CHAPTER 4

# Disposal of Medical Waste in the COVID-19 and the Post-COVID Period

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## Introduction

As a result of the global coronavirus pandemic, factories and manufactures have been stopped, a substantial percentage of businesses have been suspended, and 3.38 billion people in 78 countries—43% of the world's population—are in self-isolation.

During the period of the pandemic, each country discovered the insufficiency of its established systems for sorting and recycling waste. The need to modernize the established measures for separation and disposal has thus become critical. A large amount of medical waste—including masks, gloves, napkins, and plastic bottles from under antibacterial agents—is going to landfills along with food waste; this is fraught with unforeseen biological consequences, or rather the complete infection of the area, and the inability to use these resources in the future.

Waste generation has significantly increased around the world in recent decades, and there are no signs of it slowing down. This is due to

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a number of factors, such as population growth, urbanization, and economic growth, as well as consumer shopping habits. In 2018, the total waste generated by the EU-27 from all economic activities and households amounted to 2.317 million tones for that one year alone, and by 2050 the generation of waste is predicted to increase to 3.4 billion tons (Neubauer, 2007).

The definition of "waste" is material which has been used: paper, plastic, glass, textiles, and metal packaging; this covers chemical, medical, household (food), and industrial waste. For a long time, there were three main technologies of waste disposal: landfills, incineration, or dumping into the ocean. Only in the second half of the twentieth century did the problem of ecology attract the planet's attention.

## Methodology

Being aware of the scale of damage that waste causes, all developed and developing countries aim to raise public awareness in the field of separate waste collection; most countries actively promote a "recycling" culture (Osipov et al., 2021). France has had a law banning the collection of unsorted household waste for more than 10 years, and The Netherlands has banned the disposal of organic waste. Regulations prohibiting or restricting the disposal of biodegradable organic waste in landfills have been adopted in Austria, Belgium, Denmark, France, Italy, Norway, and a number of other countries. However, the distribution of waste disposal, sorting, and recycling capacities is unequal across the union. Thus, Germany, France, The Netherlands, Sweden, Italy, and the UK have a share of about 75% of all incineration capacities in Europe (Seltenrich, 2013).

In the countries of the European Union, various measures are being taken to improve the waste situation. Germany uses a unique waste sorting system and is the European leader in waste recycling: One average German resident produces 618 kilograms of garbage per year. But 64% of all waste in this country is recycled or disposed of (Birkenstock, 2019). Sorting waste begins in citizens' homes, where at least 3 different garbage containers are installed. According to statistics, the German industry receives 14% of raw materials from waste. However, in Germany, there is another problem—the average German produces more garbage than the average European. Each resident of Germany in 2016 threw out 626 kg of garbage, while the European average is 482 kg per person (Birkenstock,

2019). The total turnover of all companies engaged in garbage collection in Germany alone is now about 50 billion euros per year. It is predicted that in ten years, the recycling market will play a more important role in the country's economy than the automotive industry today.

It is worth noting that the countries of Scandinavia are also not inferior to the EU. According to the local waste management association Avfall Sverige, 99% of household waste is disposed of in Sweden (TASS, 2017). The Swedes have learned how to effectively turn garbage into energy. More than 50% of municipal solid waste (MSW) is recycled and reused. Plastic, paper, and food waste are recycled or used for the production of biogas. Businesses are responsible for disposing of packaging and end-of-life goods, including electrical appliances, cars, and medicines. The remaining part of the waste—after careful sorting—is burned to produce energy, which plays a large role in the heating system.

At the moment, there are more than 30 incinerators in Sweden. In 2016, 2.3 million tons of garbage was burned to generate energy (TASS, 2017). The country even imports waste for incineration, including from Norway, the UK, and Ireland. The country has full control over sorting and processing. In such a society, no citizens would wish to break the sorting rules; most of the neighbors are familiar with each other, and in addition, there is a chairman of the condominium board who intervenes and puts things in order if something is wrong (e.g., if people overload containers with "other garbage" so that the garbage collectors refuse to empty them, they have to book an additional trip of the garbage truck for a fee). For convenience, there is a recycling center, where different types of garbage can be collected and organized, within walking distance of each residential building, with containers for collecting batteries as well as separate tanks for hard and soft plastic. This Scandinavian country is the leader in Europe in generating energy from waste.

As for Asia, Japan occupies a leading position in the processing of MSW (Ermolaeva, 2019). The principles of waste separation depend on the district and the requirements of the municipal authorities, and often the division occurs into 4 fractions: non-combustible, incinerated, recyclable, and large-sized. For each type of waste, special bags of a certain color and volume are designed, so that it is easier to distinguish what type of waste is in them. Special stickers are applied to large items. To ensure that everything is sorted correctly, the workers who service the garbage truck watch. The garbage collection machine arrives at certain hours. By the time of collection, the residents take out the bags, which

must be transparent so that the garbage collectors have the opportunity to check the correctness of sorting (the garbage is not accepted otherwise). Each type of waste is taken out exactly on the appointed day of the week, which is set by the municipality. For example, in the city of Kita-Kyushu, on Tuesday and Friday incinerated garbage is taken out, on Wednesday it is cans and bottles, and on Thursday packaging plastic is collected. On a day that is not intended for this type of garbage, it will not be accepted, and if the bags are left at the garbage truck they will issue a fine to the housing cooperative. To ensure that the guests of the country also observe the rules of separate collection, the Japanese have installed special urns on the streets: Holes in them are made to match the shape of what they are intended for. For a better understanding of what category of waste a particular container belongs to, all packages of goods have a label that makes it clear where to dispose of it. For example, on the packaging of yogurt, it is indicated that the lid should be thrown into plastic garbage, and the cup should be thrown into incinerated waste.

Japan recycles 90% of the waste, but is still concerned about this amount (Iida, 2020). According to statistics, the average Japanese person produces about a kilogram of garbage every day. To reduce the possible amount of waste to a minimum, the Japanese spread the idea of "mottainai": "Do not throw it away until you have used it completely." In the town of Kamikatsu, the government is introducing the idea of completely eliminating disposable goods. In 2003, the municipality began to actively implement a special structural reform aimed at reducing the number of disposable goods. Now, 60% of the population of Kamikatsu have made their choice in favor of reusable goods, which has significantly reduced the amount of waste. It is also worth noting that each merchant is required to report annually what they personally did to ensure that their customers make fewer purchase (e.g., selecting fewer plastic bags).

In Japan, the lack of widespread ecotechnoparks is compensated by garbage "clusters" and factories, and according to the law on the efficient re-use of resources, manufacturers are required to disassemble their own products and recover raw materials (return part of the materials or energy for reuse in the same technological process). Thus, 98% of the metal in Japan is obtained from recycled materials. In Tokyo, with a population of more than 13 million people (with an agglomeration of about 38 million people), 0.2% of the waste is processed into recyclable materials, and 0.8% is processed into energy.

It is worth noting that Japan is one of the first countries that began to form a zero-waste culture, linking the waste processing industry with pleasant associations. In this regard, in Osaka, the Maishima factory was designed as an entertainment complex by the artist Friedensreich Hundertwasser. The main function of the plant is the processing of waste into energy; in addition, however, the complex also included a rehabilitation center for the disabled, which gives the project social significance.

From all of the above, it is worth concluding that every modern developed country that cares about the future is trying to contribute to the preservation of the Earth and the improvement of the environmental situation in a global sense.

The situation in Russia is somewhat different. The Russian Federation is in the top 3 countries that produce household waste (the United States leads, with China second). In total, the country generates about 5.4 billion tons (the average annual value for the period 2013–2017) of household, agricultural, industrial, and other types of waste, of which 55–60 million tons are MSW; this amounts to about 400 kg of waste per person per year. The vast majority of raw materials are sent to landfills; in 2018, there were 5 million hectares of landfill, yet according to forecasts, this will increase to 8 million by 2026. Thus, the annual increase is 0.4 million hectares (the total area of Moscow and St. Petersburg).

Unfortunately, only about 7–8% of the collected MSW is involved in the economic turnover; the rest of their volume is sent for disposal. A small percentage of waste reuse is associated with insufficient infrastructure development: currently, 243 waste reuse complexes, 53 waste sorting complexes, and about 40 thermal recycling plants operate in Russia.

In accordance with the Decree of the President of the Russian Federation №204 "On National Goals and Strategic objectives for the development of the Russian Federation for the period up to 2024," the national project "Ecology" has been developed (National project "Ecology", 2019), within the framework of which federal and relevant regional projects for the period 2019–2024 are planned for implementation. Now all the work on the removal and disposal of garbage is aimed at increasing the volume of recycling and the reclamation of old landfills. The regional operator will manage the entire process.

Since January 2019, Russia has introduced a new system for handling MSW. The principles and mechanisms of garbage collection, sorting, recycling, and disposal have changed. The main goal of these innovations is to

solve the problem with landfills, increase the number of processing facilities, and reduce social tension. At the moment, the most popular method of waste disposal among the regions of Russia is landfill, which is highly toxic and ineffective and clearly does not fit the concept of the Ecology project.

## Results

### *COVID-19 Pandemic and Its Effect*

There has been much discussion around the purchase of medical masks. Their effectiveness in protecting against COVID-19, according to experts (Desai & Aronoff, 2019), has not been proven; according to most virologists, they must be changed every two hours when worn in conditions of constant communication with infected people (primarily doctors) or visiting crowded places. The situation is similar with disposable gloves, which are needed when traveling on the subway and visiting grocery stores (Greenhalgh, 2020).

The European Union has introduced special measures for the duration of the pandemic. In the UK, Italy, and France, they refused to separate the collection for the time of the coronavirus. All household waste automatically became potentially hazardous medical waste, which had to be collected in double bags to avoid contact with animals. It was also recommended to throw out the bags no earlier than 3 days, and if there are symptoms of COVID-19, leave the waste at home until the test results are received. At this time, Germany issued recommendations for separated collecting waste: all waste, except glass, should be thrown into a tank for non-recyclable raw materials.

The United States—the leader in the number of cases—also suspended the movement of RRR (reduce, recycle, reuse) in a number of states. Those who wish to collect waste separately are invited to store "clean" waste at home; the collection and transportation of such waste from homes are now suspended. Eco-friendly recycling programs have been scaled back in almost all major US cities.

In Wuhan, China, medical waste has increased sixfold. Before the epidemic, the volume of medical waste was 40 tons of medical masks, gloves, and protective suits; now it has increased sixfold and reaches at least 240 tons. Recycling technologies are not used for such waste.

A similar rapid growth of medical waste is recorded in Russia. Since the introduction of the self-isolation regime across the country, garbage collection companies and cluster workers have recorded an increase in the amount of household waste (Salikhov, 2020). In Omsk, the volume of garbage increased by 30%, in Kazan by 20%, and in Ufa by 45% on average. According to experts, the coronavirus can survive for five to seven days in waste and on surfaces that an infected person has touched. This applies to plastic bottles, aluminum containers, and medical masks. Rospotrebnadzor (Russian State Service of consumer rights protection) made recommendations regarding the suspension of the sorting centers. This is due to the fact that manual labor is mainly used on sorting lines. Accordingly, this can provoke infection.

Plastic waste has another problem, which is only indirectly related to the COVID-19 pandemic. Plastic recycling is becoming unprofitable. This is due to the fact that oil is becoming cheaper, and processing is quite a costly process. It is easier for manufacturers to make new plastic from cheap raw materials than to buy an expensive result of processing.

Thus, an analysis of existing solutions for system waste collection (Table 4.1) was carried out, with the aim of implementing them to minimize the consequences of the coronavirus pandemic in the Russian Federation.

Thus, it was chosen to consider the Ecotechnopark (ETP) option in more detail for the following reasons:

1. The solution is complex: The Ecotechpark will collect not only hazardous types of waste (masks, gloves, plastic packaging) but also normal waste (no less important for processing); multistage sorting, processing, and production from recyclable materials;
2. This approach will improve the current system—sorting centers and vending machines have already been introduced in some cities of Russia for the separate collection of aluminum and plastic containers (even if often only bottles), but a large percentage of Russian cities are not yet sufficiently equipped with these tools;
3. The issue of separate waste collection should be approached gradually. At the moment, the population is not ready to independently deal with waste sorting. Ecotechnopark will solve this problem with the help of residents, educational and entertainment events held for training based on the ETP, and cooperation with large companies.

**Table 4.1** Analysis of technological solutions for waste collection applicable in Russia

| *Options of sorting waste* | *Advantages* | *Disadvantages* |
|---|---|---|
| *Sorting points* | | |
| Household collection points (bins for waste paper, waste for sorting: colored glass, porcelain, metal, cardboard, wrapping paper, empty bottles, batteries, colored napkins, plastic, biowaste, unsorted and non-recyclable waste) | Convenient location; a gradual introduction of the population to the problem; the average cost is 14,000 rubles (plastic waste bin with a volume of 240 liters is designed to separate various household waste into four fractions) | Cluttering often occurs because the flow and removal of garbage is irregular; due to the lack of knowledge and culture among the population, incorrect sorting is possible, which will affect the quality of recyclable materials; it is necessary to sort and process garbage in advance, otherwise this raw material will not be accepted for processing |
| Quarter waste bins (a chain of 10–15 containers of different colors and with different inscriptions, made of steel or plastic, sorting waste into fractions) | Convenience of quarter boxes being distantly located from crowded "points," which allows tanks to have a large volume; collections can be organized less often with the possibility of shipment of larger vehicles | A well-functioning system is needed so that people collect waste at home, accumulate it, and take it to a certain place |

(continued)

The key task of the emergence of an Ecotechpark as an investment object will be the development of a system for processing and neutralizing medical waste, with the introduction of the latest technologies and attracting the potential of scientific and educational institutions, as well as the creation of an economic zone with a special tax regime.

**Table 4.1** (continued)

| *Options of sorting waste* | *Advantages* | *Disadvantages* |
|---|---|---|
| Bulky reception stations on the street, at churches, and near parking lots (collection of clothes, shoes, toys, bulky items/accessories, and household appliances) | Convenient location with places of permanent use and long-term stay | A well-functioning system is necessary so that people collect waste at home, accumulate it, and take it to a certain place |
| Tanks in stores (for glass bottles, plastic of a certain category, batteries, light bulbs) and in pharmacies (for expired medicines, etc.) | Convenient location with places of permanent use and long-term stay; it is possible to carry small portions of hazardous waste, without the need for disposal | It is necessary to regularly and fully educate the population on the collection of this type of waste, since much belongs to hazardous types (unusable batteries and accumulators; expired medicines and vaccines; paints and varnishes; car tires; polyethylene; mercury lamps; thermometers, etc.) |
| Fandomats in educational institutions, residential buildings, parking lots, gas stations, train stations, and metro stations | Solves the issue of convenience—can be located in any room or area equipped with a protective coating, equipped with sensors and holes designed for a certain type of waste; most offer "incentives" in the form of bonuses for certain products | The cost of the equipment is about 300,000; the issue of installing these devices has not been legally resolved; this is happening at the initiative of the manufacturer of fandomats |
| *Seasoned and initiative collection points* | | |

(continued)

**Table 4.1** (continued)

| *Options of sorting waste* | *Advantages* | *Disadvantages* |
|---|---|---|
| Waste collection points organized monthly | Collection of rare seasonal waste for recycling | This must be a place that is both convenient and functional, which is easier to do right away at the sorting base; the amount of waste may be insignificant for further processing; the collected waste will have nowhere to recycle due to the absence of this type of recycling center |
| *Sorting centers* | | |
| Mobile centers | Convenient location with places of permanent use and long-term stay; can be located in parks, on beaches, and other places of active recreation; serviced with the same regularity as house bins, larger volume; ease of removal from the territory (park area, camp, beach, etc.) | An unpopular type of separate collection; in Russia there are no suppliers of these centers; the cost is higher than average |

(continued)

The necessary finances for the implementation of the ETP project are currently estimated at 500 million rubles. This amount is necessary to launch the project; the further process will be automated within the system and additional financial resources will not be required.

**Table 4.1** (continued)

| *Options of sorting waste* | *Advantages* | *Disadvantages* |
|---|---|---|
| Ecoparks and Ecotechparks | Provide the ability to perform all operations from collection and sorting to overproduction and the creation of new products; requires an only initial investment, then works autonomously; ensures the collection of the maximum number of waste fractions; performs the functions of a production unit, a research center, and an educational site; provides jobs for more than 400 people | Expensive (in Russia the average cost of a project is about 18.3 billion rubles); requires a large number of resources (financial, labor, etc.); requires an area of 10 hectares and well-established logistics |

*Source* Created by the authors

The project's production capacity of 300,000 tons—including 200,000 tons of solid waste per year—assumes the production of electricity for the ETP's own needs, which also provides the possibility of organizing a closed system.

The estimated cost of the project is 500,000 thousand rubles. The area required for an ETP with 4 greenhouses (for growing vegetables on fertilizer from recycled materials) is 10 hectares.

The advantages of the Ecotechpark include:

1. The absence of emissions from highly toxic secondary products formed during the incineration of garbage at low temperatures—dioxins, furans, Benz(a)pyrenes, etc.;

2. The dimensions of the sanitary protection zone are less than the normative ones and are within the boundaries of the allocated building area;
3. Its nature—it is a completely land-free method of the disposal of waste;
4. The modularity of the equipment and the ability to quickly increase productivity at the request of the customer by adding new modules;
5. The creation of new jobs;
6. The equipment used is of Russian production.

The project has a complex business model: manufacturer-aggregator-franchise. At the initial stage, the priority is about services for waste processing, as well as the production of organic fertilizers. In the future, the focus will be more on the service segment—amplifying the provision of residency and developments in the field of environmentally friendly production, as well as becoming an educational and event platform. The next step will be the registration and sale of licenses—the franchise business model.

## Discussions

There are several solutions for disposing of medical waste in the COVID-19 and post-COVID period, such as incinerators, using old and modern technologies (Sweden, Japan, Germany), modern landfills (Denmark, Norway, Sweden), etc. However, this list does not name any of ecological element. This article sets out to present a project that can be a worthy option for currently operational systems.

For this project, several types of risks were considered: technical, economic, political, associated with ensuring safety; these were analyzed with Bow Tie, SWOT, FTA, ETA, and a review of risks with possible measures to prevent them.

1. Technical risks

   A lack of practice using large-scale equipment for high-temperature super-adiabatic combustion in Russia and around the world. To reduce the technical risks herein, the plan is to use Russian equipment.
2. Economic risks

Possible costs due to the absence or delay of payments from suppliers for waste disposal; the risk associated with the inability to implement the investment return schedule (lack of waste, unforeseen costs). Economic risks can be mitigated through the following measures:

- Ensuring a stable supply of waste through the conclusion of contracts with factories and industrial enterprises;
- The volume of daily deliveries of waste should be at least 600 tons per day and up to 300,000 tons per year;
- Development of the transport structure of the enterprise to ensure a guaranteed supply of raw materials (commercial waste) and export of finished products.

3. Political risks

   The likelihood of losses due to political decisions/changes. The successful implementation of the project is a factor in strengthening the political course aimed at developing, strengthening, and stabilizing market transformations (Osipov, 2021a, 2021b). With the most unfavorable political changes, this project is supported by the interests of solving environmental problems associated with the disposal and recycling of waste, both newly formed and existing landfills.

4. Risks associated with ensuring security at the facility

   Potential disruptions or complete shutdowns caused by sabotage, interference, and natural disasters.

These risks can be prevented by:

- providing round-the-clock security of the plant territory with a pass entry and exit system;
- establish a system for protecting commercial secrets at the enterprise;
- organizing the principle of organizing the work of emergency teams.

### *Analysis*

The FTA of the project takes into account the quantitative characteristics of each event (risk). Fault Tree Analysis (FTA) is a technique for identifying and analyzing factors that can contribute to the occurrence

of a specific undesirable event (risk, defect). This analysis is carried out sequentially, in a hierarchical order from the "final" event to the "basic" ones, which are the primary causes of risk development. Each event has its own probability of occurrence, calculated by the project manager, risk owner, or risk manager. A fault tree is used to identify and evaluate probable events leading to a risk (defect). The analysis can be carried out at any stage of the project (initiation, selection, development, implementation). For example, at the initiation stage, an undesirable event is analyzed in detail, working through as many events as possible in order to choose the most suitable option for the development of the project. At the selection stage, the risk can be considered with an emphasis on the unwanted reactions of the interested parties (stakeholders) involved in this process. Undesirable events at the development stage mainly relate to the technical process, such as a lack of resources, the departure of key members of the organizational group, etc. Risks regarding the implementation of the finished product are considered in order to identify the reasons associated with the lack of support from users, the government, and other stakeholders.

Figure 4.1 shows an integrated tree: ETA and FTA results, sorted by project stage. Event Tree Analysis (ETA) is a graphical method that displays a sequence of mutually exclusive events with the likelihood of occurrence in order to prevent unwanted consequences. This analysis is used to model project processes to identify the most favorable scenario. The input data are the initiating event, its causes, and the probability of these events occurring. The Integrated Tree, in turn, combines Fault Tree Analysis (ETA) and Event Tree Analysis (FTA). This presentation option is necessary to simplify the perception of the overall picture of project risks.

Also, a SWOT analysis of the ETP project was carried out in order to identify risks, weaknesses, and opportunities, highlight strengths to prevent them, and reduce the impact (Popova, 2020).

- Legend: S-strength, W-weakness, O-opportunity, T-threat.
- Ratings: Z-importance, P-certainty, V-significance (calculated as Z * P).

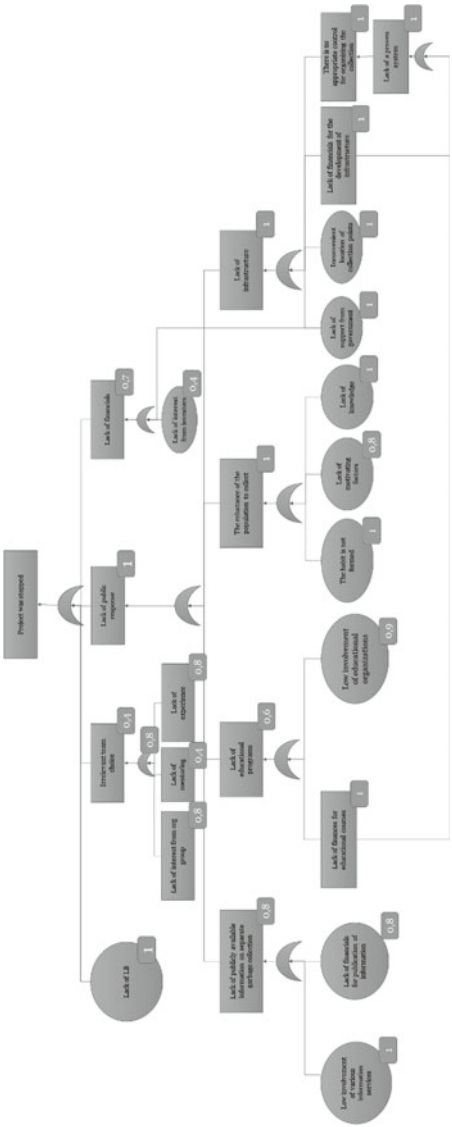


**Fig. 4.1** Integrated "tree" of project events (*Source* Created by the authors)

Each factor is assessed taking into account its significance: V is an assessment of its importance for doing business, taking into account the certainty of this assessment (i.e., the probability that it is erroneous).

For each of the fields of the SWOT matrix, the arithmetic mean score U is derived. The introduction of these estimates allows, among other things, to display on the diagrams the significance of strengths, weaknesses, opportunities, and threats, to compare them with each other, and to visually assess the attractiveness of the starting position of a new business.

Strengths U = 90.7

- S1: Circular Economy: Z = 10; P = 10; V = 100
- S2: Cost is below the market average: Z = 10; P = 9; V = 90
- S3: Unique technology for biogas production: Z = 10; P = 10; V = 100
- S4: Production capacity: Z = 10; P = 9; V = 90
- S5: The project is suitable for national goals (including the National Project "Ecology"): Z = 10; P = 10; V = 100
- S6: Variability of ETP configuration for regional requests: Z = 8; P = 8; V = 64

Weaknesses U = 32

- W1: Unknown in the market: Z = 4; P = 4; V = 16
- W2: Financial resources of RUB500 million are required to start the project: Z = 7; P = 9; V = 63
- W3: Lack of project management experience: Z = 6; P = 4; V = 24
- W4: Financial Management: Z = 5; P = 5; V = 25

Opportunities U = 81.6

- O1: Entering the markets of the CIS, Asia, and around the world: Z = 10; P = 10; V = 100
- O2: Entering new markets—fronting: Z = 8; P = 9; V = 72
- O3: Implementing new technologies: Z = 8; P = 8; V = 64
- O4: Expanding the product range: Z = 9; P = 8; V = 72
- O5: Creating a high-tech cluster in the field of green technologies: Z = 10; P = 10; V = 100

Threats U = 69.8

- T1: No investor to start the project: Z = 10; P = 10; V = 100
- T2: Global Force Majeure: Z = 6; P = 4; V = 24
- T3: Deterioration of the Russian economy: Z = 7; P = 9; V = 63
- T4: Frame leak: Z = 10; P = 10; V = 100
- T5: Change of the governing body of the project: Z = 10; P = 10; V = 100
- T6: Political risks: Z = 4; P = 8; V = 32

This analysis is visually presented in the diagrams in Fig. 4.2.

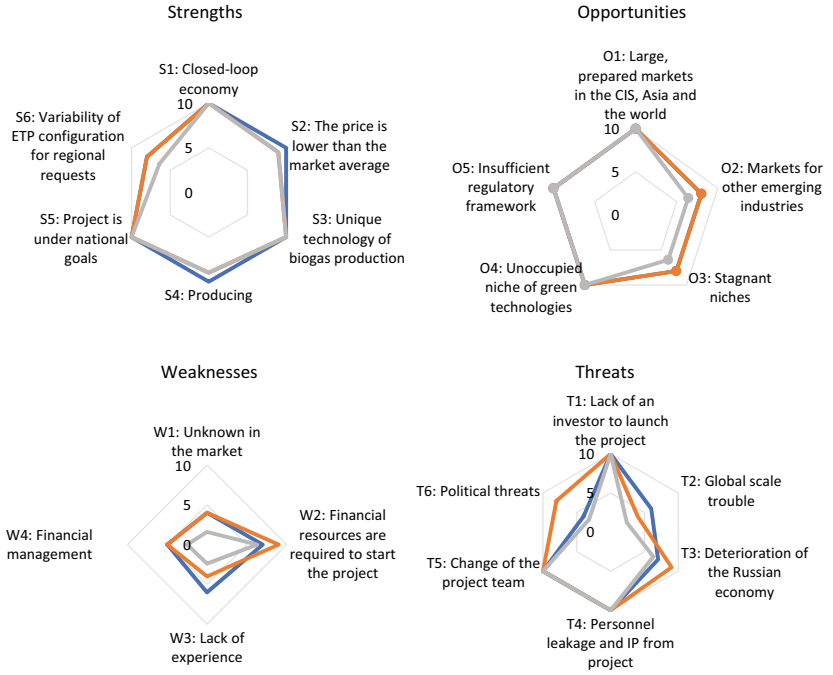


**Fig. 4.2** SWOT-analysis of the ETP project (*Source* Created by the authors)

*Competitor Analysis*

Analysis of the competitor's environment allows the action of the organization to be planned, choosing a strategy to get the maximum effect from the activity based on the strengths and capabilities of the project, reducing the impact of risks and weaknesses. The analysis of possible competitors in the same field of the project is presented in Table 4.2.

The purpose of this analysis was to identify existing, ongoing, and planned projects, the main activity of which is the sorting and processing of waste with further production.

*Economic Indicators*

The total capital expenditures for construction are determined in 2019 prices in the amount of 430.5 million rubles in Table 4.3.

The calculation took into account tax and insurance contributions required to be paid by LLC in accordance with Federal Law No. 209-FZ of July 24, 2007 "On the Development of Small and Medium-Sized Businesses in the Russian Federation" (Tax Service of the Russian Federation, 2020). The data is relevant at the time of the situation with COVID-19, which does not allow for determining the exact tax rates for the project and may vary.

The key indicators of the project are:

1. Cost price—430.5 mln rub.
2. IRR—21.2%
3. Revenue—815.6 mln rub.
4. Payback period
5. Job places—400–450 people
6. Capacity—300,000 tones/year waste, including 200,000 tones/year solid waste
7. Area (with 4 greenhouses)—20 hectares
8. Products—recyclable materials, fertilizers, heat and electricity, biofuels (synthesis gas, biogas, pellets, briquettes, etc.), building materials (plastic pipes, rubber chips, polymer-sand products, crushed stone, eco-cotton, etc.), products from recycled materials (toilet paper, buckets, garden tools, children's playgrounds, etc.), and organic farming products (cucumbers, tomatoes, herbs, peppers, strawberries, radishes, etc.).

**Table 4.2** Comparison table for competitors

| *ETP* | *Location* | *Operation* | *Production* | *Price (bil. rub)* | *Product* |
|---|---|---|---|---|---|
| Ecotechpark KALUGA | Kaluga | Recycling and sorting of garbage | 500 (10^3 tones/year) | 25 | Ferrous and non-ferrous metals, glass, paper, plastic, electronic scrap |
| Ecotechpark BUMATIKA | Perm | Complex for sorting, temporary storage, and disposal | 300 | 4.9 | Paving slabs, paving stones, fence caps, eco-wool, PET granulate, heating oil |
| Ecotechpark Ryazanskiy | Ryazan | Recycling, disposal of solid waste | 245 | 3.4 | Industrial products, compost from biological waste—food and other liquid waste, alternative energy and fuel, textile wool and threads, waterproofing material, rubber granules for children's and sports grounds, bitumen, crushed stone, cardboard, glass, metal, polyethylene raw materials, fuel briquettes |
| Ecotechpark (project) | Saint Petersburg, Vladivostok | Collection, sorting, processing, production, research | From 300 | 0.5 | Cement, tools, agricultural products, fertilizers, food products, fuel, construction parts |

*Source* Created by the authors

**Table 4.3** Costs of the ETP project and taxes required to be paid by the project

| *Name* | *Costs (rub)* |
|---|---|
| Planning | 39,680,900 |
| Civil works | 66,724,100 |
| Installation of equipment | 17,884,600 |
| Commissioning works | 20,035,000 |
| Waste processing complex equipment | 286,214,500 |
| **Total** | **430,539,200** |
| *Taxes* | *Rate, %* |
| VAT (USNO applies) USN | 0.0 |
| USN | 6.0 |
| FOMS (SME entity) | 5.0 |
| FOPS (SME entity) | 10.0 |
| FIU (as a resident of Skolkovo) | 14.0 |
| FSS in case of temporary disability and in connection with maternity | 0.0 |

*Source* Created by the authors

From an analysis of these, the effectiveness of the implementation of such tools in Russia can be concluded.

## Conclusions

The proposed solution of the "Ecotechnopark" project is an effective, socially necessary, multifunctional complex that will be implemented under the national goals and the Ecology project in the fight against a dangerous, deadly virus. Critical tasks for the disposal of hazardous waste can be implemented; this will protect the population throughout this difficult social situation. The project was positively evaluated by ITMO (Saint Petersburg) and FEFU (Vladivostok) universities and accepted for the implementation of processing plants in the Leningrad Region of the Russian Federation.

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