

Faculty of Transport Systems and Mechanical Engineering;

Implemented Projects 2018-2023

Annex

| № | Name of the grant | Lead | Fund | Years of project start/end | Volume (amount of Budget) | Status completed/on going | Grant code |
|---|--|--------------------|--|----------------------------|------------------------------|---------------------------|--------------|
| 1 | Creation of a flexible small production site for the production of stair lifts for persons with disabilities | Vazha Qiria | Shota Rustaveli National Science Foundation of Georgia | 2023-2024 | 240 000 | Ongoing | AR-22-621 |
| 2 | AR-18-613. - Production of pilot samples of small wind power plants using basalt fiber, installation, testing, determination of operating parameters. Main directions: 1. Engineering technologies; 2. composites; 3. mechanical engineering 2019–2023 | Merab Shvangiradze | Shota Rustaveli National Science Foundation of Georgia | 2019-2023 | 418800 | Ongoing | AR-18-613. |
| 3 | Quantitative and qualitative evaluation of phenolic compounds of wheat processed with laser biotechnology in order to make a health-improving drug. | Nana Bakradze | Shota Rustaveli National Science Foundation of Georgia | 2020-2021 | 250000 | Completed | CARYS-19-573 |
| 4 | Implementation of the entire cycle of production of metal-cutting weapons in the production union "Tbilaviamshen | Nana Bakradze | Shota Rustaveli National Science Foundation of Georgia | 2023-2026 | 240000 (GTU part) 102 000 | Ongoing | NFR-22-6966 |

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|---|---|----------------------|--|-----------|---------|-----------|--------------|
| 5 | “Case Analysis of the Georgian Transport Sector, Interoperability and Intermodality with the European Systems” | Boris Gitolandia | Shota Rustaveli National Science Foundation of Georgia | 2016-2018 | 39 450 | Completed | N YS-2016-41 |
| 6 | Device for diagnosing wear and damage of rails and rails. Scientific field: railway Scientific direction: information technologies 4-140. | Nikoloz Mgebrishvili | Shota Rustaveli National Science Foundation of Georgia | 2015-2018 | 245 000 | Completed | N FR-18-4002 |

Summary:

1. -specific result-

- Recommendations

Summary: The project is related to the establishment of a small flexible production area, where the main business object is defined as stair-moving devices for persons with disabilities, the necessary use of which in public, medical and educational system institutions is defined by the legislation of Georgia.

Based on the diagrams of devices for moving up stairs, depending on various technical and economic features, for the production of a platform moving along of stairs and a tracked device (patents: R 2022 7356 B and R 2022 7381 B), a project plan for a flexible production site.

The flexible enterprise we propose will be based on a university enterprise and will be equipped with computer-controlled (CNC) machine tools.

This allows us to manufacture the above devices for the disabled, as well as some wear and replacement parts for various purposes, maintaining a balance of quality and price.

2. -specific result-

- Recommendations

Summary: Georgia has desirable conditions for the development of wind energetics. Therefore, it is advisable to carry out research and practical work in this direction. The content of the applied project performed by us serves this purpose. It is necessary to apply polymer composite materials for the manufacture of wind generators, as they would be applied to create lightweight and high-strength wings. It is obvious that the main acceptable component of polymer composite material, reinforcement fiber in Georgia is produced as basalt fiber. During the project we researched and studied the technological process of obtaining polymer composite materials and the possibility of manufacturing wind generators from it. As a power unit we use Chinese-made generators with power: 0.5-0.54 kW, 2-2.5 kW, 3-3.5 kW. And 5-7 kW. We have wings and wind rotors with appropriate parameters for each power. According to the mentioned power, the diameters of wind rotors are 2.67 m, 5 m, 6 m, and 9.2 m. The rotors are all with three-bladed. In addition, according to the project plan, we have constructed wind generator housings with a wind direction

orientation tail and a vertical wing. Considering that the project is practical, its essence is to design wind generators, create their manufacturing technologies and make pilot items that was implemented during the project. Technical equipment and installations are usually quite expensive products when was purchased abroad. Naturally wind generators also belong to such equipment. The price of electricity generated by wind generators bought abroad is quite high for the population of Georgia. Consequently, bringing them is devoid of any rent. Therefore, of course, it is advisable to master the production of wind generators in Georgia. This project correctly serves the possibility of mastering the technology of manufacturing wind generators in Georgia. Accordingly, a precondition is created for the production of household wind generators in Georgia. For example, the Georgian Technical University has a sufficient intellectual level, production facilities as well as service staff.

3. specific result-

- Recommendations

Summary: In order to increase the yield of crops and protect the environment from global pollution, an innovative biotechnology of wheat production has been developed; The positive effect of wheat seed pre-sowing two-step treatment (with laser irradiation and *Azospirillum Brasiliense* suspension) on wheat germination, growth and development under greenhouse and field conditions has been established. pre-sowing treatment of wheat grains with laser and with laser in combination with *Azospirillum brasiliense* increases the yield by 18-35% and reduces the risk of crop fungal disease as well. This, in turn, ensures an increase in the supply of food to the population for a healthy life and the fight against hunger.

4. specific result-

- Recommendations

Summary: Cereals are considered a strategic product all over the world, therefore their production is a priority for all countries in order to provide for the population. Local wheat production in Georgia provides 15-20% of the country's needs. In order to increase wheat production and enrich it with useful compounds, it is important to use new technologies.

The mechanisms of the positive effects of laser radiation have not yet been fully established. There are only fragmentary studies and hypotheses devoted to studying the mechanisms of the effect of laser radiation on plant seeds. Despite numerous studies of laser-induced phenolic compounds and their beneficial properties in wheat grains, germinates of seeds, and grass seedlings, data are insufficient

Refined wheat grains, which flour mainly is used for bread production, are poor in antioxidant compounds and are a risk factor for the development of obesity, diabetes, and metabolic syndrome. Wheat grains are contaminated with many microorganisms, insects and are exposed to many harmful environmental factors. Wheat husk, grain germinates, and grass seedling are rich in biologically active phenolic and other compounds and can be used to form functional preparations.

Planned research involves the stimulation and accumulation of phenolic antioxidants in laser-treated wheat, thus increasing the antioxidant status of baked bread and its positive impact on the human body. Wheat grains are susceptible to many diseases. Accumulation of phenolic

compounds and phytoalexins is characteristic of plant (and including wheat) phyto-immunity. Study of bioactive compounds generated in wheat grains germinates, and grass seedling in animal cell model systems (Jurkat, MDCK) will reveal highly active compounds to form a functional therapeutic and prophylactic drug. Creation of functional, immunomodulatory drugs, especially important during the COVID-19 pandemic. The novelty of the proposed study lies in the combination of different approaches:

- Increase wheat grain yield, pest resistance, and utility by developing innovative laser bio-agrotechnology.
 - Study of compounds in laser-treated wheat grain germinates in animal cell model systems (Jurkat, MDCK).
- Creation therapeutic-prophylactic, immunomodulatory functional drugs.

5. specific result-

- Recommendations

Summary: The project dedicated to discuss the problem of interoperability and intermodality of the transport sector of Georgia with the European transport systems and provides the results of the research analysis. The compatibility of Georgian transport and its infrastructure with European systems, technical parameters and other problematic issues of challenges in this regard are listed and shown, ways to solve the problem and further prospects for adaptation to EU standards are proposed. Within the project is prepared monography and this is intended for scientific workers, master's and doctoral students in the field of transport, the monograph will also provide great help to specialists in the field. It is possible to present the results of the research in a lecture format to students of the relevant specialty, professors and teachers, expert circles and people interested in the issue in general.

6. specific result-

- Recommendations

Summary: By installing the proposed device on each pair of individual rolling stock units (wagons), automatic control of the pair and rail condition will be achieved. In particular, the rolling stock:

- Detecting worn out pairs of eyes and determining the degree of wear;
- detection of a damaged pair of eyes;
- Fixing a worn or damaged pair of eyes.

Based on a mathematical model developed and compiled in advance:

- detection of worn rail;
- detection of damaged rail;
- Determining the exact location of a worn or damaged rail.

A mockup is made.