

**FEASIBILITY STUDY OF THE INNOVATIVE PROJECT
"PROTECTION AND DURABILITY OF ROLLING BEARINGS
OPERATING IN ALL SECTORS OF THE GLOBAL ECONOMY"**

1. INTRODUCTION

THE WHOLE WORLD TURNS ON ROLLING BEARINGS

PROJECT

"Protection and durability of rolling bearings operated in all sectors of the global economy"

Organization name: Small enterprise "FAN"

Legal address: Uzbekistan, 150102, Ferghana, A. Yassaviy, 40b, 44.

Year of foundation: 1992.

Main activity: development and implementation of innovative projects.

Number of employees - 15 people

Contact person: Lee Vladimir

Position: director and project manager

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2. SUMMARY OF THE PROJECT

The project is proposed to increase the durability and reliability of rolling bearings used in all sectors of the economy of any country.

Achieving this goal is carried out by protecting the rolling bearings with the innovative LIZA material.

Practice has established that 1% anthracite dust in the lubricant causes an increase in the wear rate of gear parts by 2-3 times, and the presence of 2% sandstone dust - more than 30 times (Tregubov N.M. et al. Repair of mining machines. M., Nedra, 1978, p. 58).

To an even greater extent, this statement applies to bearing assemblies. Thus, equipment that should be operated for one year (8760 hours) fails after 12 days (8760 : 30 = 292 hours ≈ 12 days). LIZA materials are developments made at the level of inventions and patented in the Republic of Uzbekistan (patents No. 4740, 5967, 2013, 6044). Patent owner - Lee V.P. and small enterprise "FAN".

The World Intellectual Property Organization (Geneva) examined patent No. 5967 and recognized it as a world-class invention, international publication number - **WO 97/25544**.

On the Russian site: <http://втораяиндустриализация.рф.рф/zashhita-podshipnikov/> LIZA material is included in the reference book of domestic (Russian) breakthrough technologies. This handbook includes developments that:

1. Can be implemented everywhere;
2. Do not require significant investments for their implementation
3. Significantly reduce technological costs;
4. Provide a multiple reduction in the cost of production (10 or more times);
5. Repeatedly increase the service life of operation and reliability of equipment;
6. Achieve a multiple increase in labor productivity;
7. Many times reduce losses, useless and harmful costs in the economy.

The LIZA material was included in the collection “Perspective Objects of Intellectual Property” of the Agency for Intellectual Property of the Republic of Uzbekistan (Tashkent, 2002, p. 50).

The development is included in the catalog of the VIII Republican Fair of Innovative Ideas, Technologies and Projects (Tashkent, 2015, p. 63).

The LIZA material made it to the semi-finals of the Open Innovations Startup Tour - 2017 in Astrakhan, the largest event of the Skolkovo Innovation Center to search for the most promising innovative projects in Russia and the CIS.

Prime Minister Aripov A.N., in 2017, at the X Republican Fair of Innovative Ideas, Technologies and Projects, by his order included this development in the list of the 12 most effective innovative projects to be implemented as a priority in the economy of Uzbekistan.

In 2020, SE "FAN" received admission and took part in the Russian Forum "OPEN INNOVATIONS STARTUP TOUR 2020" in the "Competition" section.

In 2021, this development was presented at the "OPEN INNOVATIONS STARTUP TOUR 2021" Forum in the Exhibition section, <https://2021.startup-tour.ru/exhibitors?page=5>.

In 2022, the innovative project of SE "FAN" was again admitted and presented at the Forum "OPEN INNOVATIONS STARTUP TOUR 2022" in the "Exhibition" section, <https://startup-tour.ru/exhibitors?page=2>.

In 2023, this development was presented at the "OPEN INNOVATIONS STARTUP TOUR 2023" Forum in the Exhibition section, <https://startup-tour.ru/exhibitors/13>.

In 2023, the small enterprise "FAN" received the status of resident of the «INNO» technology park under the Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan.

In 2024, the innovative project of SE "FAN" was again admitted and presented at the Forum "STARTUP TOUR 2024" in the "Exhibition" section, <https://startup-tour.ru/exhibitors/80>.

LIZA antifriction materials are designed to protect rolling bearings from any abrasive particles and aggressive media, from the negative effects of various atmospheric factors.

Abrasive substances in the form of dust, sand, sawdust, fibers, various contaminants and aggressive media in the form of solutions of acids, alkalis, salts during operation penetrate into the bearing units of the equipment and cause catastrophic wear, corrosion, which leads to a quick failure of the bearings and stopping the entire production, line, complex, conveyor, etc.

In fact, abrasives are a **micro grinder** (angle grinder), which penetrated into the bearing and extremely quickly does its dirty work.

LIZA material is an impact-resistant oil and petrol-resistant composition that is long-term resistant to atmospheric factors, various aggressive media in the form of solutions of acids, alkalis and salts.

Temperature range limit of operation of the LIZA material is in the range from -40 to $+130^{\circ}\text{C}$. LIZA material is certified, environmentally friendly, non-toxic, slow-burning and fire-, explosion-proof material. The bearing industry produces standard bearings with shields and seals, unfortunately in a limited range of dimensions. The small enterprise "FAN" has developed a technology **for protecting rolling bearings of any size**.

LIZA material can also protect ball bearings of a heavy series, single-row tapered roller bearings, double-row spherical ball and roller bearings, support ball and roller bearings, cassette

and roller bearings of axle boxes of railway cars, track rollers of caterpillar vehicles, which are produced by open-type bearing plants.

When using standard bearings with shields and seals, abrasive substances, aggressive media still penetrate into the bearing cavity through the gap between the inner ring and the seal, causing wear and failure.

When applying this development, a gap remains between the bearing and the LIZA material, measured in tens of fractions ($0.1 \div 0.5$) of a millimeter. This gap, which can be adjusted, is filled with grease, which also makes it difficult for foreign particles and substances to enter the bearing cavity.

The essence of this development is the creation in the cavity of a standard bearing of a labyrinth seal, which works very reliably under difficult operating conditions.

Labyrinth seals require high precision manufacturing and are difficult to production and relatively expensive (metal), but provide effective protection of bearing units and therefore are widely used.

The compacting effect of the labyrinth device is based on the creation of a small gap of complex tortuous shape between rotating and stationary parts node.

These seals have significant advantages over felt and lip seals:

- low internal friction of the lubricant;
- absence of wearing parts;
- low demands on their care;
- unlimited peripheral shaft speeds.

The cost of the technology for protecting rolling bearings with LIZA material is an order of magnitude lower than the cost of the bearing itself.

For example, by protecting the fully open bearing 6305 with a 17 g LIZA material, worth **1000 soums**, we increase the durability of this bearing from 1.5 to 7 times.

The cost of bearing 6305 currently ranges from **15,000 to 27,000 soums**.

The development is very promising from an environmental point of view: the lubricant embedded in the bearing with the LIZA material is an order of magnitude less than the lubrication norm recommended for bearing assemblies of industrial equipment.

For example, a bearing with an inner diameter of 25 mm, according to current standards, requires **100 g** of lubricant, and a bearing with a LENS of the same diameter contains only **2÷4 g** of lubricant, quite sufficient for long-term and reliable operation of the bearing due to the almost perfect tightness created by the LIZA material.

The bearing cage is an armature for the LIZA material and therefore it rotates together with the cage. The rotation of the LIZA material occurs regardless of whether the shaft (i.e. the inner ring) or the outer ring of the bearing rotates.

When the LIZA material rotates, an effective centrifugal force arises, which instantly rejects any particles and media that seek to penetrate the bearing.

Therefore, the sealing properties of the LIZA material are much more effective than the protective washers and seals of standard bearings.

The effectiveness of the development is evidenced by the fact that in the 80s the Socialist Industry newspaper, together with the USSR State Committee for Science and Technology, the State Committee for Inventions, the Central Council of All-Union Society of Inventors and Innovators and Exhibition of Achievements of the National Economy of the USSR, took

patronage over the introduction of eleven promising developments, one of which was the AFZ-3 antifriction filler for rolling bearings.

The economic effect of one bearing with AFZ-3 material ranged **from 3 to 466 rubles (\$)** at a bearing price **of 30-39 kopecks (¢)**, ("Today, tomorrow and every day" According to the pages of the Socialist Industry newspaper 1969-1989, M., 1989, pp.162-163).

Unfortunately, bearings with AFZ-3 material due to its fragility (during transportation, installation and operation), they did not go into mass production. Also, bearings with this material are intended only for low-speed friction units (**100÷300 rpm**), since they operate in a purely dry friction mode, which is categorically unacceptable for bearing units of any equipment.

The technological process of protecting bearings with AFZ-3 material is laborious: processing of each bearing on a lathe and simultaneous purging with compressed air is required.

The world leader in the bearing industry, the Swedish company SKF, produces bearings with Solid Oil antifriction filler, which contains liquid oil.

Unfortunately, judging by the publications, this development is also intended for low-speed units, since the gap between the rolling elements, rings and Solid Oil filler is characterized as a micro gap.

At high speeds, bearings with this material will definitely keep warm. It should also be taken into account that liquid oils are used in 10% of bearing assemblies, and the remaining 90% are lubricated with greases.

It is also worth considering that it will not be possible to organize the production of bearings with Solid Oil, while the introduction of LIZA material at any single enterprise can be carried out within 10-15 days, since the technology does not require investments and special equipment.

The effectiveness of the use of impact-resistant material LIZA has been repeatedly confirmed by acts of industrial testing and implementation at a number of large enterprises in Uzbekistan:

1. Navoi Mining and Metallurgical Combine;
2. Almalyk Mining and Metallurgical Combine;
3. JSC "Akhangaranshifer";
4. Uzbek plant of refractory and heat-resistant metals;
5. JSC "Kuvasaycement";
6. Almalyk Production Association "Ammophos"
7. Navoi Construction Department;
8. JSC "Akhangarancement".

The service life of bearings with LIZA material in friction units of various equipment of these enterprises increased from 1.5 to 7 times.

The economic effect of the LIZA material on the conveyor line (CLT) of the Navoi Mining and Metallurgical Plant alone, calculated by the plant on the basis of its own acts of industrial testing of this material, is **5 billion soums ≈ \$2 million.**

The length of this conveyor line is 10 km, the width of the belt is 2000 mm, 30,000 rollers work on the conveyor, i.e. 60000 bearings 6310 (https://youtu.be/v7SvBf5pe_A). The service life of rollers on bearings with LIZA material increased by **4 times.**

Enterprises of the mining, mining and processing, oil and gas, coal industries, enterprises for the extraction of non-metallic materials and other industries use large-sized radial spherical double-row roller bearings.

These bearings are characterized by high cost and scarcity. To protect bearing 3656 (22356) worth 400 thousand rubles, 3 kg of LIZA material is needed. If the durability of such bearings with LIZA is increased by 1.5 times, then from an investment of **2 thousand** rubles (the cost of protecting the bearing), the effect will be at least **200 thousand** rubles.

Per Arnold Elgqvist Olsson, former Mechanical Engineer from SKF (bearing industry leader), on the website:

<http://ru.bearing-news.com/bearing-reliability-tips-part/1>,

<http://ru.bearing-news.com/bearing-reliability-tips-part-2/> in Postulate No. 8 writes: Conclusion:

Use **sealed bearings as often as possible!**

Our YouTube video: <https://youtu.be/B20pc7GDH6U> It shows that this statement is outdated and clearly proves that bearings with LIZA material are **many times** more durable than **standard bearings with a seal**.

In this video, the standard rolling bearing 6305 2RS (with a protective seal) worked for **only 38 seconds** when exposed to pure abrasive sand, and the bearing with LISA material worked for **more than 7 minutes**, i.e. more **than 10 times**.

The most striking confirmation of the effectiveness of the use of LIZA bearings is the results of their work on the pulsators of the mill equipment of the Central Mining Department of the Navoi MMC.

According to the existing technology, the standard bearings in this unit are lubricated automatically twice an hour. And the bearings from LIZA were immediately disconnected from centralized lubrication after installation and worked for **7,400 hours (10 months)**.

During this period of time, 1 ton of lubricant was saved on three pulsators (6 bearings 6209 with LIZA).

I.e. 6 bearings 6209, protected by 200 g of LIZA material, with a total cost of **10 thousand soums**, gave an economic effect of **38 million soums** (the price of 1 ton of Aeroshell Grease 6 (SHELL), Unirex S 2 (Esso), Energrease LCI, LT 2 (British Petroleum) lubricant at this time) and prevented contamination the environment.

The technological process of protecting rolling bearings with LIZA material was developed by the small enterprise "FAN", is its property, includes know-how.

Two employees who have mastered this technology can meet the annual demand of a single enterprise for such bearings. A unique feature of this development is the speed of implementation: 10÷15 days, since this innovative technology requires virtually no investment and special equipment.

The equipment necessary for the protection of rolling bearings with LIZA material is not in short supply and is used at all ordinary enterprises (a drying laboratory cabinet, a drilling and a lathe).

The implementation of this invention corresponds to the following formulations:

- Energy efficiency, resource and energy conservation;
- Protection of bearing assemblies of various vehicles, equipment, machines, mechanisms and devices;
- Technologies and technological processes of mining, mining and processing, oil and gas, coal, chemical industries, extraction of non-metallic materials, construction materials industry;
- Underground mining operations;
- Application and improvement of conveyor lines;
- Reducing the cost of production;
- Environmental protection and saving of energy and material resources;
- The use of industrial products with increased durability;
- Reduction of repair and labor costs during the operation of various machinery and equipment;
- Bearings of all sizes can be protected with this technology.

The development can be exported to other countries.

3. PROSPECTIVE AND SCOPE OF PROJECT IMPLEMENTATION

3.1. The scope of the project is extensive, since rolling bearings are used in all sectors of the economy of any state.

3.2. In the mining, mining and processing, oil and gas, coal industries, enterprises for the extraction of non-metallic materials, the use of bearings with LIZA is promising due to the fact that the equipment of these industries is constantly exposed to the negative influence of abrasive substances, they work in atmospheric conditions, as a result of which they have a short service life.

3.3. It is also necessary to take into account that the equipment of these industries is characterized by large dimensions and, of course, bearings of appropriate sizes. LIZA material can protect bearings of any size.

3.4. In the construction industry (reinforced concrete plants, house-building plants, building materials plants, mines, sand pits, mines, cuts) associated with the extraction of sand, gravel, crushed stone, clay and the production of cement, brick, cement and concrete mortars, mixtures, i.e. e. abrasives, the implementation of this invention will also be very effective.

3.5. In the agro-industrial sector, the use of LIZA material in the bearing units of agricultural machinery, which in the process of operation experiencing constant exposure to soil, sand, dust, clay, various pollution is also promising.

3.6. In the chemical industry, the use of chemical-resistant material LIZA is effective due to the aggressiveness of the substances and media used.

3.7. In the cement industry, the implementation of this invention will also be effective.

3.8. In the railway industry, the development will also be very promising in the axle boxes of various cars.

3.9. In the flour-grinding industry, the application of this invention, due to the dust content during the processing of products (wheat, rice, various cereals), seems promising.

3.10. In the transport, road construction engineering, the implementation of the development also seems to be effective: the bearing units of this equipment, due to their low location, are constantly in contact with sand, dust, dirt, etc.

3.11. In the timber industry, in the furniture industry, this invention will also be very effective due to the presence of wood flour, sawdust and shavings.

3.12. However, first of all, the most promising and **100%** guaranteed (at least a twofold increase in service life) is the introduction of LIZA material into bearing units of conveyor and conveyor lines, as well as mine cars, into axle boxes of railway cars, into track rollers of caterpillar vehicles.

The cost of the conveyor belt (quite high) is **50%** and the cost of the rollers is **30%** of the cost of the entire conveyor, so the total cost of the belt and rollers is **80%** of the total.

Increasing the service life of the conveyor belt and rollers will have a great effect, given the universal applicability of conveyors in many industries. The wear of the belt and rollers directly depends on the service life of the rolling bearings on which the rollers rotate.

When the bearing is jammed, the rollers stop rotating, respectively, catastrophic wear of the belt and rollers begins, which ultimately leads to a rapid failure of the entire conveyor line, forced downtime and large financial losses.

3.13. Conveyor lines are used in all industries: mining, coal mining, chemical, flour-grinding industry, construction industry, mines, quarries and cuts.

3.14. As noted above, the economic effect from the use of the LIZA material on the conveyor alone (**cycle-flow technology**) of the Navoi MMC is **5 billion soums** \approx **\$2 million**.

3.15. Hence the conclusion: if there are such savings on the conveyor line of the Navoi MMC alone, then on the scale of a separate country or state, the economic effect will amount **to tens, and maybe hundreds of millions of dollars.**

3.16. All of the above can also be attributed to track roller bearings (tractors, bulldozers, excavators, pipelayers, military equipment: tanks, infantry fighting vehicles, infantry fighting vehicles, air defense systems), which are produced only in open form.

3.17. The specifics of the work of track roller bearings of caterpillar vehicles is such that they work "up to their ears" in conditions of complete off-road, experiencing constant, continuous exposure to dirt, dust, sand, as a result of which they quickly fail.

3.18. The foregoing is also typical for the bearings of the axlebox units of various railcar fleets.

3.19. In the Russian Federation, the rolling stock of Russian Railways has 1,250,000 units. Each car is equipped with 8 cassette type bearings or 16 roller bearings, i.e. **10 million cassette bearings and 20 million roller bearings.**

3.20. One cassette bearing costs **27,000 rubles**, if after protecting the cassette bearing with LIZA material its durability increases by 2 times, then the economic effect will be an unthinkable amount - **270 billion rubles.**

Conclusion - the introduction of the innovative material LIZA will significantly increase the service life of bearing units of machines, mechanisms, equipment of all sectors of the economy of any state, which will lead to a large multiplier economic effect.

The turnover of the global bearing market in 2021 amounted **to 129.81 billion dollars**, in 2028 this figure will increase **to 189.41 billion dollars**: https://www.linkedin.com/pulse/bearing-market-2022-show-impressive-growth-2028-supriya-koshti?utm_source=share&utm_medium=memberandroid&utm_campaign=share_via.

The average annual growth rate of bearing products during this period will be around **7.0%**, thus the annual increase in bearing turnover will be **about 10 billion US dollars.**

And finally, in 2021, the total volume of the global bearing industry it amounted **to over 230 billion pieces.**

Thought:

If the efficiency from one bearing with LIZA is only 1 dollar The use of this technology on 200 billion bearings (90% of manufactured bearings can be protected by development) will create an economic effect of **\$200 billion.**

Total:

Mother Earth and our descendants will be grateful for the purity of the planet!

Director SE «FAN»



V. Lee