BSUIN – Baltic Sea Underground Innovation Network

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Abstract The aim of the BSUIN project is to join efforts in making the underground laboratories in the Baltic Sea Region's (BSR) more accessible for innovation, business development and science by improving the availability of information about the underground facilities, service offerings, user experience, safety and marketing.

Keywords: Baltic Sea, Underground Laboratories, Innovation, Network

1. Introduction

The main goal of the project is to combine activities for the better use of different Underground Locations (UL), both the locations of operating underground laboratories as well as less known potential underground sites.

The project activity duration is 36 months and it will end in September 2020.

Baltic Sea Underground Innovation Network (BSUIN) [1] project is funded by Interreg Baltic Sea funding cooperation [2]. Currently 6 underground laboratories are involved in the BSUIN project. Total budget of this project is 3.4M€.

2. BSUIN Basics

A key aspect of the BSUIN project is a transfer of technology and use of research infrastructure for business purposes. In addition to scientific applications, there are a number of potential applications that use the unique conditions at underground locations. There is a range of possibilities to develop various types of mine technologies, tunnel construction, radiation protection systems, geophysics and other research instruments. Underground locations can potentially be used to produce food under different conditions and use geothermal energy for different purposes.

The main assumptions of the BSUIN project are schematically presented in Figure 1. It is important to how cooperation can be strengthened and lead to competitive advantages.

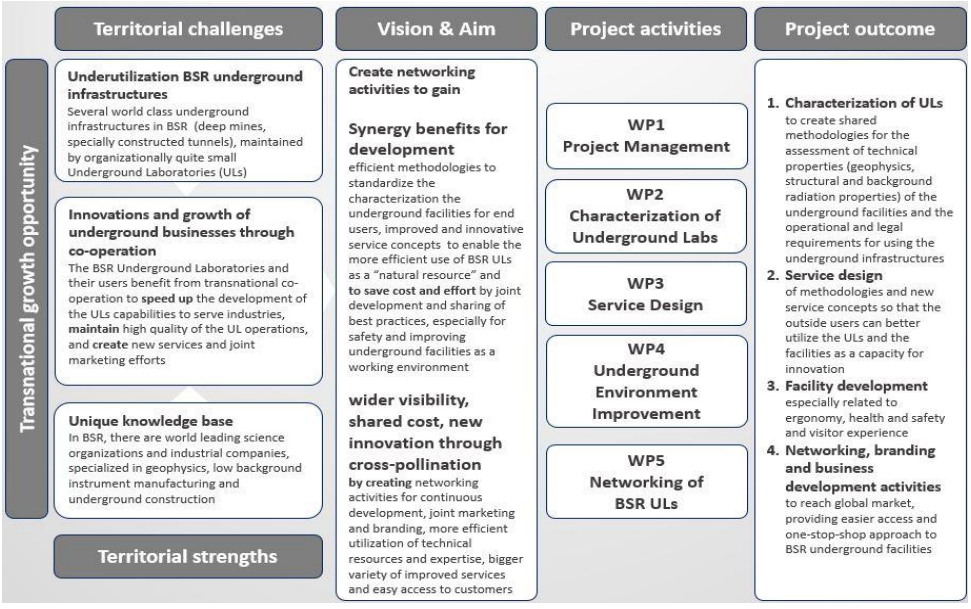

Fig1. *Main benefits from the BSUIN Project.*

3. Project activities

The project is divided into 5 smaller Work Packages (WP) focusing on different aspects:

1. WP1 Project management and administration
2. WP2 Characterization of underground facilities
3. WP3 Service design, market design and branding of ULs as a capacity for innovation
4. WP4 Underground environment improvement
5. WP5 Networking of BSR ULs and their users

Different institutions are involved in various work packages, both from project partners and 14 associated partners. In Figure 2 the relations between different work packages and the activities are schematically shown.

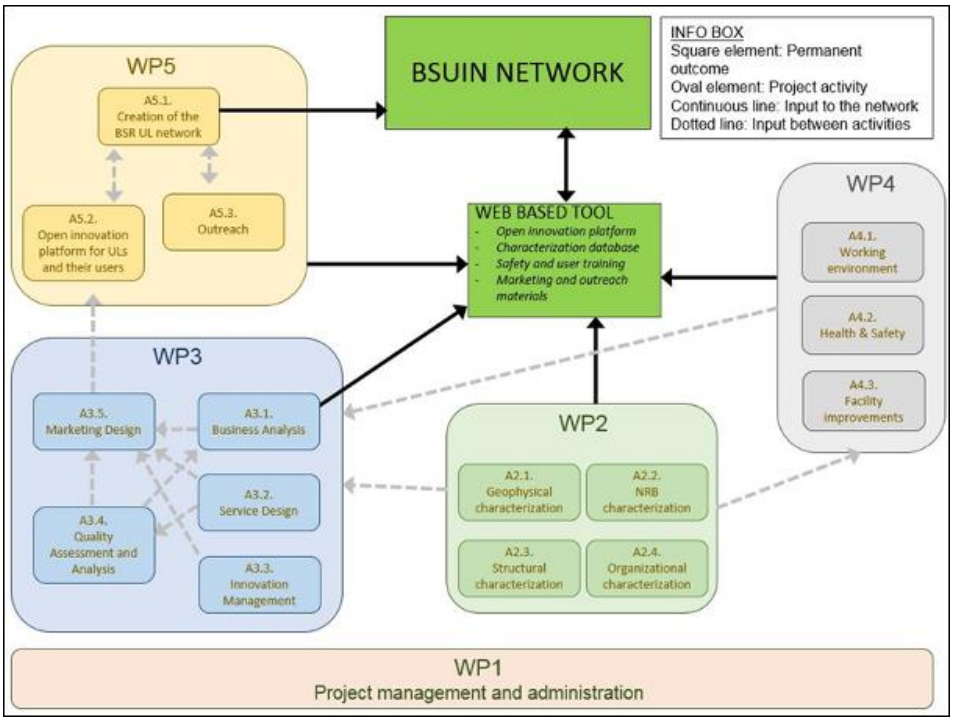

Fig 2. *The BSUIN project work packages (WP) scheme. Relations between different work packages and the activities are schematically shown. In each of the work packages, institutions from many countries of the Baltic Sea region participate.*

Due to the fact that underground locations are significantly different from the Earth's surface, it is necessary to characterize individual locations. The characteristics of underground locations presented in a friendly way can be used by potential commercial customers. This is the main objective of WP2.

The goal of WP3 is to highlight the innovative possibilities that can be developed. Many of the underground locations do not have adequate infrastructure to conduct the organized activities. In order for innovative projects to be developed there, it is necessary to

organize safety procedures. Development of standards is needed for the transfer of innovative technologies to the wide application market.

The WP4 package will define the conditions of work organization in ULs and safety rules as well as risk assessment. Dissemination of best practices and development guidelines will be shared.

The last WP5 package is organizing cooperation between underground locations. Creation is planned of a common web page platform for innovative activities and sharing of various types of information, training, security procedures, marketing materials and all kinds of other information that may be useful for other partners.

4. Results & Outcomes

The most important benefit of the BSUIN project is the cooperation of underground laboratories and potential places where such a laboratory can be organized. One of the benefits will be a database containing the characteristics of underground laboratories in the Baltic Sea region. This information will be organized in a friendly website, where those interested in underground infrastructure will be able to get acquainted with it. Cooperation of the Baltic countries in the use of underground locations can bring tangible benefits to a profit-making industry.

The main result of the project is a balanced network organization that disseminates technical, marketing, operational quality, training and other information about UL BSR generated during the project. The online tool and network organization will be designed to provide an open innovation platform for further quality and innovation development and to share best practice on service concepts, infrastructure improvements and methodological recommendations from pilot actions.

Underground locations are also very important for science that can take place in them. Multi-messenger astronomers can benefit by placing underground cosmic ray detectors, neutrino experiments, and those seeking scarce phenomena. Space weather, supernova explosions, neutrino oscillations are just some of the topics that are explored underground. Many of the places mentioned here and potential underground locations can contribute to the development of science in a very wide range.

5. Project and associated partners

The BSUIN consortium has 14 members from eight Baltic Sea countries. Six underground labs (sec. 6) are looking for new collaboration in the project.

Partner	**Country**
University of Oulu, Kerttu Saalasti Institute	Finland
Oulu University of Applied Sciences	Finland
University of Silesia in Katowice	Poland
Swedish Nuclear Fuel and Waste Management Co	Sweden
KGHM Cuprum Research & Development Centre Ltd.	Poland
TU Bergakademia Freiberg Technical University	Germany
German Research Centre for Geosciences	Germany
Vilnius University	Lithuania
National Center for Nuclear Research	Poland

Baltic ScientificInstruments	Latvia
Karelian Research Center of Russian Academy of Sciences	Russia
Joint stock company "Khlopin Radium Institute"	Russia
Sotkamo Silver AB	Sweden
Tallinn University of Technology	Estonia

Associated partners of the BSUIN Project:

- The Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences, Poland
- Rockplan Oy, Finland
- Normet Oy, Finland
- K+S GmbH, Germany
- Kalmar regional Council, Sweden
- Pyhäjärvi Municipality, Finland
- DMT GmbH, Germany
- M-Solutions Oy, Finland
- Muon Solutions Oy, Finland
- University of Tartu, Institute of Physics, Estonia
- Kolmas Karelia LLC, Russia
- Geological Institute of Karelia, Russia
- Pyhäsalmi Mine Oy, Finland
- University of Aarhus, Denmark
- University of Oulu, Department of Architecture, Finland
- University of Jyväskylä, Department of Physics, Finland
- Amberg Group including Versuchsstollen Hagerbach (VSH), Switzerland

6. Underground laboratories

Underground laboratories involved in the BSUIN project:

- Callio Lab, Pyhäsalmi mine, Finland
- Äspö Hard Rock Laboratory, Oskarshamn, Sweden
- Reiche Zeche, TU Freiberg Research and Education mine, Germany
- Conceptual Lab development co-ordinated by KGHM Cuprum R&D centre, Poland
- Khlopin Institute Underground Laboratory, Russia
- Ruskeala, Russia

Fig 3. *Map with denoted locations of underground locations involved in the BSUIN project.*

Acknowledgements

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