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URBAN ECOTOURISM DEVELOPMENT: THE CASE OF THE «MAZE» ECOPARK IN OSKEMEN

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ABSTRACT

The study aims. This study addresses severe environmental degradation in Ust-Kamenogorsk by developing the "MAZE Ecopark," an innovative urban ecotourism model that integrates sustainable tourism, ecological restoration, and environmental education.

Methodology. A mixed-methods approach was applied, combining GIS-based spatial and environmental analysis, a pilot sociological survey (n≈80), cost-benefit and visitor-flow modeling, 3D visualization, and expert consultations. These tools allowed evaluation of environmental conditions, community demand, and preliminary economic viability.

Originality/value of the research. This is the first ecopark framework specifically designed for post-industrial cities in Central Asia. Unlike traditional urban parks, the model combines maze-design principles with ecological remediation and educational programming, linking recreation with sustainability and community engagement.

Key findings. Results confirm: (1) serious environmental degradation, with air quality indicators exceeding WHO standards and limited green infrastructure; (2) strong public support and willingness to engage in urban ecotourism; and (3) financial feasibility, with potential to attract substantial visitor flows and achieve medium-term payback. The expected impact includes ecological improvements (air-quality mitigation, urban greening), social benefits (public health, environmental literacy, social cohesion), and economic contributions (tourism revenue, new jobs).

Keywords: urban ecotourism, sustainable development, green infrastructure, GIS analysis, tourism planning, Ust-Kamenogorsk, ecopark model.

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INTRODUCTION

Industrial cities in Central Asia face unprecedented environmental challenges resulting from decades of intensive manufacturing and resource extraction. Ust-Kamenogorsk, Kazakhstan's primary metallurgical center with approximately 350,000 residents, exemplifies these challenges through severe air pollution, degraded urban environments, and insufficient green infrastructure. As the administrative capital of East Kazakhstan Region, the city serves as a critical case study for understanding how post-Soviet industrial centers can address environmental degradation through innovative urban planning solutions.

The environmental situation in Ust-Kamenogorsk represents one of Kazakhstan's most pressing urban ecological challenges. According to data from the Committee of Environmental Regulation and Control (2023), the city consistently ranks among Kazakhstan's most polluted urban areas. Air pollution regularly exceeds

WHO standards (PM2.5 levels 3-4 times higher). Green space availability is five times below recommended levels (4.2 m² per capita vs. 20–25 m² standard).

The convergence of environmental degradation and limited recreational infrastructure in Ust-Kamenogorsk creates a complex urban challenge requiring innovative solutions. Traditional approaches to urban greening have proven insufficient, while the city's tourism potential remains underdeveloped due to environmental constraints and inadequate green space infrastructure.

This research aims to design and evaluate an ecopark concept that supports sustainable spatial development, improves environmental awareness, and enhances the green infrastructure of Ust-Kamenogorsk. Specific objectives include: developing an innovative urban ecotourism model that integrates environmental restoration with recreational infrastructure; assessing community demand and economic viability for ecological tourism development; creating a replicable framework applicable to similar post-industrial urban contexts in Central Asia. However, applied urban ecotourism models for post-Soviet industrial cities remain largely absent, creating a research gap that this study seeks to address.

Literature review. Despite growing international literature, there is still a lack of applied frameworks tailored to the realities of post-Soviet industrial cities. Urban ecotourism research has evolved significantly over the past two decades, yet substantial gaps remain in understanding its application to post-Soviet industrial contexts. This literature review examines three key thematic areas: theoretical foundations of urban ecotourism, economic valuation of urban green spaces, and regional applications in Central Asian contexts.

Theoretical Foundations of Urban Ecotourism

Urban ecotourism emerged as cities worldwide recognized the need to balance environmental conservation with economic development. While numerous studies explore urban ecotourism in Western contexts (Higham & Lück, 2002; Dodds & Joppe, 2001), there is a lack of applied models tailored to post-Soviet, industrial cities in Central Asia. Higham and Lück (2002) established urban ecotourism as a fusion of nature-based tourism principles with urban environments, emphasizing conservation and educational experiences [1]. Their framework provides a theoretical foundation for integrating environmental restoration with tourism development, directly informing our approach to designing multifunctional urban spaces.

Dodds and Joppe (2001) advanced this conceptualization by defining urban ecotourism as environmentally focused tourism within urban boundaries that reconnects city dwellers with nature [2]. Their emphasis on environmental awareness aligns with our research objectives of promoting ecological consciousness in heavily industrialized settings. However, their Canadian urban context differs significantly from the post-Soviet industrial environment of Ust-Kamenogorsk, highlighting the need for context-specific adaptations. Higham and Lück (2002) emphasized the role of ecotourism in reconnecting urban residents with nature, while Dodds and Joppe (2001) extended this perspective by linking sustainability with urban policy frameworks. Taken together, these studies illustrate how Western research situates urban ecotourism both as a lifestyle reconnection with nature and as a policy-driven sustainability agenda.

Economic Valuation and Environmental Benefits

Research on the economic value of urban green spaces demonstrates substantial financial returns on ecological investments, supporting the viability of ecopark development in industrial cities. Wu and Tan (2012) provided crucial evidence that strategically designed green spaces can reduce air pollution by up to 24% in surrounding areas, offering both environmental and public health benefits [3]. This finding directly supports our hypothesis that the proposed ecopark could address Ust-Kamenogorsk's severe air quality issues while generating economic returns.

Chen and Jim (2010) quantified the economic benefits of urban greening, demonstrating that properties near well-maintained urban parks command premium prices [4]. Their hedonic pricing analysis revealed significant increases in property value, validating the economic sustainability potential of ecological initiatives. While their research focused on Chinese urban contexts, the industrial heritage similarities with Ust-Kamenogorsk suggest comparable economic benefits may be achievable. Taken together, Wu and Tan (2012) demonstrated the ecological benefits of urban green spaces by showing measurable reductions in air pollution, while Chen and Jim (2010) highlighted their economic value through increased property prices. This combination of environmental and financial evidence reinforces the long-term sustainability potential of ecopark initiatives in post-industrial cities. While Western studies emphasize reconnecting urban residents with nature (Higham &

Lück; Dodds & Joppe), Asian research highlights the quantifiable ecological and economic returns of greening (Wu & Tan; Chen & Jim). In contrast, post-Soviet contexts lack such applied evidence, underscoring the distinctiveness of our case study.

Gibson et al. (2019) contributed important design insights, demonstrating that labyrinth or maze configurations increase visitor engagement and time spent in green spaces [5]. Their findings directly informed our decision to incorporate maze design principles in the proposed ecopark, linking design innovation to enhanced recreational and educational outcomes.

Regional Context and Post-Soviet Urban Development

Limited research addresses urban ecotourism development in Central Asian contexts, particularly in cities with extensive industrial heritage. Aktymbayeva et al. (2020) examined sustainable tourism potential in Kazakhstan's urban areas, noting that cities like Ust-Kamenogorsk face unique challenges due to their industrial legacy while presenting opportunities for innovative ecological solutions [6]. Their research emphasized collaborative approaches involving government, business, and community stakeholders, informing our methodology for community engagement and stakeholder consultation. In contrast, research in post-Soviet contexts such as Kazakhstan (Aktymbayeva, 2020) remains largely descriptive and concentrated on natural, rather than urban, tourism. This contrast highlights a critical gap: while Western studies emphasize reconnection and policy integration, and Asian research documents ecological and financial returns, post-Soviet literature still lacks applied models of urban ecotourism.

However, existing studies in the region focus primarily on natural tourism destinations rather than urban ecological restoration projects. This gap in applied research for post-Soviet industrial cities creates both a challenge and an opportunity for developing context-appropriate urban ecotourism models.

Research Gap and Theoretical Contribution

The literature reveals a significant gap in applied research specific to the development of urban ecotourism in post-Soviet industrial cities. Most existing studies focus on Western urban contexts or developing nations with different environmental and industrial profiles. Our research addresses this gap by developing a comprehensive framework that integrates international best practices with Central Asian urban realities, contributing to both urban planning theory and sustainable tourism development in post-industrial contexts. A survey was conducted asking specific questions about visiting green spaces and park areas (Figure 1).

METHODOLOGY

3.1 Research Design and Theoretical Framework

This study employed a mixed-methods case study approach grounded in sustainable urban planning theory and the ecosystem services framework. The framework draws on sustainable urban tourism and ecotourism planning models, integrating spatial, social, and economic perspectives. The research design integrates multiple analytical methods to address three primary research questions:

- How can urban ecotourism development serve as a mechanism for environmental restoration in post-industrial cities?
- What are the economic and social feasibility parameters for implementing innovative ecopark concepts in Central Asian urban contexts?
- How can maze-design principles enhance visitor engagement while maximizing environmental education outcomes?

As part of the research design, 3D modeling was used to conceptualize the proposed “MAZE Ecopark”, linking ecological restoration with recreational infrastructure. Consequently, urban parks are vital assets in the local community as they help address a wider range of environmental and social issues. Therefore, using 3D modeling, an “ecopark maze” project will be developed in the city.

The theoretical foundation draws from urban ecology theory (Forman, 2014), which conceptualizes cities as complex socio-ecological systems where human activities and natural processes interact [7]. The ecosystem services framework (Costanza et al., 2017) provided the analytical structure for evaluating environmental benefits, while sustainable tourism theory (Hunter, 1997) guided the integration of conservation objectives with economic development goals [8,9].

The case study methodology was selected as appropriate for exploring complex urban phenomena within specific geographical, cultural, and institutional contexts (Yin, 2018) [10]. This approach enables an in-depth

investigation of the relationships between environmental conditions, community needs, and tourism development potential in Ust-Kamenogorsk.

3.2 Site Selection and GIS Analysis

A GIS-based city map of Ust-Kamenogorsk was prepared to visualize potential sites for the ecopark. Open spatial layers (land use, accessibility, and pollution hotspots) were compiled and analyzed. Site evaluation followed a multi-criteria framework in which environmental indicators were weighted highest (40%), followed by social accessibility (30%), infrastructural feasibility (20%), and economic potential (10%). The resolution of the analysis was based on a 30-meter raster grid, allowing identification of land-use patterns and pollution concentration zones. Validation was conducted through expert consultation with urban planners and municipal specialists. A limitation of this approach is the reliance on open-source and secondary data, which may reduce precision and exclude long-term monitoring indicators.

3.3 Sociological Survey (design, sample, analysis)

A pilot sociological survey was conducted to explore community attitudes and demand for urban ecotourism infrastructure. The sampling strategy combined convenience and snowball sampling among students and residents of Ust-Kamenogorsk. A total of 100 questionnaires were distributed, of which 80 valid responses were obtained (80% response rate). Respondents ranged in age from 18 to 45, with approximately 60% female. The questionnaire consisted of three thematic blocks: recreational behavior, environmental attitudes, and preferences for ecotourism development. Data analysis included descriptive statistics (frequency distributions, percentages), chi-square tests to identify associations between demographic factors and preferences, and thematic coding of open-ended responses. While indicative of local attitudes, the limited sample size prevents generalization to the entire city population.

3.4 Economic Modeling

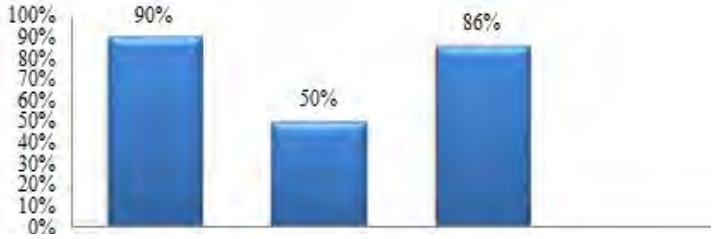
The project's financial viability was assessed using cost-benefit analysis combined with sensitivity testing and visitor flow modeling. Key assumptions included a discount rate of 5%, with visitor growth modeled under two scenarios: conservative (2% annual increase) and optimistic (5% annual increase). Cost components included land preparation, construction, landscaping, maintenance, and staffing. Benefits were estimated from projected ticket sales, concessions, and indirect spending in the local economy. Sensitivity analysis tested variations in visitor numbers and maintenance costs. Limitations of the model include the exclusion of inflation shocks, unexpected policy changes, and broader macroeconomic risks.

MAIN PART OF THE STUDY

4.1 Survey Results

To understand community perspectives, a pilot survey was conducted among university students and residents (n≈80). The questionnaire included sections on recreational behavior, environmental attitudes, and interest in ecotourism activities.

Research results showed that more than 90% of participants sometimes or often visit green areas or parks, and more than 50% frequently or always stay in environmentally responsible accommodations. Those who participate in ecotourism activities, such as local community events (86%), support the authors' proposal to use such experiences for all tourists visiting urban areas (Figure 1).



1. Visiting parks. 2. Environmentally responsible accommodations. 3. Attending urban ecotourism events

Figure 1 - Survey on visiting green spaces

Note - compiled by the author

The project's novelty lies in the introduction of a new type of ecotourism in Kazakhstan, focusing on city greening with an emphasis on parks, normalizing nature, climate, and air in the territory by preserving natural elements of the urban environment.

Urban ecotourism emerges in cities with the potential to restore natural objects that have been tainted, blocked, or damaged as a result of industrial and commercial activities [11]. Therefore, we take the city of Ust-Kamenogorsk, the center of the East Kazakhstan region, as an example.

Due to the industry and people with low levels of awareness, the city's ecological situation is in an extremely poor state. Ust-Kamenogorsk, despite its environmental agenda, is a metropolis with a high concentration of greenery, but in recent years, the number of trees and shrubs has begun to decrease. Every year, 20,000 to 30,000 trees are planted in the city, of which half survive the first winter and only 10-20% survive after three years [12]. This occurs due to improper planting of seedlings and a lack of proper care. Based on these criteria, Ust-Kamenogorsk is difficult to call a "green" city. Its main problem, as for many years, remains air quality. Even though authorities follow an "evolutionary" principle and develop plans to relocate residents to areas more distant from factories and industrial zones.

1. Development of the "MAZE" ecopark concept as a tourist facility that meets modern expectations and visitor requests.
2. Preparation of project documentation for the construction of the specified tourist facility.
3. Ensuring sustainable development of the ecopark in the long term.

Figure 2 - Figures of unusual animals
Note - compiled by the author

Conceptual images of green animal figures to be installed in the ecopark. The visualization includes possible forms of topiaries (horses, wolves, bears, birds) made from plants and shrubs specific to the region (Figure 2).

1. Increase in the number of tourists visiting the city of Ust-Kamenogorsk.
2. Expansion of opportunities for recreation and entertainment in the city.
3. Increasing the attractiveness of the city for tourists and investors.

The "MAZE" tourist facility will be built taking into account the principles of sustainable development. Environmentally friendly materials and technologies will be used in construction. The facility will be operated in a way that minimizes negative environmental impact.

Business plan for creating the "MAZE" ecopark in the city of Ust-Kamenogorsk.

Ust-Kamenogorsk, KShT residential district, about an hour's drive from Ust-Kamenogorsk, are the Sibiny 5 lakes in the mountains. Near Ust-Kamenogorsk is the Bukhtarma reservoir, where residents often travel in summer.

Figure 3 - Project implementation address

Note - compiled by the author

Schematic representation of the location of the future ecopark “MAZE” in the residential neighborhood KShT (Silk Fabric Factory) in the city of Ust-Kamenogorsk. The area has a convenient location - popular natural attractions of Eastern Kazakhstan, such as the Sibinsky Lakes and Bukhtarma reservoir, are located nearby (Figure 3). The choice of this territory is determined by both environmental necessity and the tourist potential of the zone.

4.2 GIS Outputs

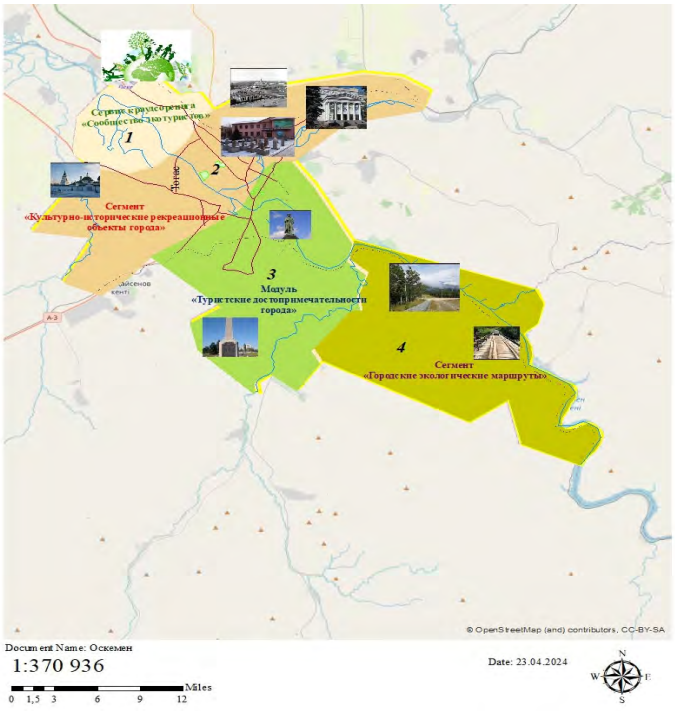


Figure 4 - GIS-based mapping of Ust-Kamenogorsk tourism and ecotourism zones

Note - compiled by the author

The GIS-based map illustrates four functional segments identified for urban ecotourism development: (1) cultural-historical and recreational objects in the city center; (2) architectural and community heritage clusters; (3) tourist landmarks and viewing platforms; and (4) urban ecological routes. These segments highlight both the concentration of cultural assets and the availability of green corridors suitable for ecological restoration and recreation. The spatial analysis confirmed that the southern and eastern parts of the city hold the highest potential for implementing ecopark initiatives, due to their accessibility and environmental value (Figure 4).

These results confirm significant community demand for ecotourism development, though the limited sample suggests that broader surveys are needed for generalization.

The GIS mapping confirmed that the southern and eastern green corridors are most suitable for implementing the “MAZE Ecopark,” combining accessibility with environmental value.

It is planned that the ecopark “MAZE” will become not only a local landmark of Ust-Kamenogorsk, but also serve as a model for replication in other cities of Kazakhstan, primarily in Almaty and Konayev. These cities are also experiencing the need to restore green areas and develop urban ecotourism infrastructure. Thus, the project is scalable and can be adapted to various urban and natural conditions.

The official logo of the ecopark “MAZE” symbolizes the combination of nature, labyrinth, and sustainable development. It can include elements of green leaves, a spiral, or stylized animal contours (Figure 4).

Figure 5 - Project logo
Note - compiled by the author

An ecological park in the form of a maze with figures of animals and birds in the city center.

Project Description: City residents are often surrounded by concrete jungles, which can negatively affect their mental and physical health.

Ecoparks allow city residents to relax and admire the beauty of the ecopark's objects.

Ecoparks can become an excellent place for educational activities aimed at improving the environmental culture of the population. Tours, master classes, exhibitions, and other events can be held in ecoparks, helping citizens learn more about nature and its protection. Ecoparks can become attractive tourist destinations, attracting guests from other cities and countries. This can contribute to the development of the city's economy and create new jobs.

The specific goals of creating ecoparks in the city may vary depending on the characteristics of the city and its needs. As the industry develops, an ecopark in the city contributes to increasing the environmental literacy of the population and reducing the negative impact of enterprises on the environment.

In general, ecoparks are an important element of the urban environment, benefiting both city residents and the environment.

In this regard, our prepared “MAZE” project is aimed at developing ecological and urban ecotourism, general tourism in Ust-Kamenogorsk, gaining financial benefits, and receiving about 2,000,000 ecological tourists

to the region, meeting their needs, providing access to nature for residents, and environmental education of the city's population. It is designed for education, employment of the local population, and most importantly, to reduce wind speed in the construction area, contribute to air purification, and give vacationers the opportunity to feel, know, and explore the surrounding world.

- Referenced successful urban park projects like High Line (NYC) with 8 million visitors and Gardens by the Bay (Singapore) with 6.4 million annual visitors

- Included regional context with Kazakhstan examples (Borovoye: 400,000 visitors, Kok-Tobe: 1.5 million visitors annually) [13].

Listed specific factors used in the calculation:

- Regional population base (1.4 million)
- Adjacent tourism flows from the Russian Altai (2.8 million)
- Domestic ecotourism growth rate (15% annually)
- Projected international visitors (20,000-30,000)
- Visitor density benchmarks for similar parks

The park will be made in the form of a spiral or maze of trees or round flower beds. Flowers, shrubs, and trees will be planted in the park (Figure 5). Lanterns, trash cans, and benches will also be installed. In the center of the spiral or maze, a Ferris wheel will be installed for city viewing. Animal figures located in the park will be made from green plantings. They will depict various types of animals found in the region, such as horses, bears, deer, wolves, birds, etc. Observation platforms will also be built, from which visitors can admire the panorama of the maze.

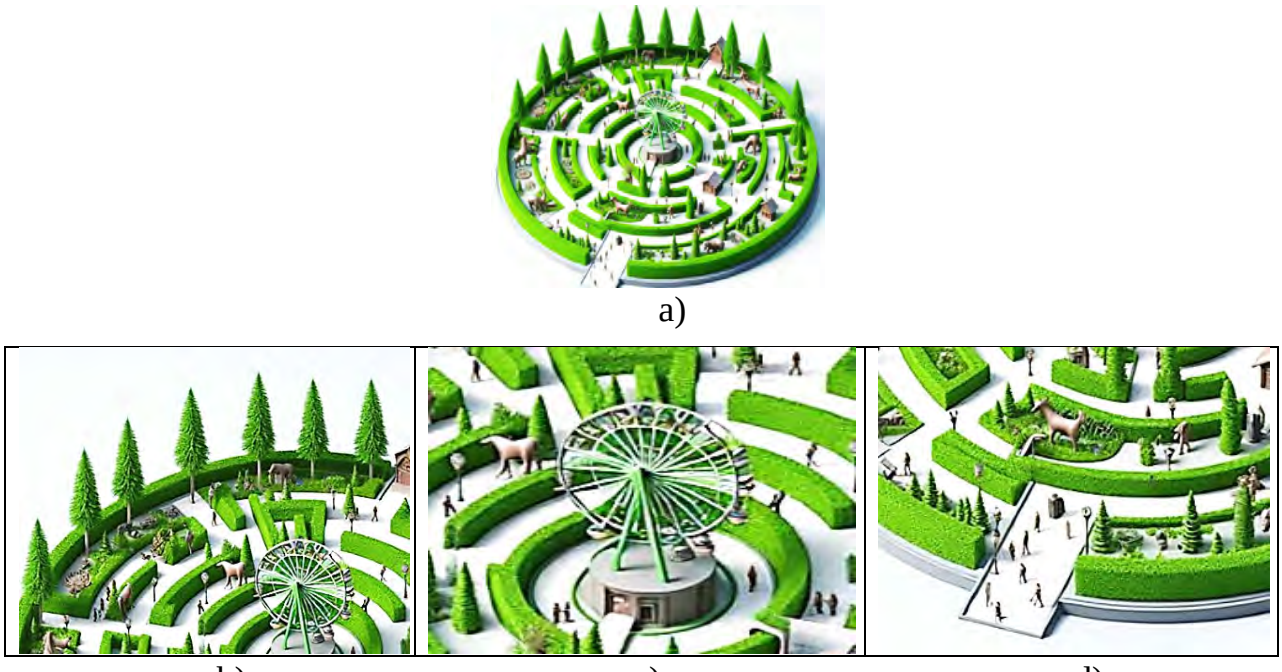


Figure 6 - 3D model of the ecopark “Maze”

Note - prepared by the authors using the program “BLENDER 4.0”

a) b) c)

Figure 7 - Ecopark, located in the city center, was created by artificial intelligence

Note - prepared by the authors with the help of AI

Generation of the future type of ecopark using artificial intelligence (Figure 7). The model gives an idea of how the park will fit into the urban environment and will look like in the future after implementation.

To increase the park's attractiveness for tourists, the following elements can be added (Figure 8):

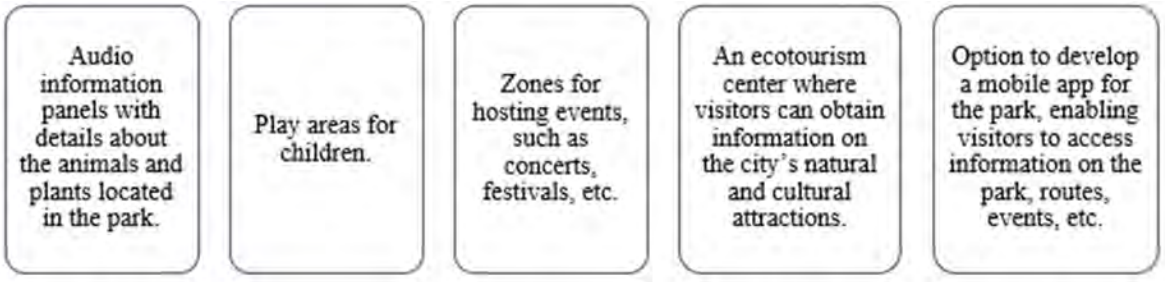


Figure 8 - Additional suggestions to increase park attractiveness

Note – compiled by the author

Implementation Effect: positive. Research has allowed for the identification and evaluation of a wide range of existing and potential practical solutions.

Economic Impact: The ecopark can become an attractive tourist destination that can contribute to the development of the city's economy. It can attract visitors from other cities and countries, which can lead to increased tourism revenues and the creation of new jobs. The ecopark can also increase the value of real estate in nearby areas. This is because people are willing to pay more for housing located near green spaces.

A business plan has been developed for the implementation of the “MAZE” project in the “Kombinat Shelkovykh Tkaney” (KShT) microdistrict of Ust-Kamenogorsk.

4.3 Economic Modeling Results

The ecopark territory comprises 40 hundred square meters of land. 40 hundred square meters equals 4,000 square meters. The radius of a circular plot of land with an area of 40 hundred square meters is 24.67 meters.

Table 1 - Cost estimates

Name	Prices
Marketing and advertising strategies	Advertising campaigns in the media can be estimated in the range from 200,000 to 500,000 tenge per month, depending on the scale and format of the advertisement.
	Online advertising, including social media presence and contextual advertising, can cost from 100,000 to 300,000 tenge per month.
	The design and development of advertising materials costs from 50,000 to 200,000 tenge per project.
Park management and maintenance	The care of plants and green spaces is estimated at about 100,000 to 300,000 tenge per month, depending on the total area of the park and its infrastructure.
	Electricity costs for lanterns and other equipment can range from 50,000 to 150,000 tenge per month.
	Cleaning and maintenance of benches and trash cans range from 50,000 to 100,000 tenge per month.
Other current expenses	Maintenance and repair of equipment such as the Ferris wheel and observation decks usually cost from 100,000 to 300,000 tenge per month.
	Security costs, including security services and video surveillance systems, can range from 150,000 to 500,000 tenge per month.
	Various other expenses, such as water supply and maintenance, usually range from 50,000 to 200,000 tenge per month.
Security	Salaries for security personnel can range from 100,000 to 300,000 tenge per month, depending on their position, work experience and responsibilities.
Note – Compiled by the authors	

Investment volume: 150,850,000 tenge.

Expected payback period: 3-5 years.

Projected net profit: 5,000,000 tenge per year.

The table describes the monthly and project costs for the maintenance and operation of the park (Table 1). It includes marketing (advertising, social media), utility and operating costs (electricity, plant care, security, repairs).

Table 2 - Estimate of the recreation area

№	Name	Amount	Total
	Land plot		3 000 000 KZT per 40 acre
	Project development		450 000 KZT
	Installing the Ferris wheel	1 PC	25 500 000 KZT
	Making animal figurines	10 pieces	* 250 000 KZT= 2 500 000 KZT
	Construction of viewing platforms	3 pieces	* 700 000 KZT= 2 100 000
	The Olendorfi spruce	24 pieces	* 6 000 KZT= 144 000 KZT
	Acrocona spruce	24 pieces	* 5 600 KZT= 134 400 KZT
	Herman nau spruce	24 pieces	* 4 400 KZT= 105 600 KZT
	The yew is pointed	24 pieces	* 7 300 KZT= 175 200 KZT
	Short-leaved yew	24 pieces	* 6 600 KZT= 158 400 KZT
	Canadian yew	24 pieces	* 7 500 KZT= 180 000 KZT
	Thuja brabant	24 pieces	* 2 800 KZT= 67 200 KZT
	Thuja biota	24 pieces	* 2 900 KZT= 69 600 KZT
	Japanese Thuja	24 pieces	* 3 000 KZT= 72 000 KZT
	Boxwood	50 pcs	* 2 500 KZT= 125 000 KZT
	Snowdrops	80 pieces	* 300 KZT= 24 000 KZT
	Woodlands	80 pieces	* 330 KZT= 26 400 KZT
	Crocuses	80 pieces	* 80 KZT= 6 400 KZT
	Anemones	80 pieces	* 180 KZT= 14 400 KZT
	Lawn		400 m^2 * 2 000KZT/M^2 KZT= 800 000 KZT
	Emergency call button	5 pieces	* 9 000 KZT= 45 000 KZT

	Fire extinguishers	4 pieces	* 4 000 KZT= 16 000 KZT
	Equipped with an automatic fire extinguishing system		750 000 KZT
	Video surveillance		3 000 000 KZT
	Automatic plant watering system (installation)		2 000 000 KZT
	Tube		400 m * 700 KZT= 280 000 KZT
	Garden path		225 m * 2 300 KZT= 517 000 KZT
	Landscape lights in 1	86 pieces	* 9 900 KZT= 851 400 KZT
	Landscape lights b2	8 pieces	* 7 800 KZT= 62 400 KZT
	Lamps	94 pieces	* 1 200 KZT= 112 800 KZT
	Wiring		300 m * 400 KZT= 120 000 KZT
	Gas sensors	15 pcs	* 2 500 KZT= 37 500 KZT
	Smoke detectors	20 pcs	* 2 500 KZT= 50 000 KZT
	Benches	20 pcs	* 20 000 KZT= 400 000 KZT
	Fire extinguishers	10 pcs	* 10 000 KZT= 100 000 KZT
	Trash cans	10 pieces	* 5000 KZT= 50 000 KZT
	Kiosks grocery store large	1 piece	1 500 000 KZT
	The souvenir kiosk is small	1 piece	650 000 KZT
	Doghouse	2 pieces	0 KZT
	Security booth	2 pieces	800 000 KZT
Total			40 820 100 KZT
Note - Compiled by the authors			

The table provides a detailed financial breakdown of the costs of creating the ecopark “MAZE” in Ust-Kamenogorsk. All stages are included, from land acquisition and design to installation of equipment and landscaping. Prices for trees (spruce, yew, thuja), flowers, security equipment (video surveillance, firefighting), infrastructure (benches, kiosks, paths), and total expenses are given (Table 2).

The economic model confirms the project’s financial viability, supporting both environmental and social objectives within a medium-term payback period.

Social Impact: The “MAZE” ecopark can have a positive impact on the physical and mental health of city residents. It will provide residents with the opportunity to engage in physical activity in the fresh air, which can help reduce the risk of developing cardiovascular diseases, diabetes, and other chronic diseases. In addition, it can help reduce stress, improve mood, and increase energy levels.

The ecopark can be used for education and increasing the environmental awareness of city residents. Tours, educational events, and programs can be conducted in them, helping people learn more about nature and its importance for our health and well-being. Also, the “MAZE” ecopark can become a gathering place for city residents, where they can communicate with each other, spend free time, and participate in various events. They can contribute to strengthening social ties and increasing the level of social cohesion.

Environmental Impact: The ecopark can contribute to improving air quality in the city. It absorbs pollutants from the air, such as nitrogen oxides, sulfur oxides, and particulate matter. This can lead to reduced air pollution and improved health of city residents, helping reduce noise as parks absorb sound waves, which can make the city a quieter and more peaceful place to live. It will reduce wind speed in the construction area.

Technical And Economic Data Of Equipment

Each project will be equipped and implemented with its forecasting tools. Each technique or equipment is considered in accordance with the object.

The best evergreen plants for the park will be used:

1. Spruce A coniferous plant with abundant brown cones, characterized by fluffy green foliage and an average height of 25 to 30 meters, reaching 50 meters under favorable conditions [14]. Spruces show high adaptability to lighting, able to grow both in partial shade and in open sun. They are extremely sensitive to humidity and air purity, preferring light, slightly alkaline soils and moderately moist loams. There are more than 45 varieties of coniferous trees in the world. Recommended species for the site include:

1. Olendorfi: a compact multi-peak plant up to 200 cm tall, with golden-green foliage.
2. Acrocona: a slow-growing compact spruce up to 400 cm tall, with dark green foliage and lilac-crimson cones.
3. Herman Nau: a dwarf spruce with a cushion-shaped crown, not exceeding 150 cm in height and with grayish-blue needles.

2. Yew Characterized by slow growth, this conifer is represented by both shrub and tree-like species. The needles are distinguished by being short, soft, and pleasant to the touch, with a rich green color. It forms fruits in the form of scarlet berries. Yew has high shade tolerance and is not demanding of conditions. It takes root well in various soils, although preference is given to fertile neutral soil without excessive moisture. Below are the best varieties for landscaping the site:

Pointed: tree forms can reach 20 meters in height, although on average they are limited to 6 meters [15]. Shrub species are compact, spreading. The needles have a sickle-shaped form, dark green on top, light underneath.

Short-leaved: a many-branched, slow-growing tree, reaching a height of 5 to 15 meters. The crown is wide, conical in shape. The needles are flat, straight. The berries are bright scarlet.

Canadian: a winter-hardy shrub variety. Grows up to 100-150 centimeters in height and up to 300-400 centimeters in width. In winter, the needles acquire a red-brown hue.

3. Thuja A conifer presented in various varieties, distinguished by decorativeness. Among them are both dwarf shrubs, reaching a height of up to half a meter, and majestic giant trees, up to seventy meters tall. Thujas show unpretentiousness, high frost resistance, and good growth both in partial shade and in shade. Young plants are characterized by soft needles, which over time turn into scaly needles. The following varieties are recommended for landscaping the adjoining territory: Brabant, which belongs to the western varieties. Characterized by frost resistance and rapid growth, has emerald needles. The crown shape is pyramidal. In nature, it can reach 40 meters in height, but in decorative plantings is limited to 4 meters [16].

Biota: an eastern variety with small needles tightly pressed to the branches. The crown shape is openwork-pyramidal. The cones are small, greenish-blue, and acquire a dark brown hue when ripe.

Japanese: a decorative coniferous tree with a height of up to 9 meters. The crown shape is pyramidal, with branches directed upward. The needles are emerald-green with a silvery sheen, having a strong, pleasant aroma.

4. Boxwood These plants are slow-growing shrubs or trees, reaching heights from 2 to 12 meters [17]. Their crown is characterized by compactness and high density. The branches are twined with glossy, dark green leaves of round or oval shape. Starting from the age of 15-18 years, these plants bloom with small yellowish flowers, emitting an expressive honey aroma [18]. They prefer slightly acidic or neutral, fertile soil with moderate moisture. Below are recommended varieties for landscaping the site.

Figures. All types of animals: maral, bear, monkey, wolf, horse, sheep, etc.

Flowers. There is a significant number of plants capable of blooming even under a thick cover of snow, including snowdrops, squills, crocuses, and anemones.

Perennial flowering plants represent a variety of species, each with its own characteristics. For example, crocuses have four main species, among which Dutch hybrids are especially popular [19]. A distinctive feature of these plants is their ability to bloom in different periods of spring, which allows the creation of a unique ensemble of various varieties. There is also a variety of honeysuckle in nature that shows its flowering beauty in winter. This plant is fragrant honeysuckle, which is a shrub with elongated egg-shaped leaves that remain green even under a layer of snow.

During flowering, it pleases the eye with various shades of pink and an exquisite aroma. Daffodils are also represented by numerous varieties, differing both in color and in the shape of the flowers. Due to the ability of this plant's bulb to undergo excellent winter hibernation, it can delight with beautiful flowers in spring.

Among plants that bloom in summer and continue to please until autumn, one can highlight lilies, pansies, peonies, phloxes, calendula, petunia, snapdragon, and carnation. Each has its unique charm and can decorate a garden or flower bed for an extended period.

Emergency call button (including through the application), smoke and gas sensors, and fire extinguishers. Equipped with an automatic fire extinguishing system if necessary. Video surveillance throughout the territory, as well as security work.

The commercialization prospects for the "MAZE" project are high due to the following factors:

1. Growing demand for green spaces and recreational areas in urban environments
2. Increasing interest in ecotourism and environmentally friendly activities
3. Potential for multiple revenue streams (entrance fees, events, concessions)
4. Government support for ecological initiatives
5. High population density in the target area
6. Limited competition in the specialized ecopark segment in Kazakhstan

CONCLUSION.

Thus, the "MAZE" tourist facility will be built taking into account the principles of sustainable development. Environmentally friendly materials and technologies will be used in construction. The facility will be operated in a way that minimizes negative environmental impact.

This research project demonstrates the viability and importance of developing urban ecotourism models that integrate ecological principles with recreational opportunities. The "MAZE" ecopark concept presents a replicable model that can be adapted to other urban areas facing similar environmental challenges.

By combining educational elements with recreational facilities, the project creates a multifunctional space that serves both residents and tourists while promoting environmental awareness. The economic analysis indicates that such initiatives can be financially sustainable while providing significant social and environmental benefits.

Future research should focus on monitoring the implementation outcomes, assessing the actual environmental impact, and gathering visitor feedback to refine and improve the model. Additionally, comparative studies with similar initiatives in other post-industrial cities would provide valuable insights for the continued development of urban ecotourism practices.

This study examined the feasibility of developing an innovative "MAZE Ecopark" in Ust-Kamenogorsk by integrating survey evidence, GIS-based site analysis, and economic modeling. The results demonstrated that:

- Social feasibility was confirmed by strong public support for ecotourism initiatives.
- Environmental feasibility was validated through GIS mapping, which identified suitable green corridors in the city's southern and eastern sectors.
- Economic feasibility was supported by cost-benefit analysis, indicating investment payback within a medium timeframe.

Together, these findings confirm the potential of ecopark concepts to address environmental degradation while promoting sustainable urban tourism.

LIMITATIONS AND FUTURE RESEARCH

This study has several limitations that should be acknowledged. First, the environmental analysis relied primarily on secondary data from official monitoring stations, without long-term independent field measurements of air quality, soil, or biodiversity. Second, while sociological surveys provided valuable insights, the sample size and geographic scope were limited, which may not fully capture the diversity of community attitudes across Ust-Kamenogorsk. Third, the economic modeling applied standard cost–benefit and visitor flow approaches, but did not account for dynamic seasonal variations, climate change impacts, or broader regional tourism linkages. Finally, stakeholder engagement, although constructive, was limited in scale and duration, with only a small number of workshops and interviews conducted.

Future research should therefore address these limitations by expanding environmental monitoring with long-term datasets and biodiversity assessments, conducting larger and more representative sociological surveys, and applying advanced economic modeling techniques such as dynamic simulations and multi-scenario analyses. Broader stakeholder engagement at the municipal, regional, and national levels is also essential to strengthen practical feasibility. Comparative studies with other post-industrial cities in Central Asia and internationally would further test the adaptability of the proposed ecopark model across diverse cultural and institutional contexts.

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ӨСКЕМЕН ҚАЛАСЫНДАҒЫ «MAZE» ЭКОПАРКІ МЫСАЛЫНДА ҚАЛАЛЫҚ ЭКОТУРИЗМДІ ДАМЫТУ

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АҢДАТПА

Зерттеудің мақсаты - Бұл зерттеу Өскемен қаласындағы ауыр экологиялық мәселелерді шешуге бағытталған. «MAZE» экопаркі - тұрақты туризмді, экологиялық қалпына келтіруді және экологиялық білім беруді біріктіретін урбанистік экотуризмнің инновациялық үлгісі ретінде ұсынылады.

Әдістеме. Зерттеу аралас әдістер негізінде жүргізілді: ГАЖ-талдау, экологиялық бағалау, пилоттық сауалнама (n≈80), шығын-тиімділік пен туристік ағынды модельдеу, 3D-визуализация және

сарапшылармен кеңесулер. Бұл тәсілдер қаланың экологиялық жағдайын, қоғам сұранысын және жобаның бастапқы экономикалық тиімділігін бағалауға мүмкіндік берді.

Зерттеудің бірегейлігі / құндылығы. Бұл жұмыс постиндустриялық Орталық Азия қалаларына арнап әзірленген алғашқы экопарк тұжырымдамасын ұсынады. Дәстүрлі саябақтардан ерекшелігі - лабиринттік дизайнды экологиялық қалпына келтірумен және ағартушылық бағдарламалармен үйлестіруінде.

Зерттеу нәтижелері. Негізгі нәтижелер: (1) қалада экологиялық жағдайдың күрт нашарлауы (ауа сапасы ДДСҰ нормасынан асып түседі, жасыл аймақтар жеткіліксіз); (2) халықтың экологиялық демалыс орындарына деген сұранысы жоғары; (3) жоба қаржылық тұрғыдан іске асырылуы мүмкін, туристерді тартып, орта мерзімде өзін-өзі ақтай алады. Жобаның күтілетін әсері: экологиялық (ауа сапасын жақсарту, көгалдандыру), әлеуметтік (денсаулық, экологиялық сауаттылық, қоғамдастықты нығайту) және экономикалық (туризмнен түсетін табыс, жаңа жұмыс орындары).

Түйінді сөздер: қалалық экотуризм, тұрақты даму, жасыл инфрақұрылым, ГАЖ талдауы, туризмді жоспарлау, Өскемен қаласы, экопарк моделі.

Алғыс:: (1) бұл зерттеу Қазақстан Республикасы Ғылым және жоғары білім министрлігінің Ғылым комитеті тарапынан қаржыландырылды (грант № AP23490620, тақырыбы: «Smart-технологияларды қолдануға негізделген Имантау-Шалқар курорттық аймағында туризмнің тұрақты дамуын басқаруды іске асыру»), сондай-ақ (2) Қазақстан Республикасы Ғылым және жоғары білім министрлігінің білім беру гранты бойынша мақаланың бірінші бірлескен авторының диссертациялық жұмысын жазу шеңберінде дайындалды.

РАЗВИТИЕ ГОРОДСКОГО ЭКОТУРИЗМА НА ПРИМЕРЕ ЭКОПАРКА «MAZE» В ГОРОДЕ УСТЬ-КАМЕНОГОРСК

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АННОТАЦИЯ

Целью исследования направлено на решение острой экологической проблемы в Усть-Каменогорске путем разработки концепции экопарка «MAZE». Проект сочетает устойчивое развитие туризма, восстановление зеленой инфраструктуры и экологическое просвещение, предлагая инновационную модель городского экотуризма.

Методология. Использован смешанный методический подход: ГИС-анализ и экологическая оценка, пилотный социологический опрос (n≈80), моделирование «затраты–выгоды» и туристических потоков, 3D-визуализация и консультации с экспертами. Эти инструменты позволили оценить состояние окружающей среды, общественный запрос и предварительную экономическую эффективность.

Оригинальность/ценность исследования. Впервые представлена модель экопарка, специально разработанная для постиндустриальных городов Центральной Азии. В отличие от традиционных парков, «MAZE» объединяет лабиринтный дизайн с экологическим восстановлением и образовательными программами.

Результаты исследования. Основные результаты: (1) подтверждено тяжелое состояние экологии (превышение стандартов ВОЗ по качеству воздуха, дефицит зеленых зон); (2) выявлен высокий общественный интерес к экотуризму; (3) доказана финансовая реализуемость проекта, способного привлечь туристические потоки и окупиться в среднесрочной перспективе. Ожидаемый эффект включает экологические улучшения (снижение загрязнения, озеленение), социальные выгоды (здоровье,

экологическая грамотность, укрепление сообществ) и экономические результаты (туристический доход, новые рабочие места).

Ключевые слова: городской экотуризм, устойчивое развитие, зеленая инфраструктура, ГИС-анализ, планирование туризма, Усть-Каменогорск, модель экопарка.

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