ISSN 2181-8622

Manufacturing technology problems

Scientific and Technical Journal Namangan Institute of Engineering and Technology

INDEX COPERNICUS INTERNATIONAL

Volume 9
Issue 4
2024

Google Scholar Crossref doi SLIB.UZ Scientific library of Uzbekistan

METHODS FOR ASSESSING THE EFFECTIVENESS OF WASTE RECYCLING BUSINESS ACTIVITIES IN THE ENVIRONMENTAL SECTOR

ERGASHEV ULUGBEK

Master student of Graduate School of Business and Entrepreneurship
under the Cabinet of Ministers of the Republic of Uzbekistan
Phone.: (0897) 593-6535
Corresponding author

DJURABAEV OTABEK

Professor of Graduate School of Business and Entrepreneurship
under the Cabinet of Ministers of the Republic of Uzbekistan

Abstract: Waste recycling is one of the most important measures in waste management policy. In recent years, special attention has been paid to the issue of waste recycling in our country. Enterprises that emit large amounts of harmful waste into the atmosphere and generate waste in industrial quantities should contribute to improving the environmental situation in the country. The way to solve these problems may be the introduction of environmental technologies at enterprises, which can be characterized as environmental modernization. Enterprises engaged in waste collection and sorting improve the environmental indicators of the territories in which they operate. This article explores methods for assessing the effectiveness of waste recycling businesses in the environmental sector. These methods focus on environmental impact reduction, economic efficiency improvement, and sustainable resource utilization. The study highlights key performance indicators (KPIs) and assessment frameworks that help measure the success of waste recycling initiatives.

Keywords: ecology, waste recycling, effectiveness assessment, environmental impact, economic performance, social impact, sustainability, key performance indicators (KPIs), waste management, resource recovery, circular economy, cost-benefit analysis, carbon footprint, environmental sector.

Introduction. In recent years, many countries around the world have considered social entrepreneurship aimed at environmental protection as the main measure for solving environmental problems. Because, in addition to preventing environmental pollution, it allows saving resources, preserving biodiversity, creating sustainable models of production and consumption, combating climate change, implementing innovations in these areas, developing businesses and creating additional jobs. The reason is that the rate of waste generation around the world is increasing every year. In 2020, a total of 2.24 billion tons of solid waste were generated worldwide. Only 17 percent of it is recycled. By 2050, annual waste generation is expected to increase by 73 percent compared to 2020, to 3.88 billion tons, due to rapid population growth and urbanization. Therefore, many countries around the world are taking necessary measures to reduce the generation of solid household waste and reuse or recycle products.

The growing volume of waste and its detrimental impact on the environment have made waste recycling an essential sector. Recycling businesses play a critical role in environmental protection, resource conservation, and economic development.

Relevance of the Study: The need to evaluate the performance of recycling businesses.

Objective: To identify and analyze methods for assessing the effectiveness of recycling activities.

Research Significance: This assessment is vital for improving decision-making processes, optimizing resource use, and enhancing environmental sustainability.

3. Theoretical Framework

Effectiveness in waste recycling businesses can be categorized into three key dimensions:

Environmental Impact: Reduction of waste sent to landfills, lower carbon emissions, and resource recovery.

Economic Performance: Cost-effectiveness, profitability, and return on investment (ROI).

Social Impact: Job creation, public awareness, and improvements in community health and well-being.

Previous Research:

Studies highlighting the importance of KPIs for recycling performance.

Existing frameworks such as Life Cycle Assessment (LCA) and circular economy principles.

4. Methods for Assessing Effectiveness

4.1 Environmental Assessment Methods

Waste Reduction Metrics: Total amount of waste diverted from landfills.

Carbon Footprint Measurement: Reduction of greenhouse gas emissions.

Resource Recovery Rates: Efficiency of materials reclaimed for reuse.

4.2 Economic Assessment Methods

Cost-Benefit Analysis (CBA): Evaluation of financial returns against operational costs.

Return on Investment (ROI): Measuring profitability relative to investments made.

Break-even Analysis: Identifying points where costs match revenues.

4.3 Social Assessment Methods

Employment Impact: Number of new jobs created.

Public Health Improvements: Assessing reductions in pollution-related diseases.

Community Awareness Programs: Evaluating the effectiveness of education campaigns.

5. Practical Analysis

To demonstrate the effectiveness of these methods, case studies of prominent waste recycling businesses are analyzed:

Case Study 1: A recycling plant reducing municipal solid waste by 70%.

Case Study 2: A company achieving significant ROI while enhancing environmental standards.

Challenges Faced: Financial constraints, technological barriers, and policy gaps.

By applying the outlined assessment methods, results highlight areas of success and opportunities for improvement.

In Uzbekistan, as in many developing countries, social entrepreneurship is now one of the emerging sectors. Entrepreneurs are supported in this direction, and many benefits and preferences are provided to them. In 2019, the “Strategy for the Implementation of

Work Related to Solid Waste in the Republic of Uzbekistan for 2019-2028" was approved, which provides for the creation of an effective and modern system for the processing of solid waste. The strategy aims to achieve targets such as ensuring the recycling of at least 60 percent of generated solid waste, increasing the recycling rate of specific solid waste by 25 percent, and reducing the volume of solid waste landfilled by 60 percent.

The following problems remain in the waste recycling sector:

First, there are financial and infrastructural problems in our republic to support the waste recycling process. The amount of funds received from waste-related activities does not allow for the creation of a full-fledged regional infrastructure for waste recycling.

As of 2019, there are 183 enterprises processing solid household waste in the republic with a total capacity of 894 thousand tons per year. For comparison, in France there are more than 300 enterprises with a capacity of 2.3 million tons.

Therefore, this incentive is being implemented at the expense of preferential funds from international financial institutions. In particular, at a meeting held on February 2 of this year, the President of the Republic of Uzbekistan Sh. Mirziyoyev decided to exempt imported equipment, components and spare parts from customs duties for a period of 3 years, to allocate preferential loans for up to 5 years for the purchase of sorting and processing equipment and to reimburse the part exceeding the refinancing rate, and to allocate 500 billion soums in stages for a period of 5 years from preferential funds from international financial institutions for these works.

Today, the population of Namangan region is 2,857 thousand people, and the amount of waste generated by the population per day is set at 800 grams per person. As a result, it is planned to remove an average of 571.4 thousand tons of household waste from the population annually, of which 30.5%, 174.3 thousand tons, will be recycled. The number of people covered by sanitary cleaning services in the region is 2,685.6 thousand people, which is 94% of the total population. Of these, 461.9 thousand tons of waste were removed in 2022, and 29.6% (136,663 thousand tons) were recycled.

As noted above, the types of waste that are sorted and recycled by existing environmental social entrepreneurs in the region differ significantly from those in countries with developed eco-entrepreneurship (Figure 2.3). For example, in Switzerland, waste is sorted into 25 types, which is the highest in the world. In Germany, which is currently the world leader in waste recycling, seven different colored waste containers are used.

Results and Discussion. In our research, the threshold values of the development of social entrepreneurship entities specializing in environmental protection in the districts of Namangan region were determined by calculating the arithmetic average value of the coefficients of the descriptive indicator of the entity in determining the development of the activities of business entities specializing in environmental protection. In this case, the deviation of the integral indicator of social entrepreneurship entities by district was determined by calculating the ratio of the indicator of the social entrepreneurship entity at the district level to the average value of the integral indicator of the social entrepreneurship entity at the district level.

The development of social entrepreneurship entities specializing in environmental protection operating in the districts of Namangan region and the growth of social entrepreneurship indicators at the district level are closely related to the socio-economic potential of the region.

In addition, our study extensively covered the specific aspects of managing and sustainable development of social entrepreneurship enterprises in our country through SWOT analysis (Table 2.4). SWOT analysis is one of the strategic planning methods, aimed at identifying internal and external opportunities and challenges in the development of the enterprise. This type of analysis consists of four categories: Strengths, Weaknesses, Opportunities, and Threats.

Table 1. SWOT analysis of social entrepreneurship development.

Strengths	**Weaknesses**
1. Solving existing social and environmental problems in society through entrepreneurs; 2. Reducing environmental pollution; 3. Creating new jobs; 4. Preserving natural resources; 5. Increasing innovation and investment potential; 6. Attracting investments from foreign funds and investors;	1. The high cost of using renewable resources; 2. The lack of funds in the sector; 3. The high share of income reinvested in the enterprise (currently 70%) 4. The low profitability of social entrepreneurship compared to other types of entrepreneurship; 5. The closure of environmentally harmful enterprises and the loss of jobs for employees;
Capabilities	**Dangers or threats**
1. Saving the part of the state budget allocated to social sectors through the extensive development of the social entrepreneurship sector; 2. Partial elimination of problems associated with waste disposal; 3. Using waste as a finished raw material; 4. Reducing the environmental and economic damage of thermal power plants using renewable energy;	1. People's indifference to environmental protection and socio-ecological problems; 2. Disruption of a healthy market environment by giving privileges to social entrepreneurship; 3. Strong competition in the industry in the world market; 4. Problems in attracting investments; 5. Technical and technological dependence of the development of social entrepreneurship on foreign countries

Today, there are a number of shortcomings and problems in the development of social entrepreneurship in our country. These include the high cost of using renewable resources, the lack of funds in the sector, the high share of income reinvested in the enterprise (currently 70%), the low profitability of social entrepreneurship compared to other types of entrepreneurship, the closure of enterprises that harm the environment and the unemployment of employees. However, there are also many advantages in solving existing social and environmental problems in society through entrepreneurs, such as reducing environmental pollution, creating new jobs, preserving natural resources, increasing innovative and investment potential, and attracting investments from foreign funds

and investors. Saving the part of the state budget allocated to social sectors through the broad development of the social entrepreneurship sector is an opportunity for the development of the sector.

The findings of this study reveal:

Environmental Impact: Recycling initiatives significantly reduced landfill use and carbon emissions.

Economic Performance: Businesses with structured assessments achieved higher ROI and operational efficiency.

Social Benefits: Recycling activities led to job creation and improved public awareness of sustainability practices.

Lack of standardized assessment methods.

Insufficient data collection and reporting mechanisms.

Solutions: Integrating digital tools, adopting global performance frameworks, and encouraging stakeholder participation.

Conclusion. Waste recycling businesses play a vital role in promoting environmental sustainability and economic growth. Assessing their effectiveness requires a combination of environmental, economic, and social metrics.

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