local and global influences blend, and external tasks stimulate ongoing development and transformation.

The first important comparative category among social factors in waste management relates to **cleanliness**. Research emphasizes the cultural significance of cleanliness on one's property, habits related to waste management, and the prevailing culture of cleanliness in the context of waste disposal and recycling behaviors.

In interpersonal interactions, the Chinese exhibit conciliatory tendencies (Bouvier 2003), which are associated with the collective nature of Chinese culture. The distinction between collectivist and individualistic cultures was introduced by Geert Hofstede (1991). Within Hofstede's model, he described the contrast between individualistic societies, which emphasize individual autonomy, and collectivist societies, where greater importance is placed on community and group cohesion. According to Hofstede's framework, East Asian cultures, including China, are characterized as extremely collectivist due to numerous social attributes that underscore the primacy of the group and the significance of community. Chinese culture boasts a rich historical tradition in which

society and family have played crucial roles. One of the most important virtues of Confucianism is 孝, *xiao*, filial virtue. The Chinese model fosters a bond based on the respect and obedience of the son toward the father, knowing that, in turn, the father will be respected by the son, and so forth. Principles such as reverence for elders and authorities, loyalty to family, and a commitment to the community are paramount. Based on these values, the significance of the group far surpasses that of the individual (Zhou 2003, Hsu and Huang 2016). Consequently, the Chinese may demonstrate a strong concern for the cleanliness of public spaces out of a sense of empathy and commitment to the common good. In contrast, individualistic cultures prioritize the well-being of the individual (Figure 3); in these cultures, individuals are expected to take care of themselves.

Figure 3. Hofstede's individualism: China and Poland



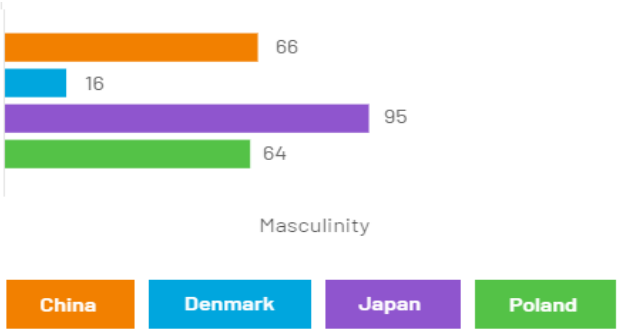
Source: Own elaboration based on: https://www.hofstede-insights.com/country-comparison-tool?countries=china%2Cpoland

Poland is situated between two cultural regions. On the one hand, its Slavic heritage inclines Polish culture towards a more collectivist orientation, while on the other hand, the influence of Western Europe, characterized by extreme individualism, balances the societal character. Regarding waste management, the primary regulations are driven by the European Union's economy, which, in this aspect, could be considered as promoting an individualistic culture in Poland. This is evident in statistics related to actions such as COVID-19 vaccinations. It is estimated that 91% of the Chinese population (over one billion people) is vaccinated against COVID, whereas in Poland, approximately 60% of the population has received a full dose (NYT 2023). In Poland, the care for the cleanliness of one's property is typically expressed through waste segregation. Increasing environmental awareness and EU recommendations have encouraged Poles to actively participate in waste segregation programs. In major cities, publicly accessible posters explaining waste segregation rules have been displayed, including in the Ukrainian language, since mid-2022 in areas such as Warsaw. Similarly, in the largest cities in China, posters and waste segregation bins have been introduced.

In association with the strong collectivism observed in East Asian cultures, a distinctive characteristic often attributed to representatives of these cultures is their diligence and frugality (Nowicka and Zhanaev 2022). However, the assertion that Asians segregate more waste than individuals from other regions of the world has not been conclusively proven (Mintz *et al.* 2019). Research indicates that those most prone to improper disposal of waste are children, teenagers, students, seniors, and individuals with a basic education. Studies have found that local waste management culture influences individual recycling behaviors, with a more pronounced impact in regions with more heterogeneous populations (Kountouris 2022). Both China and Poland can be considered homogeneous populations (OECD 2022).

Furthermore, many studies emphasize that men tend to dispose of waste more frequently than women and are less likely to adhere to municipal waste segregation guidelines compared to women. Women are more often in positions of authority regarding waste management decisions (Al-Khatib *et al.* 2009, Milea 2009, Mintz *et al.* 2019, Kountouris 2022). Research cited by Issam A. Al-Khatib *et al.* (2009) shows that men and women think and respond differently to environmental issues. Adriana Milea (2009) even suggests that social campaigns related to waste management should be specifically targeted at women, as they hold decision-making authority and have the most significant influence. Regarding financial status, researchers have conflicting opinions (Milea 2009, Kountouris 2022), eliminating the possibility of using this criterion.

Figure 4. Hofstede's masculinity: China, Denmark, Japan and Poland



Source: Own elaboration based on: https://www.hofstede-insights.com/country-comparison-tool?countries=china%2Cdenmark%2Cjapan%2Cpoland

This comparison illustrates masculine cultures, characterized by culturally described virtues typically attributed to men, including endurance, strength, independence, material success, activity, and achievement. In such cultures, gender differences in society are prominently delineated. On the opposite pole are feminine cultures, where traits culturally ascribed to women, such as nurturing and emotional bonds, solidarity, compromise, cooperation, and care, take precedence.

China and Poland emerge as masculine cultures (Figure 4) at very similar levels (66 vs. 64); they prioritize hard work over leisure and exhibit strong intergroup competition. In China, the gender differentiation in terms of masculinity and femininity is high (almost 37 million more men than women in a population of 1.4 billion), while in Poland, there are approximately 1 million more women than men in a population of 38 million (UP 2021). Despite significant numerical differences between men and women, both countries display a similar masculinity index in their cultures. In the context of waste management, this may translate to lower waste segregation rates in both cultures, especially in China due to the numerical dominance of men and in both due to the masculinization of Chinese and Polish cultures. Research suggests that gender can also determine the type of waste disposed of: among men, cigarette butts are often discarded, while among women, food waste is more commonly disposed of (Al-Khatib *et al.* 2009).

Rules also play an important role in the context of order in traditional Chinese culture, *fengshui* (风水). Energy flow: *qi* (气) is strictly related to home cleanliness. Space for the community is much clearer than in Poland. Not only individual residents but also local communities care about cleanliness in such places.

Another category of social factors highlighted by researchers pertains to **religious beliefs**. Roberts and Orekeke (2017) consider the research question related to beliefs about waste within communities. They refer to studies concerning waste disposal practices and extract implications. In one study, it was observed that waste was discarded into open drainage channels with the expectation that rain would cleanse the dirt, while in other cases, waste was not only perceived as dirt but also as sustenance for spiritual beings. Sermons and church bulletins can also enhance social awareness regarding waste management (Al-Khatib 2009, McAllister 2015). It can be argued that religious beliefs contribute to a better reception of the concept of volunteerism for the common good (Al-Khatib 2009).

From Al-Khatib's study, another interesting finding emerges: individuals who self-identify as religious tend to litter less than those with weak or no religious convictions, highlighting the role of growing moral and religious convictions as one of the most effective factors.

The cultural roots of Chinese traditions and values can be attributed to several schools of thought, including Confucianism, Taoism, and Buddhism, with Confucianism being the most influential and widespread among them (Hsu and Huang 2016). Among the most common values are harmony (Confucian), respect for authority, the cultivation of relationships – (*guanxi*, 关系) and group orientation. In opposition to China, Polish culture and tradition are rooted in the values set by European history.

In Poland, the majority of the population identifies as Christians, primarily Catholics. According to data from previous years, approximately 81—92% of Poles were affiliated with the Catholic Church (GUS 2018). The remaining part of the population mainly consists of non-religious individuals and those following other religions, such as Protestantism, Orthodoxy, or Judaism, although none of these groups is large. In China, the religious landscape is more diverse, with 50% of the Chinese population declaring no religious affiliation [Paw, 2012]. Among the religions present in China, Buddhism is the most widespread (Paw 2012). However, the issue of

religiosity among the Chinese is not extensively covered by the National Bureau of Statistics of China (NBS 2023).

Following the Al-Khatib, one might expect that Poles, as a nation with theoretically stronger religious convictions than the Chinese, would be less prone to littering. Perhaps this is because the Catholic Ten Commandments do not imply behaviors related to lifestyle that could significantly affect waste management (e.g., dietary matters) as much as, for instance, Orthodox Islam. Chinese culture is closely tied to a respect for history, tradition, and philosophy. Traditions are associated with the previous criterion of cleanliness, as found in principles such as *fengshui* (Hall 1966, 1975).

Aspects related to the **respect** for nature are intertwined with categories concerning cultural cleanliness and beliefs. The concept of environmental concern is used in the literature to refer to a range of perceptions, emotions, knowledge, and attitudes related to the environment. It is measured using the New Ecological Paradigm (NEP) scale developed by Dunlap and others (2000). This scale gauges individuals' worldviews regarding their relationship with nature and their ecological awareness.

As Keren K. Mintz (2019) suggests, support for environmental protection is generally high in both developed and developing countries. One of the cultural dimensions that can moderate the relationship between environmental orientation and pro-environmental behavior is the dimension of individualism and collectivism. In individualistic Western cultures, motivation for appropriate actions primarily stems from internal preferences and values, while in collectivist cultures, this motivation arises from a culturally embedded openness to others and norms.

Researchers also discuss environmental ethics based on two belief systems: anthropocentric and eco-centric. Anthropocentric perceives human beings as the most important, central, and more valuable than other organisms within the ecosystem. As Milea (2009) points out, this attitude has its roots in the Judeo-Christian idea of human superiority over nature and the Enlightenment drive to dominate nature.

On the other hand, in an eco-centric worldview, intrinsic value is attributed to nature and every organism. All living beings have the same right as humans to inhabit our planet. This latter dimension somewhat revolutionizes the intuitive understanding of environmentalism in individualistic Poland and collectivist China. It also suggests that Poles, entrenched in the contexts and paradigms of Judeo-Christian tradition and the European Enlightenment, may exhibit attitudes characterized by less reverence and humility toward nature. Measuring respect for nature in different cultures is, therefore, exceedingly challenging and complex, and researchers must be cautious not to fall into the trap of their own cultural paradigms.

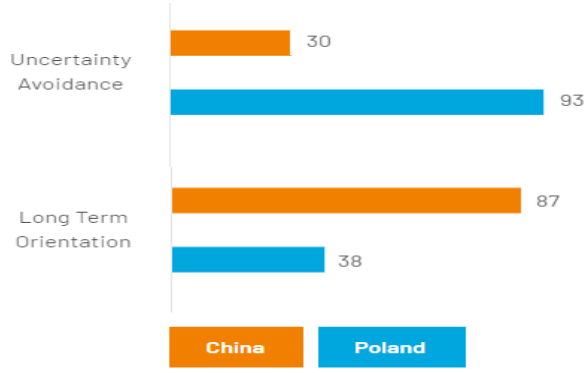
Another category encompasses aspects related to **responsibility**, including social responsibility, ecological awareness, and consumption tendencies. It is consumerism that has been one of the key factors driving the United Nations to take action in combating waste (Milea 2009). Al-Khatib and colleagues (2009) argue that the current situation of excessive waste is a result of a consumptive, materialistic way of life. New sources of pollution and new types of waste are increasingly emerging (Sobczyk 2020). The increase in littering rates in public spaces can be primarily attributed to the lack of realistic penalties or consistent enforcement, as well as a lack of knowledge regarding the environmental consequences of littering. To ensure the effectiveness of waste management programs, it is essential to define the appropriate division of responsibilities, powers, and roles. Communities should be engaged in decision-making regarding waste management strategies (Yousif and Scott 2007, McAllister 2015).

Social responsibility is closely tied to the collectivism of a culture. In Chinese culture, a strong tradition of hierarchy and authority exists, which is reflected in both family and societal life. The emphasis is typically placed on cooperation and interdependence within a group. Chinese culture values long-standing commitments to the community and the pursuit of social harmony. The ability to collaborate effectively is highly prized. In hierarchical societies, people may be more inclined to adhere to regulations and authorities' recommendations, including those related to waste segregation and recycling.

However, according to researchers, China has not yet developed clear and detailed regulations regarding the relationship between one supervisory and managerial body – the Department of Environmental Protection – and other relevant waste management authorities, partly due to rapid development. The Chinese model is characterized by contradictions in Chinese legislation, ambiguity in some waste management principles, and a lack of legislation concerning waste classification (Ivanova and Wu 2022). In the Chinese language, the expression "four-character phrase," which conveys a lot of information in just a few words, is considered a desirable skill (Bouvier 2003). Conventions are highly regarded, and indirect expression, conventionality in communication, and symbolism dominate. The content of messages and official texts is typically concise, which is also the case with regulations related to waste management.

High contextuality in Chinese culture is associated with two more dimensions of culture identified by Hofstede, namely, uncertainty avoidance and long-term orientation (Figure 5). Poland clearly avoids uncertainty by maintaining rigid codes of beliefs and behaviors. China, on the other hand, thrives in ambiguity, as indicated by the mentioned ambiguity and implied meanings in communication.

Figure 5. Hofstede's uncertainty avoidance and long term orientation: China and Poland



Source: Own elaboration based on: https://www.hofstede-insights.com/country-comparison-tool?countries=china%2Cpoland

The difference between these cultures also emerges in the dimension of long-term orientation. China has a highly pragmatic culture. People believe that the truth depends largely on the situation, context, and time. Poland, with a relatively low score, is more normative than pragmatic. Low-context cultures prioritize clarity and literal communication. At the extreme end of the contextuality axis, Hall placed North America and Western Europe.

Not only legal acts, as mentioned in the previous section, but also researchers conclude that China should clearly accept the concept of a closed-loop economy in waste management to specify the division of responsibility (Ivanova and Wu 2022). Most of the waste in China is not recycled (over 90% of industrial waste) but rather disposed of in landfills (Ivanova and Wu 2022), due to the scattered responsibility for vast construction sites and rapid development. Chinese cities are becoming increasingly overloaded with landfills; since 2010, two-thirds of Chinese cities have been surrounded by waste landfills (Lee *et al.* 2020). China is trying to shift the focus from landfilling to incineration, primarily due to the lack of space for more landfills, although this is met with numerous protests (Lee *et al.* 2020).

According to Jessica McAllister (2015), people who own property have the motivation to take care of it, in contrast to public property. It can be assumed that collective Chinese individuals will take better care of the cleanliness of public spaces than the more individualistic Poles. Researchers point out the lack of concern for the aesthetics of the environment among Poles. Even though there are always trash bins at bus stops, people scatter garbage around them. Researchers conclude that Polish cities are littered, in part because residents do not take care of cleanliness, do not feel responsible enough for environmental issues, and do not take care of communal spaces. This leads to phenomena such as widespread littering and the creation of "illegal dumps" (Sobczyk 2020). As research indicates, waste management regulations can exist in both collective and individualistic cultures (cf. Japan and Germany in Mintz *et al.* 2019). The solution for both China and Poland would involve greater community engagement and increased social awareness, which can be achieved through proper waste management education (Yousif and Scott 2007, McAllister 2015). It has been found that both external motivation (monetary reward) and internal motivation (personal satisfaction) influence recycling behaviors (Milea 2009, McAllister 2015, Sobczyk 2020). Awareness of problems does not necessarily mean that people consider solving them to be their duty (Milea, 2009).

It has been recognized that the main factor determining littering and waste segregation is a sense of responsibility for one's own waste, which could be addressed by better environmental education (Al-Khatib *et al.* 2009, McAllister 2015). Social campaigns aimed at increasing knowledge, monetary rewards, and better infrastructure, such as easily accessible separate trash containers for collecting sorted waste, can be an antidote to the waste problem. The sense of responsibility for waste management appears to be a significant factor in maintaining cleanliness and should receive the highest attention in policies, programs, or projects aimed at changing behaviors in this direction (Milea 2009).

Environmental awareness and the availability of infrastructure can be developed in another category closely related to **ecology**: the level of littering in locations, the perception of waste, the availability of waste

containers, waste labeling, and waste reduction. In pursuit of achieving the goals of sustainable resource utilization and waste reduction, national governments and international organizations encourage the recycling of household waste (Kountouris 2022).

Over the past two decades, China has experienced a rapid increase in domestic waste production. Undoubtedly, the causes of this phenomenon include China's growing population, urbanization, industrialization, changes in consumption patterns, and rapid economic development, including a sustained growth in GDP (Yousif and Scott 2007, Ezeah 2013, McAllister 2015, Roberts and Okereke 2017, Lee *et al.* 2020, Kurniawan *et al.* 2022). Since the introduction of economic reforms and Deng Xiaoping's policy of opening up to the world, China's per capita GDP growth has consistently exceeded 8% annually (Kurniawan *et al.* 2022). The increasing number of all types of waste poses a significant challenge for China. Since the 1980s, China has imported solid plastic, paper, and metal waste as raw materials for production and construction to compensate for the shortage of domestic resources in the face of rapid economic development. The first environmental protection and waste management laws were enacted in 1989 and 1996, respectively. The main legal provisions concerning the management of solid waste are the Waste Disposal Law and the Resource Recycling Law (Kurniawan *et al.* 2022). Legal regulations are continuously updated (PRC GOV 2023). To address the deepening waste crisis, the Chinese government issued a ban on the import of foreign waste in 2017. In 2019, a standard for classifying segregated waste was introduced: green for food waste, blue for recyclable waste (e.g., paper and plastics), red for hazardous waste, and black for residual waste (Lee *et al.* 2020). As Chukwunonye Ezeah (2013) notes, the composition of solid waste generated depends on dietary habits, culture, lifestyle, and climate. The most frequently chosen materials suitable for recycling include plastics, paper, metals, glass, and PET bottles. The situation is similar in both Poland and China, although the color codes are entirely different. In Poland, the first legal regulations governing waste management were formulated in the 1990s. The legal framework has since evolved to align Polish law with EU standards (Sobczyk 2020).

Littering in cities and insufficient segregation efforts are issues that affect both China and Poland. The literature often cites the lack of access to recycling-related infrastructure as a contributing factor (McAllister 2015, Mintz *et al.* 2019, Sobczyk 2020). According to Al-Khatib *et al.* (2009), one of the most effective factors in preventing street littering is the increased availability of trash bins, a finding also supported by Milea (2009). In her research, 40% of participants never segregated their waste, while a total of 60% segregate their waste to varying degrees. Simultaneously, 54% of respondents stated that they would segregated more if there were separate waste bins on the streets. Knowledge and accessibility appear to be key to improving the situation (McAllister 2015) in China, Poland, and worldwide.

4. Discussion and Summary

Researchers agree that assessing the impact of traditions on attitudes and behaviors in waste management can help explain differences in recycling rates between countries. At the same time, values and practices characteristic of a given culture can influence individual preferences and attitudes towards environmental protection. In Poland, there has been an increase in environmental awareness in recent years, although it is considered insufficient. In China, economic considerations dominate, affecting the pace of implementing eco-friendly measures. In both countries, inconsistency and ignorance regarding waste segregation can be observed. Among Polish people, cultural factors, individualism and short-term perspectives can be identified. The EU's waste management goals have compelled Poles to engage in waste segregation. In larger cities, information about increased fees for municipal waste collection if it is not segregated is often seen. As Wiktoria Sobczyk and Anna Kowalska (2020) point out, Polish people do not feel responsible for the waste crisis.

Chinese people also do not feel responsible for the waste crisis. Despite China being the world's largest construction site and landfills being a common sight around cities (Ivanova and Wu 2022), Chinese culture, with its characteristics such as high-context culture, tends to blur responsibility. China's development is happening at such a rapid pace that society has not yet fully internalized waste segregation principles. China's situation differs from that of its close neighbors, such as South Korea and Japan, where recycling rates are higher.

Moreover, researchers also agree on the significantly negative impact of ineffective waste management on the environment. This impact includes increased fire risks due to flammable landfill gases, the release of ozone-depleting gases into the atmosphere, air pollution, soil contamination, leachate infiltration from landfills into the soil, groundwater, rivers, lakes, and oceans, as well as urban waste overload (Yousif and Scott 2007, Milea 2009, Mintz *et al.* 2019, Lee *et al.* 2020, Kurniawan *et al.* 2022, Ivanova and Wu 2022). Consequently, further research on the social factors of waste management and the development of appropriate patterns and tools should be pursued.

Our study compares two ways of waste management that are geographically, historically and traditionally very far from each other, with a focus on its cultural aspects, which exposes completely new motivations and helps to understand the consequences of waste management deficiencies in both countries, as well as neighboring countries. Researchers emphasize the importance of waste management studies, calling for the standardization and calming of waste management due to the pressing problem of environmental pollution caused by municipal waste. Research in the field of sustainable development and climate change is very important today not only because of its scientific nature, but also because of the alarmingly bad condition of our planet. The cultural aspects of waste management are something new, something interdisciplinary, helping to understand and take specific actions in the future to reduce environmental pollution with waste: precisely by shifting the burden to the cultural aspects. The importance of this area of research continues to grow as the world's pollution problem worsens. This determines the relevance of research in this direction.

Credit Authorship Contribution Statement

Kalina Maria Taczkowska: conceptualization, investigation, methodology, project administration, software, formal analysis, writing – original draft, supervision, data curation, validation, writing – review and editing, visualization

Maciej Borkowski: conceptualization, investigation, methodology, project administration, software, formal analysis, writing – original draft, supervision, data curation, validation, writing – review and editing, visualization

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Task-Based Budgeting in Environmental Projects Planning: A Case Study of a Manufacturing Company in Poland

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Abstract: In this paper most important differences between performance budgeting and traditional budgeting were presented. The aim of this paper is to focus only on selected differences. The conducted case-study in Poland reveals that activity-based budgeting is an effective method of financial management. Traditional budgeting is implemented according to older concepts. These rules are not compatible with the demands of modern budgeting. Unfortunately, the traditional budgeting method is widely used in public sector in Poland. It is also quite often used in commercial enterprises. The traditional method of budgeting is easier and quicker to implement. Thus, it is popular. On the other hand, it does not allow to achieve positive effects of activity-based budgeting.

Keywords: performance budgeting; traditional budgeting; case study; Poland; managerial accounting, sustainable development; environmental projects.

JEL Classification: G19; Q01; Q56; Q59.

Introduction

Two important areas of entertainments activity have recently developed in Polish companies. These are budgeting and a pro-environmental approach to business. These two trends are related to each other. The first aim to implement those tools is to increase financial performance. The second one is initiated by the growing awareness of managers who notice the need to undertake pro-environmental operations. Quite often these two areas of activity seem to conflict with each other. Budgeting is aimed at reducing activities that are unnecessary in terms of financial performance. Pro-environmental activities are often considered as economically unjustifiable. However, budgeting is not solely focused on positive financial results. Pro-environmental activities are not in every case unprofitable. The purpose of budgeting is such selection of ecological projects is that their total financial result is acceptable. It does not have to be a positive result achieved in the short term. Quite often occurs situation that companies accept a negative financial result in short term. The usage of task-based budgeting method in the comprehensive planning of environmental activities. From this point of view, budgeting can be used in pro-environmental activities so that their total effect is economically acceptable. Therefore, the task-based budgeting method can be used in order to achieve that goal. According to its rules, all pro-environmental activities which are undertaken, should be included in one common program. This will allow to create a total budget for such projects. Positive financial results do not have to occur in every implemented ecological project. Profits from such projects could be financed by losses of the other ones. The purpose of budgeting is to select green projects in such a way that their total financial result is acceptable. Moreover, it does

not have to be a positive result achieved in short term. A negative financial result in the short term could be temporally accepted. The aim of this article was to present how the implementation of task-based budgeting method could be used in environmental activities planning.

1. Literature Review

The concept of performance budgeting was first introduced in public finance. However, in Poland this method has been widely used to construct local government budgets. It is one of the additional budgeting methods used only in managerial accounting. This method has been also successfully used also in commercial enterprise finances. The main differences between traditional and performance budgeting are following:

1.time horizon,
2.compatibility with strategies,
3.correlation of budget allocations with tasks and objectives,
4.performance indicators.

According to Organization for Economic Co-operation and Development (OECD) performance budgeting is defined as the systematic use of performance information to inform budget decisions, either as a direct input to budget allocation decisions or as contextual information to inform budget planning. Its purpose is to instil greater transparency and accountability throughout the budget process by providing information to government officials, legislators, and the public on the purposes of spending and the results achieved. (Chaplin 2005, 125). Posuła Marta in her article presented a comparative analysis of performance budget definitions, and the new trends emerging in the contemporary discourse on public governance methods in Poland (Postuła 2018, 244). In another article she also assed to what degree the advancement in the implementation of instruments from the area of the so-called performance budgeting contributes to the rational management of public expenditure structure (Postuła 2018, 144). Peter A. Pyhrr defined "Performance budgeting as an administrative innovation which focuses on the relationship between money and results. It involves the presentation of data in such a way as to emphasize the accomplishment of objectives and the value of outputs." (Pyhrr 1977, 4). Allen Schick stated that "Performance budgeting is a system of budgeting which involves the presentation of budgets in such a way as to show the accomplishments expected from proposed expenditures." (Schick 1971, 1029 - 1030). John M. Gaus was cited by Olsen, Johan P. in 2003. Personally John M. Gaus found performance budgeting as an attempt to relate money spent to work done; it was a method of asking whether the work is worth the money" (Olsen 2004, 69-79). Among others Christian Ax and Elin Ax in 2022 presented empirical case study of beyond budgeting in Sweden (Christian 2022, 444). Performance Budgeting Models and Mechanisms were described by Robinson Marc. The definition of performance budgeting put forward is a broad one. It refers to public sector funding mechanisms and processes designed to strengthen the linkage between funding and results (outputs and outcomes), through the systematic use of formal performance information, with the objective of improving the allocative and technical efficiency of public expenditure. Together with Brumby J. they attempted to ascertain what light the empirical literature sheds on the efficacy of performance budgeting. Performance budgeting refers to procedures or mechanisms intended to strengthen links between the funds provided to public sector entities and their outcomes and/or outputs through the use of formal performance information in resource allocation decision making (Robinson 2005, 3). To sum up, looking at the perspectives in in the United States, it is premature to claim that performance-based budgeting will replace line-item budgeting in near future, particularly at the federal and state level (Kong 2005, 92). The above mentioned changes in budgeting took place not only in the management of public finance. Such trends could be also observed in corporate finance management. Therefore, within time budgeting tools have transformed due to the development of management methods as well development of information technology (Zeller, Metzger 2013, 300). Solutions used in the past do not fulfill today's standards. Such solutions are called traditional budgeting (Asogwa 2017, 112). One of the most significant disadvantages of traditional budgeting is the lack of connection between budget sources with the performed tasks. The management of the company uses the traditional budget as a strict plan that limits the amount of available funds. Within the presented attitude towards budgeting, budgetary discipline is more important than the necessity to accomplish tasks. As a consequence, such an application of the budgeting has been criticized both in practice and literature. (Michalchuk 2017, 55). For these reasons, the Beyond budgeting method of management has become more and more popular, (Neely *et al.* 2003, 23). This concept allows to resign from creation of a traditional budget. However, the budgeting system is subject to Berland's evolution. Its shortcomings are being eliminated. Current recognized as correct budgeting standards differ significantly from traditional solutions. There are many international organizations creating and promoting good budgeting practices such as for example the International Group of Controlling (IGC). The principles of effective use of budgeting as one of the most important tools of controlling are presented in the article entitled Controlling Process Model 2.0 (Möller 2018, 32). The tasks

of modern budgeting nowadays are much wider than to limit resources (Chalastra 2021, 277). One of the important tasks facing today's budgeting is goal-oriented planning (Rubin 2000, 88). The task-based budgeting method is used for this. Task-based budgeting is therefore quite often used in commercial companies.

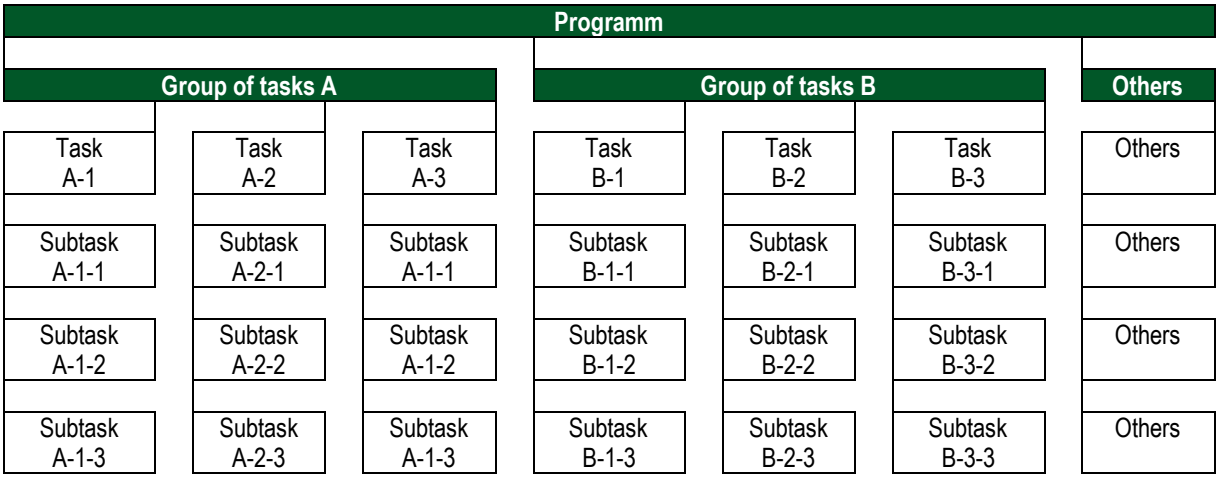
2. Methodology

The article was based on the implementation of budgeting systems in a medium-sized manufacturing company operating in the mechanical industry in Poland. The field of the study was the budgeting system of the enterprise and its environmental projects. The result of the research was the development of a task-based budgeting concept. One of the aims of the implemented task-based budgeting system was to create a budget for a pro-environmental program. The study was conducted using the case study method. In the examined enterprise, the method of research by action (Action Research) was applied. The employees of the company were involved in developing the budgeting system.

3. Case Study

The performance budget should be planned for the entire period of the project implementation which may last longer than one year. Traditional budgets are often created for one year according to the compatibility of the budgeting period with the financial year. If long-term tasks are implemented, the new budget project are postponed. Moreover, the financial impact of the implemented long-term tasks is unsure and unknown. The multi-year budget planning process is followed by general rules. It provides synthetic values for specific strategies. In task-based budgeting they are called programs. Such synthetic data are usually peculiar and detailed. Within the framework of these programs, budgets are created for both specific projects as well as for individual tasks. They precisely indicate the resources and their results. These tasks are not random as they are the consequence of long-term strategies. In traditional budgeting process there is no strategic planning which indicates main directions of spending money over next years. This can result in randomness of tasks in the following years in the future. In performance budgets resources, tasks and goals to achieve should be with each other correlated. Moreover, the responsible people for each budget item implementation should be precisely dedicated. In traditional budgeting such requirements does not appear. So it is quite difficult to indicate which budget items are related to its tasks, goals and, what is more, people responsible for them. A major disadvantage of traditional budgeting is also its overall structure. Numerous tasks are implemented within different financing funds. All activities and actions should be focused on the efficient usage of budget funds. Appropriate performance measures should be devoted to each task. Such requirements do not occur in traditional budgeting. Therefore, traditional budgets concentrate on activities which enable to keep resources and implement tasks without taking into account their efficiency. The concept of performance budgeting is used not only in sector of public finance. These principles could be applied to the budgets in commercial enterprises. They share recommendations shared by organizations dedicated to develop modern budget systems. Such es for example studies on Modern Budgeting created and presented by the Internationaler Controller Verein eV. Similar recommendations can be found in the area of beyond budgeting concepts. (“Controlling Process Model 2.0"). The essence of activity-based budgeting is to transfer general data to specific data. According to this concept, it is not correct to plan the budget only in terms of synthetic data as they are too aggregated and difficult to analyze. It is practically impossible to determine the reasonableness of the value of the planned funds or the people responsible for them. Therefore, the budget of a large enterprise should be properly detailed. Several levels should be created depending on the enterprise and the type of its activities, it. At the very first synthetic level, the name of the program is presented as well as allowing to identify the area of activity under which the budget will be planned. At this level synthetic budget data could be included such as total revenues, costs and financial results, as well as targets for the entire program. The second level of such budget is the task group. It could be similar to the organizational unit responsible for their implementation. Within this task group, individual tasks could be indicated. These tasks could be covered by single project budgets. The third level of budget process is to plan individual projects. In such project detailed stages are often identified. Next step is to create sub-task budgets which should be created at every stage. The number of task budget levels depends on specifics of enterprise activity. The example of a multi-volume task budget process is presented in Figure 1.

Figure 1. The example of a multi-level task budget structure



Source: own work.

Similar principles could be applied to the enterprise budget. An example of such strategy in an enterprise might be enterprise which conducts training or coaching activities. Within such strategy, groups of educational tasks could be implemented, as well as training on specific topics for individuals or groups of employees. In every group it is possible to define detailed tasks. Individual tasks could be divided into subtasks such as for instance business travels, educational room equipment or conducting the trainings. The same principles could be applied to budgeting for other activities of strategic importance. Task budgeting, due to its labor-intensive nature, is rather recommended for the implementation of projects which are significant and consist of many individual tasks. To sum up, activity-based budgeting coulfd be applied to both public entities as well as to commercial enterprises. Environmental activities implementation often faces accusations that they are unprofitable. Due to that fact, many companies carry out only very limited activities within such projects. Most of the companies which can allow to conduct such actions are large corporations. It is one of the ways to achieve their main goal which is to create a positive impact on the company image. Unfortunately, small enterprises in Poland, due to limited resources, are not interested in implementing such activities. Such an approach is not appropriate and pro-environmental tasks can and should be implemented in every company. It should not depend on the size of the enterprise. Appropriate accounting tools should be created to measure the profitability in order to encourage enterprises to undertake such activities. This would allow to select an appropriate set of projects and actions. To conclude, it is possible to implement both pro-environmental and profitable tasks. The first step to create a task budget for environmental activities is to create a relevant process. Within this process, many different groups of tasks could be identified. The tasks could be divided into following criteria:

1.organizational units,
2.profitability (profitable and unprofitable),
3.accounting recognition categories (investments and others financed by current activity costs),
4.importance of expenses incurred (high, medium and low expenses),
5.duration of the task and the payback period of the expenses incurred (long, medium and short-term),
6.sources of financing (own funds, European and national funds, leasing or credit),
7.categories of environmental activities (energy, heating, water, waste, environmental support).

Among the criteria presented, one can select either all or only some criteria. These criteria can be at an equal level of relevance. This will create a multidimensional task budget structure. It will define the main strategic areas of the activities which are undertaken. Its purpose is to apply the principle of sustainable development. This means that the criteria presented will set the framework for the planned tasks. They will determine the strategic areas of pro-environmental activities undertaken in a specific enterprise. They should be determined on the basis of individual conditions. It is worth to implement the principle of sustainable development which indicates the legitimacy of implementing pro-environmental tasks in all dimensions. Pro-environmental activities implemented in too limited a scope should be avoided su as those characterized only by following features: profitable only for production, with subsidies and short-term activities. The next stage is to submit individual environmental projects. Each project should fit into the overall structure of pro-environmental strategies established at a particular enterprise. Projects can be proposed by various entities such as:

1.the Board of Directors,
2.directors of the divisions,

3.employees,
4.controlling department,
5.the lean management specialists.

Environmental projects quite often present positive effects in long term. The lack of such short-term balancing does not mean that this feature cannot be considered as important one. Such balancing should be pursued in the cumulative account. The example of a profit plan for the pro-environmental budget action program balanced by time factor is presented in table 1.

Table 1. Profit budget for the implementation of environmental projects constructed according to sustainable development in terms of time

Type of the projects		Time of planning		Short-term		Long-term		
				year 1	year 2	year 3	year 4	year 5
According to time	According to profitability	Project	Type of project					
Green short-term projects	Profitable projects	1						
		2						
		3						
		Total						
	Unprofitable projects	1						
		2						
		3						
		Total						
	Balance of annual financial result							
	Cumulative financial result balance							
Green long-term projects	Profitable projects	1						
		2						
		3						
		Total						
	Unprofitable projects	1						
		2						
		3						
		Total						
	Balance of annual financial result							
	Cumulative financial result balance							
Green projects together	**Balance of annual financial result**							
	Cumulative financial result balance							

Source: own work.

In the presented profit budget, the item "Ecological projects together" is particularly important. Within its frames the annual and cumulative financial result can be observed. These values indicate whether ecological projects are balanced. A positive value of this item indicates that the total gains from planning ecological projects does not generate a loss for the entire program. Another relevant item is the project category. It can be a breakdown by financing methods, organizational unit or another category in accordance with the designated structure of all ecological activities. The information contained in this item allows for the sustainability of ecological projects in these dimensions. Theoretically, it is possible to aim for total sustainability of all projects in all perspectives. In practice, however, such an approach is difficult to achieve. It can result in very important projects which are not implemented due to the need for full sustainability. Periodic imbalance should occur only temporally but in long-term it is worth achieving balance.

Conclusions

The presented case study shows that many of the pro-environmental tasks which were undertaken at the selected company are unprofitable. Consequently, it is difficult to convince the top management to implement that kind of tasks. The factor of lack of economic effect often causes abandonment of pro-ecological activities. However, there is a certain group of pro-ecological tasks which are characterized by a positive financial result. In order to select such projects and determine their projected profits, one can use the sentence budgeting method. Each implemented pro-ecological project will have an individual budget developed. This would avoid undertaking such unprofitable measures. Awareness of the need to develop pro-environmental measures in Polish companies

is slowly increasing. More often unprofitable projects are accepted and implemented. Sources of financing for such projects could be financed through profits from profitable projects. Such an attitude makes it easier to approve unprofitable tasks. It is therefore important to develop budgets for each pro-environmental project. The budgets determine the inputs as well as the outputs of each project in specific periods. All individual budgets of pro-environmental projects could be summed up into one common budget. This would enable to create a budget for the pro-environmental program implemented in a specific enterprise. This is a well-known method of task-based budgeting.

Credit Authorship Contribution Statement

Anna Siemionek-Lepczyńska: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.
Michał Chalastra: Conceptualization, Investigation, Methodology, Project administration, Software, Formal analysis, Writing – original draft, Supervision, Data curation, Validation, Writing – review and editing, Visualization, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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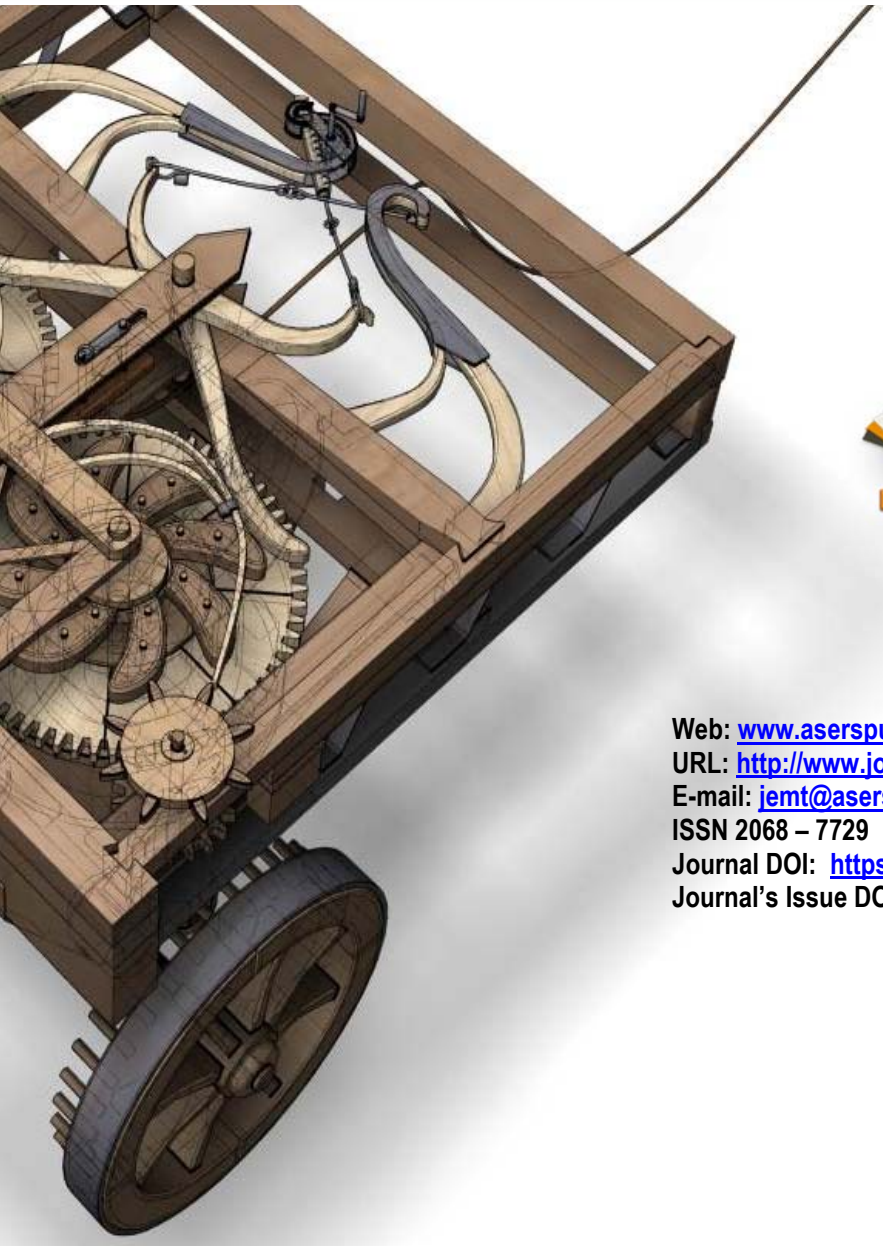

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