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COMMERCIALIZATION OF ENVIRONMENTAL PROJECT WITH DUAL-USE TECHNOLOGY

In the article the problem of scientific projects implementation were investigated with the emphasizing on their further commercialization. Environmental Projects with dual-use technology require specific approaches, such as project management and partners' cooperation, thatwere discussed in present publication. Analysis of stages for project realization have been carrying on regarding to the recommendation of the most recognized and validated funding organizations.

Keywords: commercialization, environmental monitoring, geomechatronic complex, data collection system, projectmanagement.

Problem indication. The problem of environmental contamination, caused by both, industrial and military systems operation, requires immediate response from scientific, industrial and educational organizations. Solid attention should be given to areas where environmental problems, inherent for industrial processes, are supplemented with other causes of environmental load, such as military-related operations (minefields, use of phosphate mines, destruction of civil infrastructure, etc.). Thus, the development of reliable means for information collection and processing on potential and existent hazards in such areas, for both environment and humans, is necessary.

Environmental Project with dual-use technologydevelopers often meet additional difficulties connecting with lack of finance support as from their own institutions and organizations, so from the governmental bodies. It requires, except the project idea formulation, additional knowledge in economic area, especially in project and grant management. So, in Ukraine and other countries, the best variant for project realization is grants with further commercialization. Many organizations – donors (e.g. the STCU and the MESU, SEPS etc) underlined importance of the following requirements:no less than 50% of project participants should be scientists with prior experience in the development of weapons of mass destruction; in accordance with the new policy approved at the 42nd STCU Governing Board, the definition of Category 1 participants is expanded, with the focus not only on former weapons experts, but also specialists who have «experience in the field of dual-use technology» which, in principle, may include a younger generation of scientists. Project proposals will be evaluated on the basis of (but not limited to) the following key criteria: a) Scientific justification (uniqueness and level of science p resented, understandability and readability, references and citations, etc.); b) Scientific methodology (methodological justification: uniqueness and reasonableness) c) Scientific promise (ability to achieve stated goals, reasonableness of developing new or improving existing technologies from the stated results); d) Applicability and feasibility (ability to achieve stated results based on material and financing requests, as well as upon existing institute technical capacities and resources); e) Sustainability (Feasibility of further scientific development or commercial potential); f) External support and interest. So, if someone is interested in sustainable and successful environmental or other project, it is vitally important to think about its commercial potential and innovative components.

Analysis of the latest research and publications. Starting from the second half of twentieth century, most of armed conflicts are taking place without the application of nuclear weapons and with minor use of chemical ones. This decrease in demand for nuclear missiles has boosted the production and use of «classic weapons», relatively safe for the environment but yielding high destructive consequences. High degree of attention is given to explosive-related ammunition that allow to minimize handler’s loses, yet provide the means to solve a variety of tactical issues [1-4]. The other side of this coin is «legacy» left by every military conflict – minefields and single unexploded mines, being the cause of deaths and disabilities for civilians [5, 6]. Social initiatives to ban such types of explosive ammunition (International Campaign to Ban Landmines (ICBL)) as landmines, aren’t expected to be effective while being ignored by the largest producers: US, Russia, China [7, 8]. Existing fences, industrial areas are surrounded with, make it difficult to control and to eliminate the causes of environmental load during the production processes and after they are being stopped. Environmental impact of high relevance in Ukraine, causing mining companies to suspend the production for both, short and long time, is ground methane leakage and ground surface damage from mine flooding. Also, the increase in ground water levels leads to higher mineralization rates and higher hazard matters content, e.g. radioactive elements. This problem has been observed at «Yunkom» mine and at a number of industrial and military areas.

The estimated area, where such surveillance studies are needed immediately is 10 thousand sq. kilometers in Ukraine and 2 mil. sq. kilometers in the World. According to ICBL, neglecting these problems in given areas has led to 5461 deaths (38% of those are children) in 2015. Thus, the development of geo-technical system for military and disaster-affected areas surveillance is an urgent problem.

Solid contribution in the field of automated surface and atmosphere survey belong to National Aeronautics and Space Administration. One of the most successful and widely known projects within Mars Science Laboratory programme is the third-generation mars rover Curiosity, which is a chemical laboratory for solving a variety of geomorphology-related tasks. The application of such hi-tech solutions for surface survey is associated with certain difficulties, e.g. their availability and the trade-off between information yield and costs. Thus, the estimated costs for Mars Science Laboratory is between $2.5 and $40 billion, where Curiosity itself has spent $1.6 billion. Also, the issue of nuclear technologies application on the Earth surface, being the backbone of mars rovers, is underrepresented. General framework for the power train and equipment setting of terrestrial robots for research purposes is holding a great promise in this context. Some examples of automated Moon and Mars surface surveillance systems are ExoMars (developed within joint collaboration programme between European Space Agency and Federal Space Agency of Russia for Mars Research), Mars Aster, developed by Lavochkin Scientific and Production Association, «Robot-geologists» from the Vernadsky Institute of Geochemistry and Analytical Chemistry Sciences and others. Also, worthy of noting the Chinese project «Chanchzhэn-5», intended to launch in 2020.

Consideration should be given to military robotic systems developed by Northrop Grumman Corporation, Konzern Foster-Miller, iRobot, Remotec Inc., Resquared,MED-ING, «Izhevsky Radio Factory» JSC and others. Common basis for these systems are either wheel or caterpillar drive with the operational module and visualsensors to conduct complex task on defusing dangerous items. Some of those are designed to perform hazardous substances sampling, like RI International. Such systems, however aren't applicable for dangerous items detection, hidden below soil layer and for performing environmental surveillance.

The most applicable systems for this purpose hitherto is remotely controlled equipment for finding mines and batch mine defusing. Undergoing efforts to develop unmanned defusing robots, taken by many businesses and research institutions did not yet yield the desired results. One example – wide-range robotic radio system for mine detection (Canadian Husky Mk 3, RMDS) allows to find both metal and plastics-based anti-tank mines located on the roads.

Some of the methods, used for locating a variety of items are non-linear radiolocator, subsoil, ultrasonic, laser radars, IR sensors, chemical parser, nuclear resonance based devices. None of these methods, however, are capable of providing sufficient accuracy (0.97) required by UN.

Disadvantages, the above mentioned methods of soil surveillance under extreme conditions are associated with, influence the accuracy and efficiency of monitoring, which is a major drawback for locating dangerous items and further analyses of contaminated areas.

A common disadvantage of these methods is the tendency to establish target chemical and physical properties, without the possibility to locate dangerous items.

The Project Goal. The goal of this project is to develop the algorithm and a prototype for intelligent geomechatronic complex for environmentally polluted areas monitoring with further commercialization**.**

Presenting main material. The core application for this system is monitoring the state of environment, exposed to man-made changes, including military operations, with the purpose of locating and identifying chemical and biological soil changes so as dangerous items. This multipurpose geomechatronic complex, consisting of on-ground and aerial modules, incorporates the advantages of rapid information collection/analyses and high degree of data accuracy.

Aerial system performs surface surveillance and commutes to on-ground module and control station real-time. Information module provides the means to data collection, processing saving and further transfer, based on unique algorithms and software. The system will be composed of three modules, namely aerial, on-ground and control station. A distinct property of the system is the application of pioneering method for soil surveillance, capable of detecting environmentally dangerous changes. The possibility of remote equipment operating reduces the risks of health damage to operator. Since most of the dangerous items, located in the upper soil areas are made of synthetic compounds, electromagnetic methods for their detection are not effective. The application of contact methods, however, allows highly accurate locating the items of any matter.

The main advantages of given systems, compared to alternative ones, are:

– low costs;
– operator's safety;
– simplicity of hardware;
– damage resistance in case of exposure to dangerous influence;
– simplicity in terms of use;
– mobility;
– portability.

In order to develop this surveillance system, both theoretical and experimental research is necessary. This implies further studies on indenter's mechanical behavior under different soil properties and the manner of positioning dangerous items.Item detection algorithms will be based in this information. Aerial system, in it's turn, will provide efficient and comprehensive data collection and transmission.

Experts from the Academy of Sciences of Ukraine (Polyakov Institute of Geotechnical Mechanics under the NAS of Ukraine), Yuzhnoye Design Office, leading technical educational institutions (Igor Sikorsky Kyiv

PolytechnicInstitute, Lviv Polytechnic National University) will be involved in further work.

This geomechatronic system for land surveillance will allow to reduce human losses and, therefore, will be useful for military forces in Ukraine and in the World. This cost-effective, portable and transportable solution will become a valuable asset for most types of military forces. Special forces, amongst others, demonstrate the mostinterest in this systems, mainly because the need to conduct land and movement routes intelligence and locating dangerous items and hazards.

The main steps to develop the mechatroniccomplex for land surveillance are:

– the development of surveillance system for dangerous items locating;
– the development of data collection system;
– the development of communication system;
– the development of steering control system;
– the development of machine vision system movement control;
– the development of positioning system;
– the development of electric powertrain system.

In order to be able to assess the project proposals submitted and compare them in a structured way, for example, WISIONS has drawn up a set of criteria to ensure the sustainable character of the projects and the relevant forms of support:

– Technical viability;
– Management model and economic feasibility;
– Local and global environmental benefits;
– Social context and impact;
– Innovative aspects;
– Replicability and dissemination concept;
– Sound implementation strategy.

SEPS in its tern defines the term «project» in a broad sense. It does not focus solely on technical solutions, but also addresses a broad spectrum of ideas that may help to foster environmental initiatives and, therefore, contribute to sustainable development. The proposed project have to satisfy all the donors key criteria and demonstrate indexes ofsustainability such as: a) An analysis of the scientific merit and significance of the project; b) An opinion whether the project can meet its stated goals within the proposed time frame; c) A practical appraisal of the qualifications and experience of the scientists proposed for implementing the project and executing its tasks; d) Recommendations for improving the proposals if they merit further development.In other words, to make our environmental project with dual-use technology commercially attractive it have been decided to apply a combine approach that had involved next components: innovative element, project management element and technical viability.

If we look deeper in the context of each component, their description would look like those prom SEPS Energy Project Criteria, namely:

Technical viability

The project must be technically feasible to implement. Technological know-how within the project team (or from experts involved as project partners) is essential, as well as proven availability of resources (e.g. adequate water flows, seasonality, etc.). Appropriate local expertise to maintain the appliances and provide sound operational management is crucial and may need to be developed to ensure that the appliances installed can be operated independently in the long-term.

Management model and economic feasibility

The establishment of a sound management model that is appropriate for the cultural and economic context of the target region is recommended. This should comprise clear responsibilities and mechanisms for regulation (e.g. supply of inputs, ownership, O&M duties, payments etc.).Therefore the proposal should include a convincing strategy for securing long-term economic feasibility. To develop economically feasible concepts it is recommended that the current local economic situation, as well as the willingness of the local partners to pay for innovations, is assessed.

Local and global environmental benefits

Please apply the Environmental Performance Calculation Procedure to work out these figures. We consider that the CO_2 reduction potential is low in regions with no or low use of fossil fuels. In these cases, we will consider the comparison with the introduction of fossil fuel appliances rather than the technology to be implemented.

Local environmental conditions are of particular importance for the welfare of the population in the project area. Therefore, we take local and environmental benefits into account, together with any negative environmental side effects caused by the project. Please describe the local and global impacts of the project.

Social context and impact

The implementation of any environmental or other project can be a significant intervention in the social context. The social setting influences the adequate functioning of the technology and its management and both have an impact on social relations and vice versa. Because of these interdependent relations the complexity of the technology and the applied management model must be appropriate for the local context. Relevant aspects of the social context include, for example, the involvement of the local population, existing local organizational structures, cultural habits, the role of the local authorities, as well as impacts of the project on poverty, employment or gender issues.

Innovative aspects of the project

WISIONS aim is to support the implementation and testing of innovative ideas that address environmental need in sustainable ways. Consequently, as well as (or instead of) demonstrating technological innovation, projects may comprise other innovative aspects, for example related to organization, finance, management or political aspects.

Replicability and dissemination concept

The project should be replicable or have clear potential benefits for projects in other areas. Existing production or supply structures, a high level of interest among the local population and the general public, and well-established links to potential users of the technology and to local and national politicians are advantageous.

It is crucial to inform and include the local population and politicians about the project if new environmental services are to be accepted and supported locally. Thorough dissemination of information is necessary in order to convince local stakeholders, such as authorities, funding institutions or project developers. This can help to increase not only the acceptance but also the replication of the project.

Implementation strategy

The project must have a sound and comprehensive concept, be in an advanced phase of development and be ready for implementation. Of crucial importance for projects in the pre-implementation phase is the quality and detail of the implementation strategy. What steps have you planned? What kind of support do you still need? What are the costs or additional costs? Who are the partners involved? The more advanced and detailed your strategy is, the better we can assess your needs for project support.

Conclusions. Environmental Project with dual-use technology «Intelligentgeomechatronic complex for environmental monitoring of technogenic polluted territories» is focused on two main tasks: 1) to develop environmental friendly technology applying Ukrainian scientists potential; 2)to make this proposal competitive among others, using combination of innovative, technical and economic approaches. Project commercialization is possible throw the mechanism of donors' financial support, scientific and technical cooperation among project participants, competent project management at all stages of the project life cycle.

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КОМЕРЦІАЛІЗАЦІЯ ЕКОЛОГІЧНОГО ПРОЕКТУ З ТЕХНОЛОГІЄЮ ПОДВІЙНОГО ВИКОРИСТАННЯ

В статті булорозглянутопроблему імплементації наукових проектів з акцентом на їх подальшу комерціалізацію. Екологічні проекти з технологією подвійного призначення вимагають специфічних підходів, таких як: управління проектами та співпраця партнерів, що й було висвітлено в цій публікації. Аналіз етапів реалізації проекту було проведено згідно до рекомендацій найбільш визнаних та надійних фінансових установ.

Ключові слова: Комерціалізація, екологічний моніторинг, геомехатронний комплекс, система збору даних, управління проектами.

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КОММЕРЦИАЛИЗАЦИЯ ЭКОЛОГИЧЕСКОГО ПРОЕКТА С ТЕХНОЛОГИЕЙ ДВОЙНОГО ИСПОЛЬЗОВАНИЯ

В статье было рассмотрено проблему имплементации научных проектов с акцентом на их дальнейшую коммерциализацию. Экологические проекты с технологией двойного назначения требуют специальных подходов, таких как, управление проектами и сотрудничество партнеров, что и было рассмотрено в этой публикации. Анализ этапов реализации данного проекта был проведен согласно рекомендаций наиболее известных и надежных финансовых организаций.

Ключевые слова: Коммерциализация, экологический мониторинг, геомехатронный комплекс, система сбора данных, управление проектами.

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