Underground laboratories Innovation management – A guideline for innovation management and support for innovation processes

Baltic Sea Underground Innovation Network (BSUIN)

Interreg Baltic Sea Region
EUROPEAN REGIONAL DEVELOPMENT FUND
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BSUIN

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REPORT

WP 3.3 Innovation Management

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1. BSUIN project introduction

The aim of the Baltic Sea Underground Innovation Network (hereinafter BSUIN) project is to make the underground laboratories (hereinafter ULs) in the Baltic Sea Region more accessible for innovation, business development and science by improving the information about the ULs, operation opportunities and principles therein, user experiences and safety within the ULs.

BSUIN is a collaboration project between 13 partners from 8 Baltic Sea Region (hereinafter BSR) countries. Besides project partners 17 associated partners contribute to achieving project goals.

The BSUIN project is participated by six (6) ULs from the BSR area. They all will be characterized and presented to potential customers in order to attract developing innovative activities and effectively activate use of those laboratories. These six underground laboratories by name are:

1. Callio Lab, Pyhäsalmi mine, Finland
2. Äspö Hard Rock Laboratory, Oskarshamn, Sweden
3. Reiche Zeche, TU Freiberg Research and Education mine, Germany
4. Lab development by KGHM Cuprum R&D centre, Poland
5. Khlopin Radium Institute Underground Laboratory, Russia
6. Ruskeala Mining Park, Russia

The main outcome of the project is a sustainable network organization, which will disseminate technical, marketing, operational quality, training and other information about the BSR ULs.

Project is funded by Interreg Baltic Sea funding cooperation. Its duration is 36 months with a total budget of 3.4 M€.

2. Content of present document

2.1 Document justification

Present document is part of the project BSUIN Work Package (hereinafter WP) 3.3 output, which is responsible for a creation of an innovation platform for the BSR ULs. The main objective is to identify research areas in underground labs which are more likely to result in innovations. Antoher main objective is to identify and characterize new R&D fields that would likely benefit greatly of operation and/or testing in the said ULs. The innovation platform concept is part of the BSUIN web-based tool and shall establish a guideline for innovation management and support for ideation and innovation processes as well as for a sustainable usage of the ULs combined in BSUIN.

2.2 Content description

In order to establish a guideline for innovation management and innovation platform, interviews, questionnaires and good practice collection was conducted among industrial partners who operate in ULs (Fig. 1). In total, we received answers from 14 industrial and research partners who operate in different ULs and using it for versatile purposes. One of them only gave answers to its research collaboration.

The experiences of the industrial partners within the present BSUIN community will have special emphasis for the layout of the concept. The involvement of the industrial partners in the creation of the innovation platform concept ensures that practical issues and customer preferences are truly taken into consideration in the process. An additional benefit is to map the best practice case studies between customers and ULs.

Output of the innovation platform concept includes:

- Industrial partner requirements are identified.
- The possible research areas are identified and evaluated.
- A guideline for implementation of site-specific services is produced.
    - A collection of good practices is collected.

The results of the questionnaire are given in the next chapter. They are divided into sub-topics and give answers to the output questions accordingly:

1) Information on the industrial partners and research collaboration
2) Industrial partners previous usage of ULs
3) Identification of industrial partners' current and future requirements
4) Identification of possible future research areas

The guidelines for implementing the site-specific services in ULs are given in the following chapter. The results are based on present questionnaire and questionnaire results from WP 3.4. The final chapters highlight some best practice case studies.

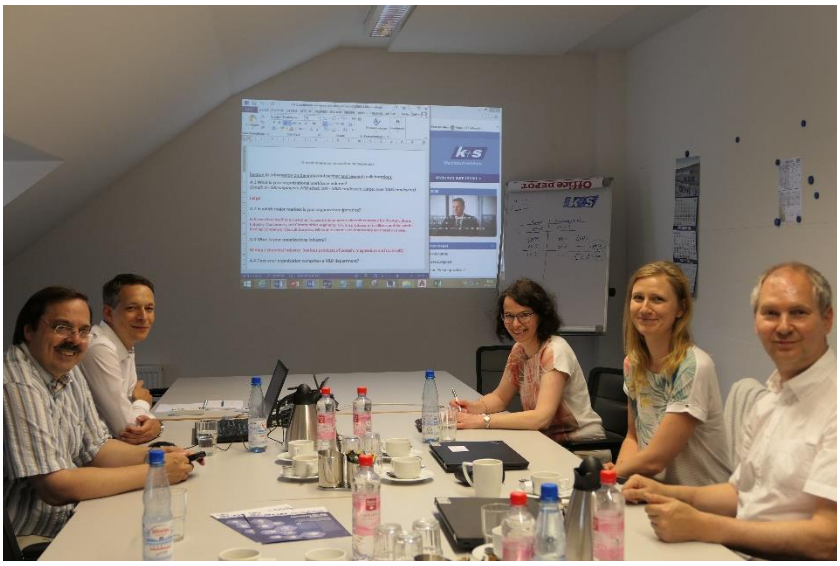

Figure 2. Meeting at the headquarters of the associated partner K+S public company in Kassel to discuss the answers to the questionnaire. K+S participants are staff members of the sections geology and R&D projects/reporting.

3. Results of the innovation management questionnaire

3.1 Information on the industrial partners and research collaboration

Industrial and research partners operate as underground space developers e.g. tunnel, mining and civil enigineers working in the fields of transport and mobility, energy production and storage, mineral suppliers, prototype developers and academic researchers. Majority of the industrial partners operate in the regional areas of Baltic and Fennoscandia, some in central Europe. This is of course influenced by the selection of partners which is result of their relation to the BSUIN project partners. Three of the interviewees operate also worldwide. Partners operate in one or up to eight listed of the listed industry sectors. The results of partners' industry sectors are given in Figure 2.

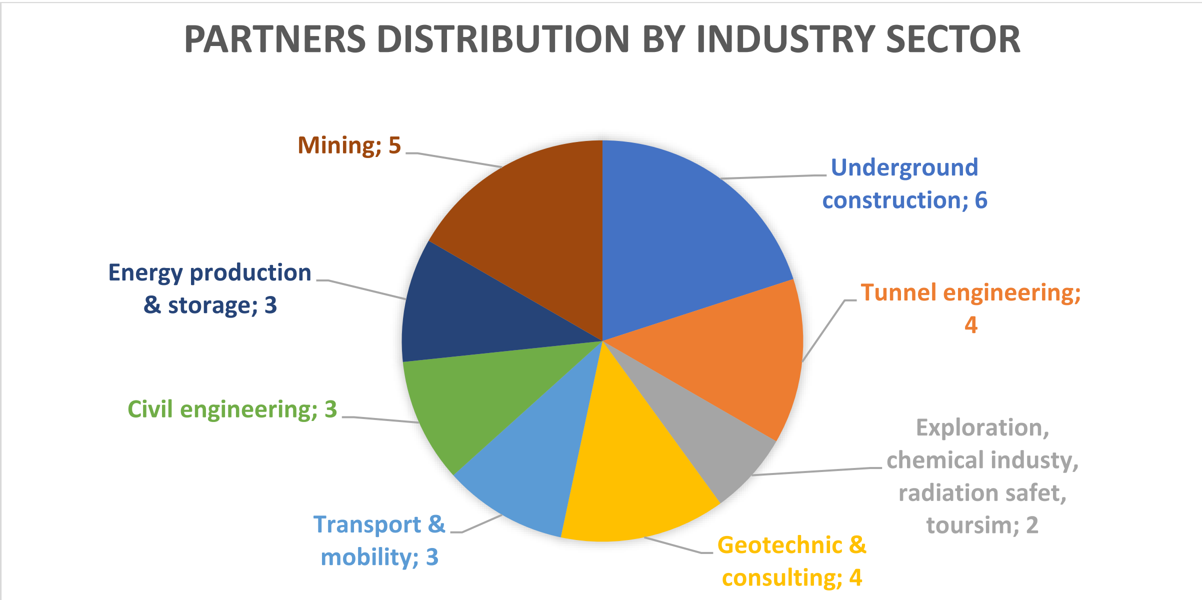

Figure 2. Distribution of partners by industry sector.

From 14 interviewees eight identified themselves as large-size (more than 250 employees), two of mid-size (50-250 employees) and four identified as small (less than 50 employees). From the results are seen correlation between company size and existency of R&D department and higher number of decision level within company. A tendency can be recogniued that mid-and large-size companies have an R&D department and more in-house decision levels. It is also notable that since the mid-and large-size companies have more in-house decision levels it takes more time for them to make decisions. The decision procedure is a step-by-step process and its duration and complexity is defined by the importance, urgency and costs of the project. The approval of the ideas respective concepts is a structured process consisting of a pre-study, main-study and finally realization phase. Grants from national and international bodies have only minor importance for the approval and decision processes. Number of decision levels (usually 2 or 4) depends on the budget of the project and in half cases takes time about 1-3 months. The others by the majority need less than six month but one company up to one year.

Most of the companies have several research fields, which are summarized in Figure 3.

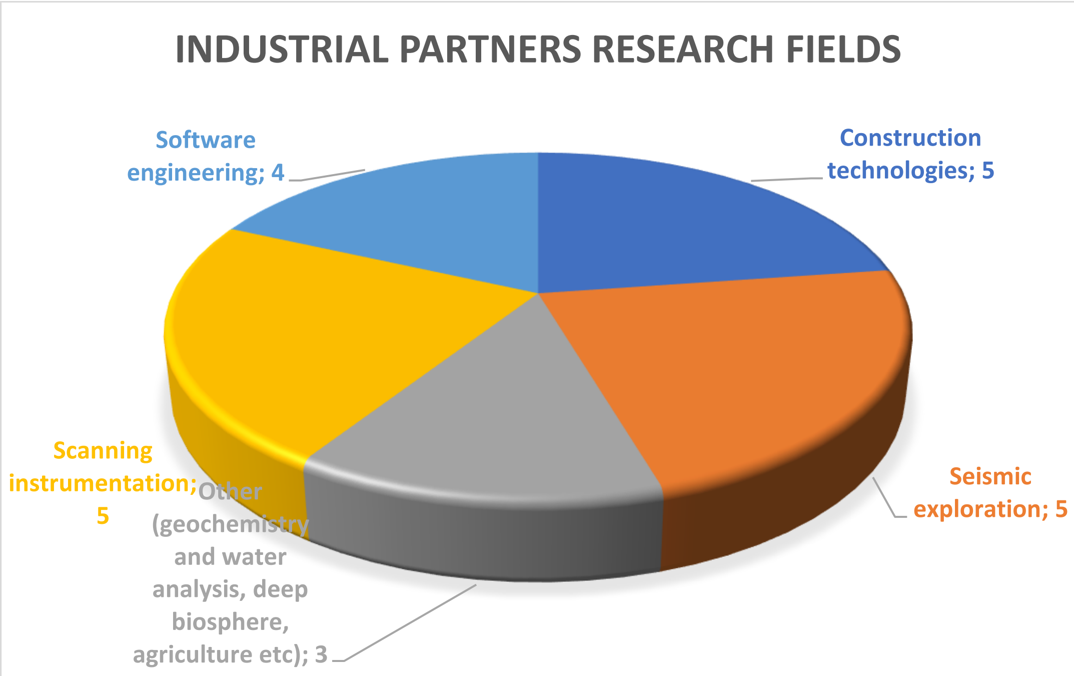

Figure 3. Research fields of the industrial partners.

Core area of reasearch fields can be grouped to construction technologies, seismic exploration, scanning instrumentation and software engineering. Additionaly, there are singular research fields mentioned by the interviewees such as deep biosphere, geochemistry, water monitoring, traffic planning and agriculture. Beside general research fields some partners delineate specific fields of investigation such as stability of arches, hydrochemical analysis of water, photogrammetric modeling and geophysics for monitoring of in situ remediation actions.

Almost all partners maintain cooperation with public research institutions. The statistics of level of satisfaction arising from such collaborations, and experienced by the industrial partners, are presented in Figure 4. In general, about three-forth of the respondents evaluated collaboration are either satisfied or very satisfied.

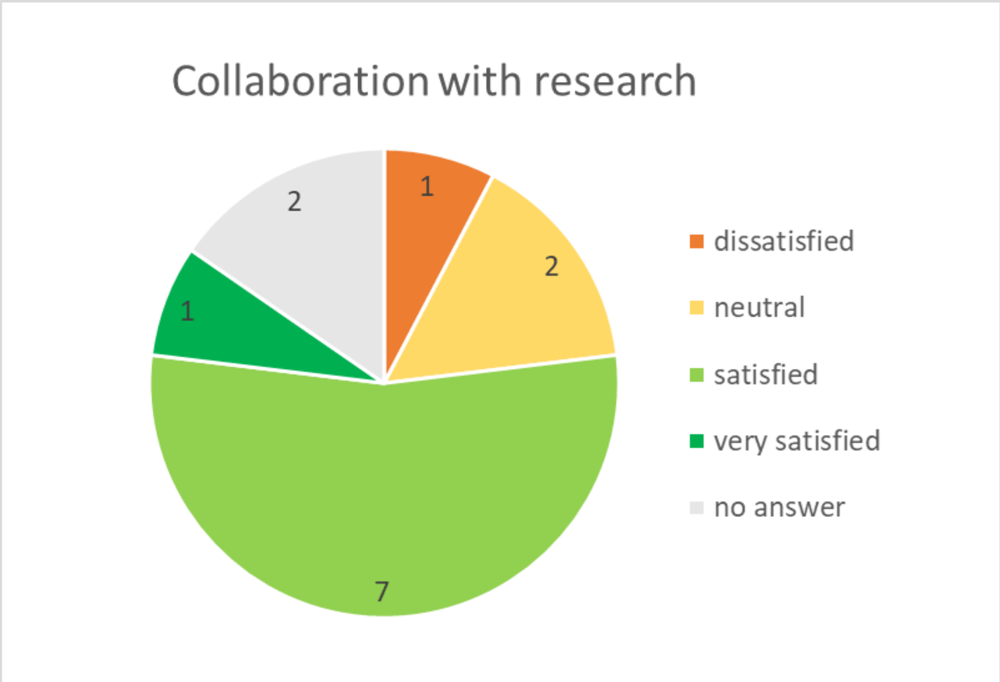

Figure 4. Partner-public research institution collaboration satisfaction level.

The respondents also evaluated what aspects are important for a good collaboration with research institutions by applying a scale from 0 (unimportant), to 5 (very important). A main outcome was that a good level of communication and realistic timelines were recognised as main aspects of satisfactory collaboration (Figure 4). The category realistic timeline ist mostly interpreted as compliance with schedule and budget. Additionally, industrial partners also mentioned important keywords for collaboration, such as "stick to the scope", "access to the facility", "data communication" and "excellence of the partners". It hence seems that collaboration between ULs, public research institutions and industrial partners requires research based primarily on solutions along the entire value chain. The answers of companies seem to indicate a slightly different viewpoint on partnerships with public research institutions depending on acting as collaboration partner or as customer. On the one hand the most important aspect is e.g. technical expertise in the research field, whereas on the other hand easy access to the facility and connected resources/personnel is more important. Thereofore, some intervieees allow less importance to categories such as technical expertise and to acces to special lab-resources. This rating might be depending on the existing in-house expertise within the companies. This needs more evaluation because it can give indications to convienent ways and types of offering technical services by the ULs.

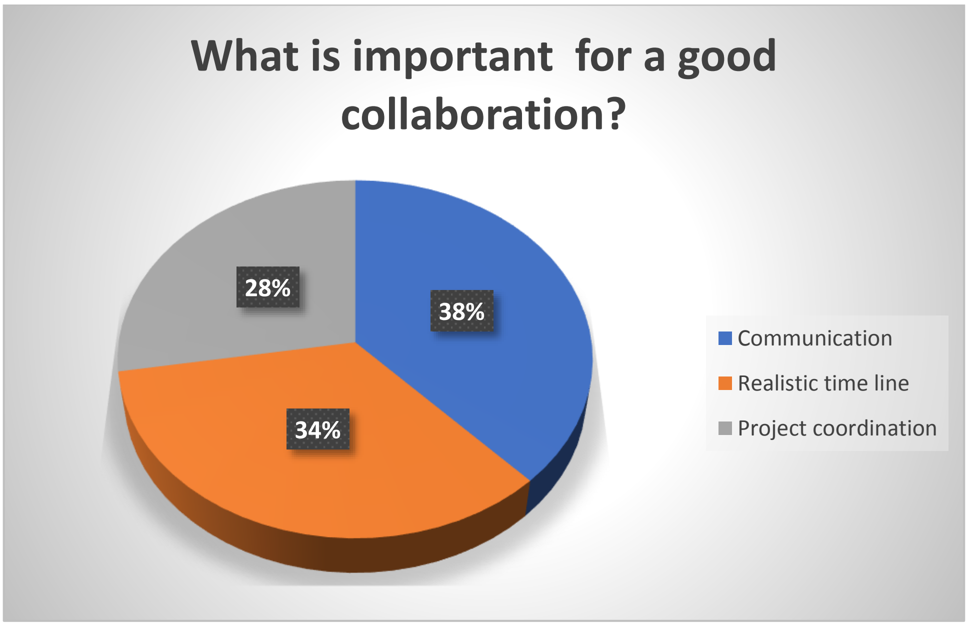

Figure 5. Views of the industry partners regarding good collaboration.

3.2 Industrial partners previous usage of ULs

Eight partners from 14 have more than five years experience using ULs, among them two even more than 10 years (figure 6). Three partners have using experience around 1 year or less. This result is in good correlation with satisfaction levels of the industrial partners about using their respective UL. The partners who have used less time in an UL are more neutral or just satisfied, in some cases even dissatisfied, about the collaboration. Main source for dissatisfaction is related to bad communication between the parties. In some ways, this correlation is understandable, because usually problems occur in the beginning of the collaboration. In general, almost all respondents are satified or very satisfied about using their respective UL(s). The majority of answers regarding the frequency of the usage is on monthly (5) and weekly basis (4). Two partners even use ULs daily. These partners either have ULs nearby or operate ULs within their own organizations.

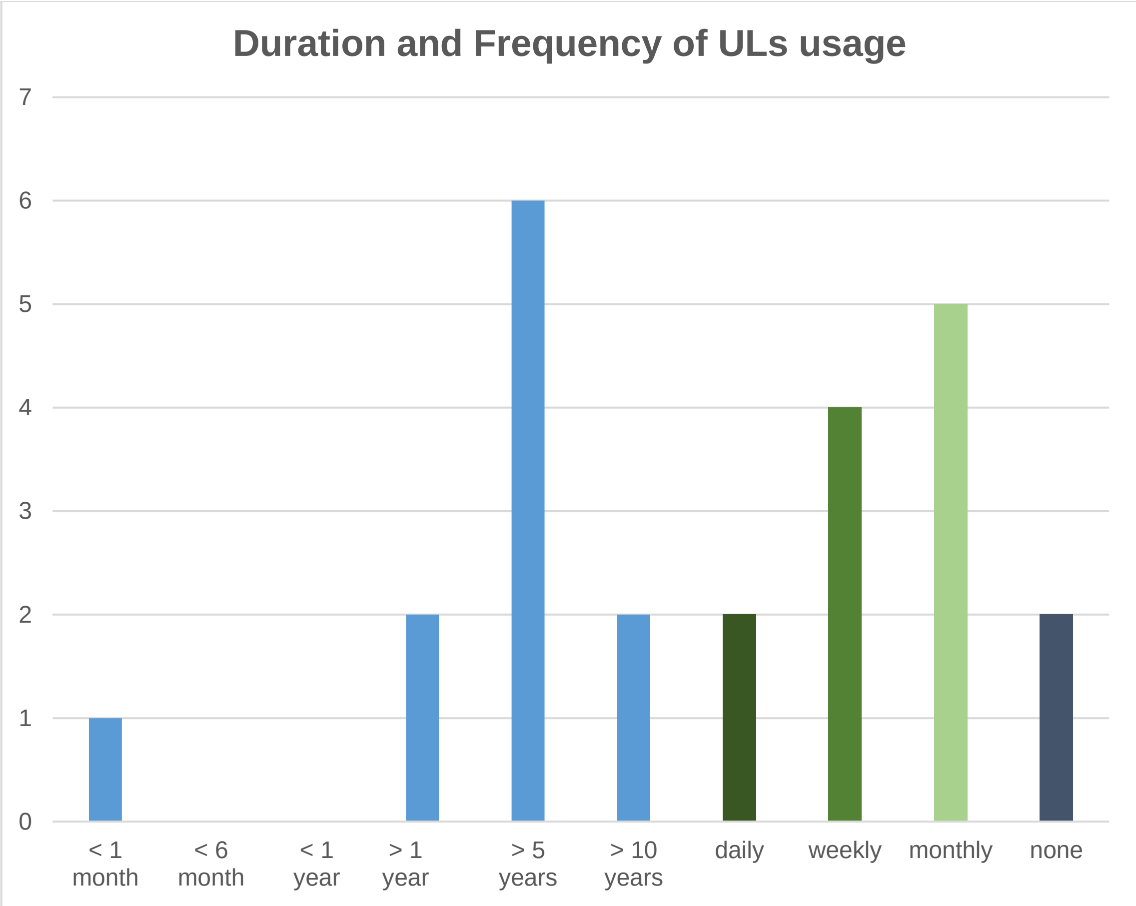

Figure 6. Diagram summarize the duration and frequency of ULs usage by the industry partners.

Figure 7 shows the fields of products the partners develop, produce or test in ULs, previoulsy. Major fields of products are exploration, energy production and storage, underground construction, geotechnology & consulting and mining. Single mentions are radiation measurments, telecommunications, deep biosphere research and tourism.

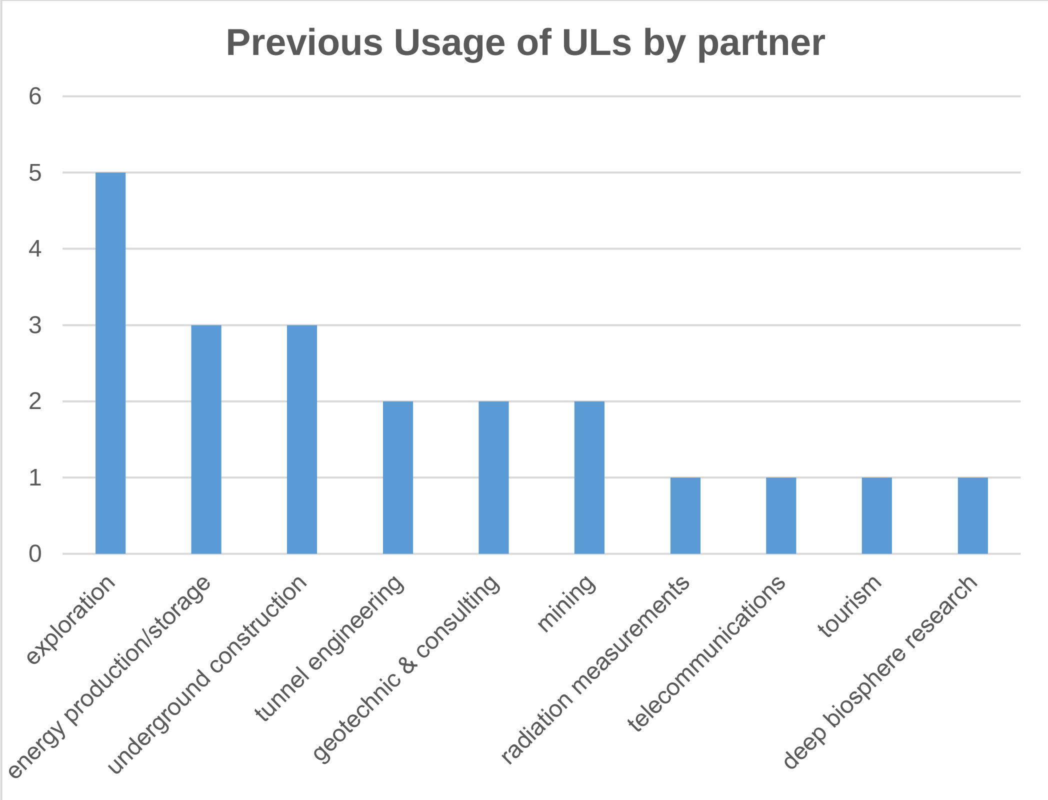

Figure 7. A summary diagram representing the fields of products the industrial partners work on in the respective UL.

Figure 8 depicts general aspects why industrial partners are using ULs for their work. Specific underground conditions which only be provided by ULs are most frequently mentioned by the interviewees. The terms environmental, real situation testing and specific geological aspects reflect this expection and wishes of the customers on ULs. On site the availability of equipment was also often mentioned by the industrial partners. This might by a hint of the importance of specific tools for underground works which UL operators shall always hold available. Single mentioned aspects for choosing ULs by industrial partnes are acces to to deep groundwaters, decreased cosmic ray background, mineralogy & geochemistry aspects as well as secucity aspects.

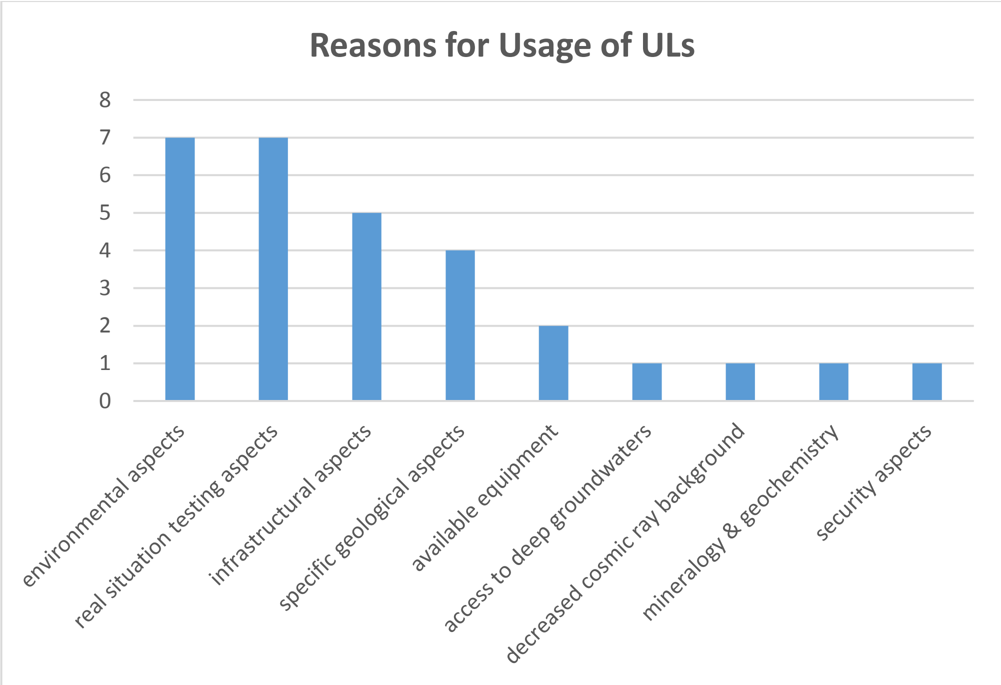

Figure 8. Diagram summarizes general aspects why industrial partners use ULs.

Figure 9 presents respondents' answers what are key issues when selecting specific ULs. There are multiple reasons why the industrial partners have chosen to use a specific ULs, but an overall issue is that ULs provide unique underground conditions and infrastructure, which are suitable for partner's specific needs, like for real situational testing, specific geological properties or access, for instance, to deep groundwater. No less important is the support from the personnel of the local UL during their operation at the site. Minor effect on choosing a specific UL seems to have the distance to the test sites which were only mentioned twice. Additionally, the access to deep ground water and unexplored environment were named by the industrial partners.

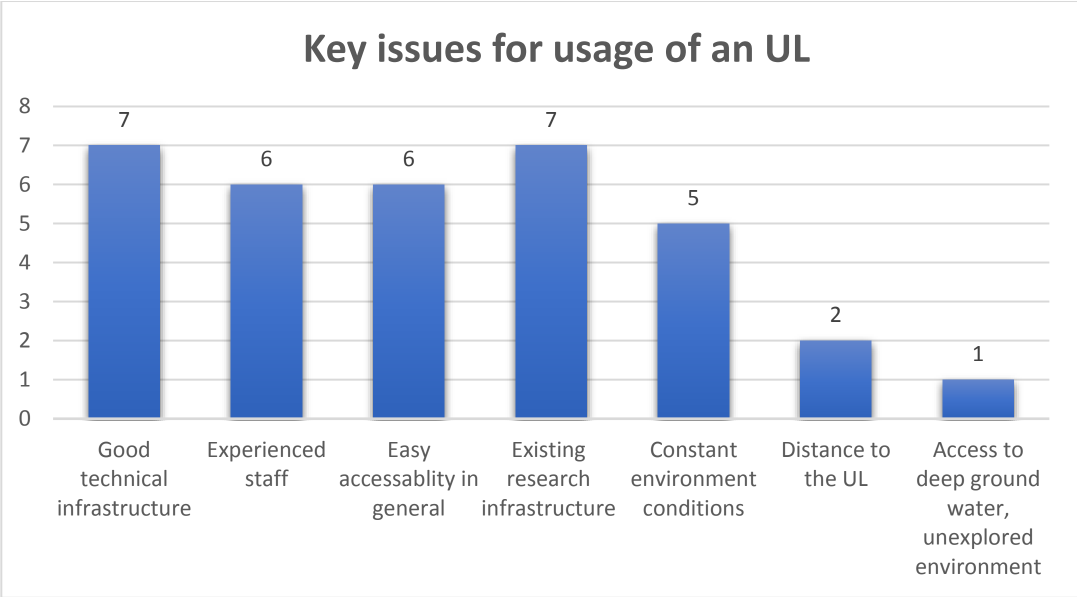

Figure 9. A summary diagram representing the key issues why the industrial partners use their respective ULs.

Figure 10 summarizes the UL services used by the industrial partners. There are some general services such as supply with electricity and water, the possibility to drill boreholes, and providing personnel, which are naturally expected by the industrial customers. Used services depend greatly on the activities a given industrial of partner is performing in its respective UL, but a partner’s expectations very much depend on the profile of its UL. For instance, as the former mine in Ruskeala is now a site of tourism, it can be expected that it will witness a year-round usage and attraction. For the others main expectations were real testing environment, easy, always and undisturbed access with good infrastructure and professional personnel who help customers during installation and managing of task such as drilling operations in the UL. Other expections to the ULs are to provide no disturbance by ongoing building activities and project specific services for underground construction. The customers expect from UL operators a careful coordination and where necessary a rectification of schedulded underground construction works.

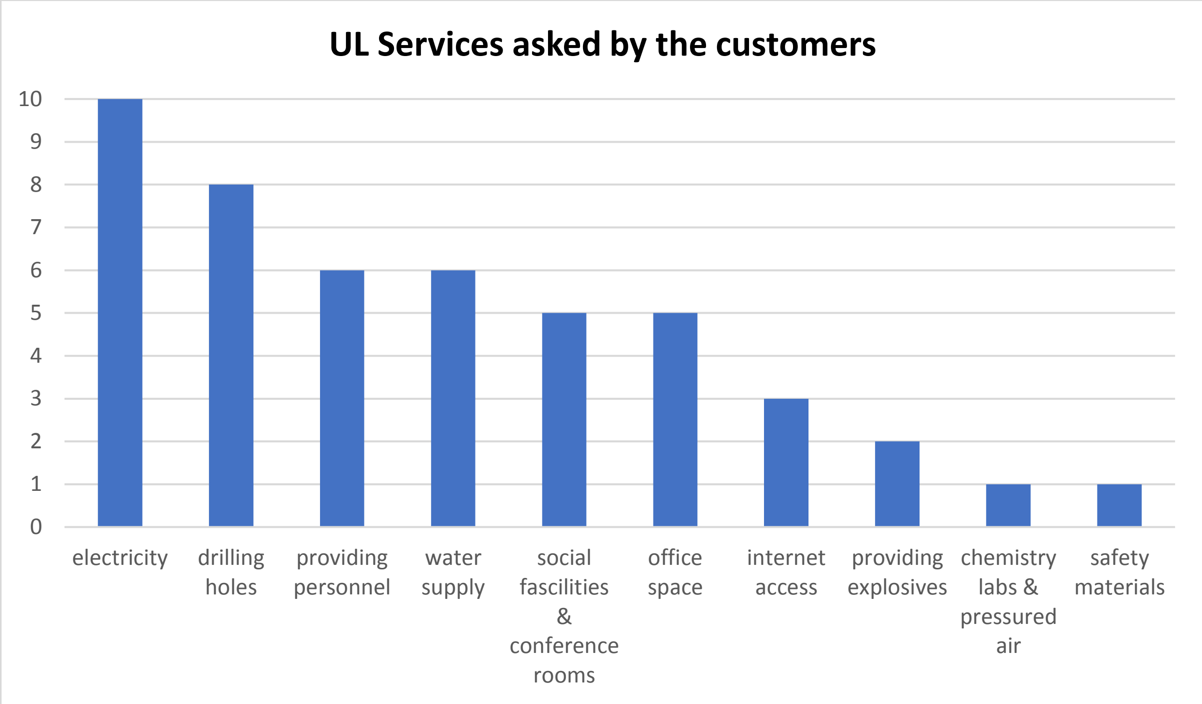

Figure 10 Diagramm summarizes the services of ULs needed by the customers.

In general, satisfaction of using ULs and their services increases over time. This reflects to some extend a growing bond of trust between the customer and the UL operator which of course influences descisions on future cooperations. Some problems arise due to missing or late communication about works, which were not possible to do or have to be shifted by the ULs.

3.3 Identification of industrial partners' requirements

Figure 11 shows the main research fields of the industrial partners. The importance of their respective UL very much depends of their own research field. For instance, if an industrial partner operates in an underground construction sector, it is irrelevant to them whether or not the given UL offers services, for example, in food production. In general, actual requirements of an industry partner dependent on what purposes it is using the given UL. Some more specific fields of activities were mentioned by the interviewees such as: testing of rock safety systems (anchors), examination of collapses and settlements, carry out of setting tests, study of multi-barrier systems, automation and digitization in underground, E-mobility testing and proof of ventilation concepts. The category 'real time scan data' in figure 11 includes point cloud visualization techniques.

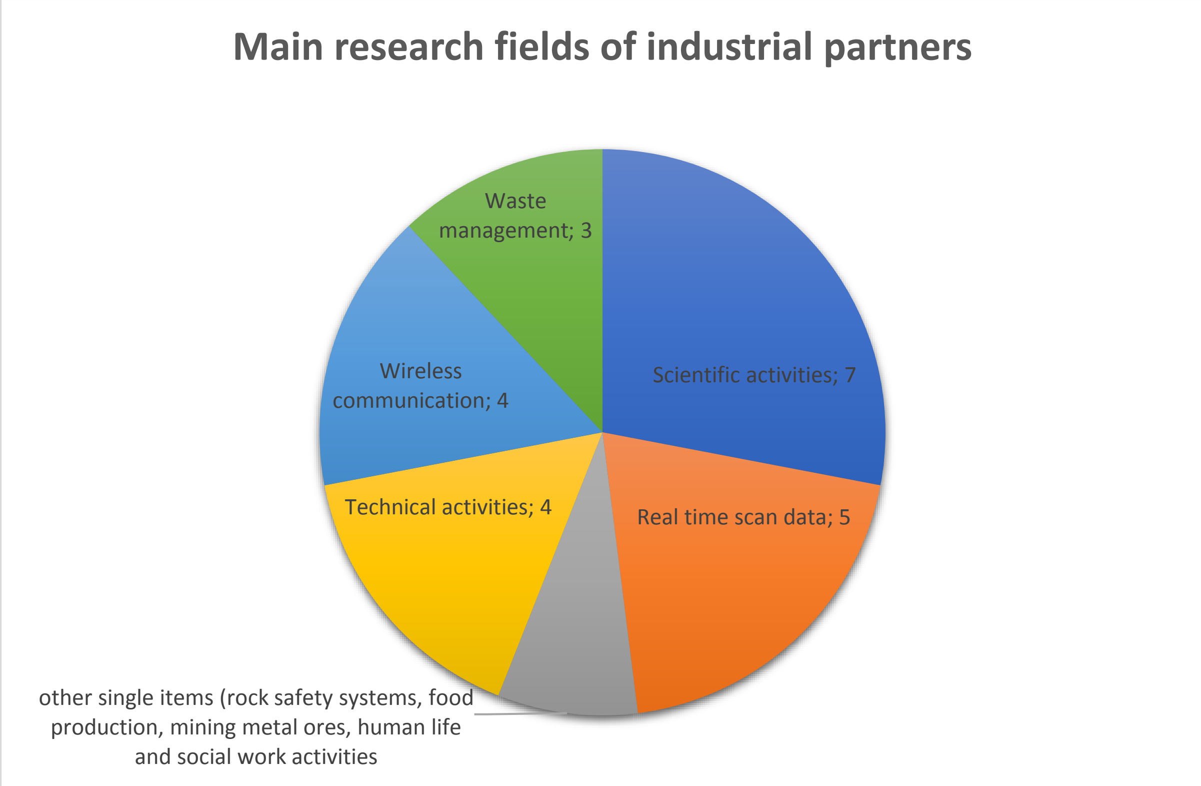

Figure 11. Main research fields of the industrial partners.

The majority of industrial partners estimate ULs as important or very important for the research fields wireless communication and real time scan data.

In summary, the industrial partners highlighted the following requirements as basics, what ULs for these research fields must at least have:

- High speed internet and GPS in tunnels
- Good infrastructure, like electricity, water supply, boreholes
- Vehicles for transport, easy access, etc.
- Availability of enough undisturbed (tunnel) space for their activities
- A storage area for equipment and office space for personnel meetings
- Availability of technical support from ULs personnel and background data

The biggest benefit the ULs have to offer is that they provide real conditions for development and testing for the industry partners. Moreover, ULs flexibility to react fast and capability to provide technical support for an industry partner are held as important requirements and basis for good collaboration. As underground environments are not normal working locations for the industry partners, they value effective and fast local support and guidance to settle in their chosen UL. Cost saving aspects are also taken into account by the industrial partners. This can be the case if mining operation would have fewer restrictions than similar action on surface. In certain cases it is just less expensive to build and operate a room as an open space in the underground than a house or workshop on surface. The costs of permission, construction and additional costs such as heating and power supply have to taken into account on a long-term scale. In particular, a high rock mass stability is one of the pre-condition for a cost effective construction and operation of these rooms in the underground.

3.4 Identification of possible future research areas

Respondents were asked to name their future research fields and/or what are their major markets. These two questions were used to collect information for mapping the possible future research areas the ULs can develop their site. According to the answers, almost all participants rank ULs as important or very important for their respective research fields. The list of possible research fields is as follows:

- Inspection of old tunnels by detailed close-up exploration of the tunnel vault
- Research of microclimate and ecosystem
- Search and mapping of arrangement of abandoned underground spaces
- Identification of acoustic features of galleries
- Glaciological studies
- In-door (undeground) GPS navigation
- Development of different fiber-based sensor systems targeted for mines and underground construction sites
- Academic research
- Deep biosphere microbiology
- Particle tracing (physics)
- Thermal-Hydrological-Mechanical-Chemical (THMC) processes for various geoscientific and civil engineering applications
- Stacking of solutions (salt mines)

- Offset and closure structures
- Gas (CO_2, Nox) and fire detection

Lastly, the respondents were asked to list what requirements they set for their UL concerning their future R&D activities in the above-given research fields. The results are shown in Figure 12. From the results it is obvious that *typical* services of the ULs, such as power supply or access and technical support, are self-evident. For them to be able to implement possible new research fields, the respondents considered such aspects as long route network of galleries and good variety of host rocks and vaults as important. This indicates that different underground conditions in different levels of the given underground facilities, including diverse geological conditions, play growing importance in implementing new research fields in the future.

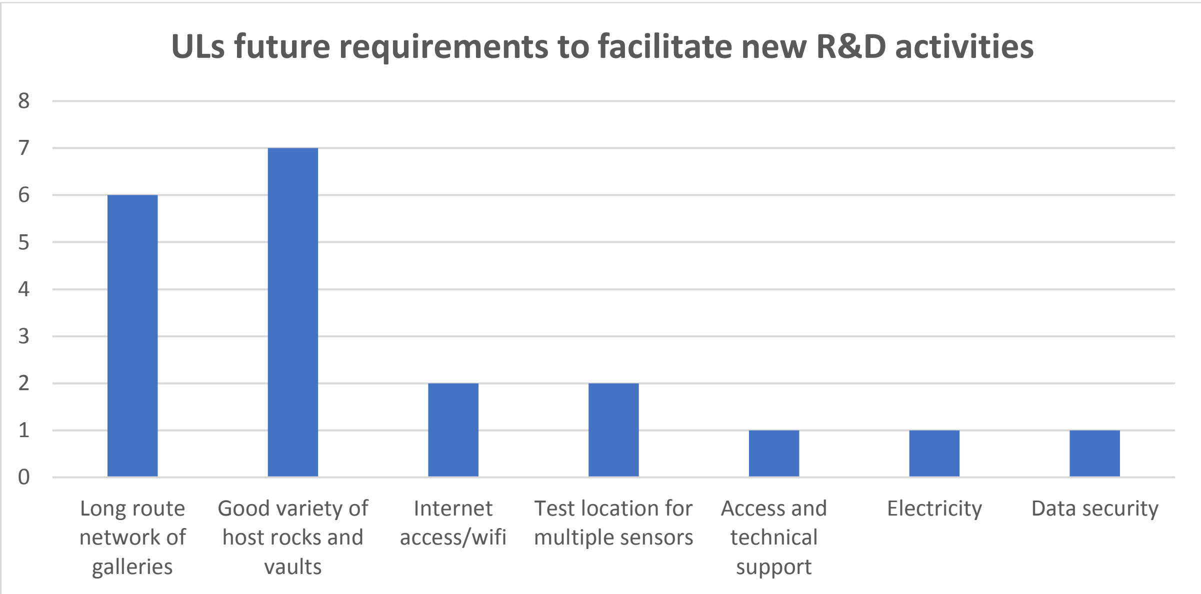

Figure 12. A summary diagram showing the requirements some of the industry partners consider important for their respective future R&D activities.

The end of the customer questionnaire comprises the paragraph miscellaneous and explanatory notes in which the respondents freely express their impressions and thoughts about underground lab usages. The item of costs or cost savings compared to on-site implementations was mentioned by the customers. A suggestion to gain possible cost savings were fewer restrictions on mining operations.

Another goup of answers can be summarized to the point knowledge exchange. This contains the exchange of ideas and know-how, especially regarding interdisciplinary issues and joint research work. The knowledge exchange can conceivably extend to post-use concepts of mine infrastructure, which is a growing field of activities and efforts for some of the industrial partners. A post-use concept was suggested which includes the creation of a service offer for externals with similar research goals, e.g. repository research and similutaneus usage by the owner.

Other customers describe special underground applications such as test tracks for fire detection experiments, energy effective methods to use lamp flora, the development of new tourism products e.g. creation of concepts for underground festivals and creative programs.

Some of the interviews just used the chance to describe their experiences with underground labs in a more task-orientated way. This description comprises the need for unexpected access to the test site for a few months, the testing of a sensor prototype with a data management system, requirements for larger testing area, multiple boreholes for multiple sensors, wireless network and close to real world conditions such as bedrock movement.

4. Guideline for implementing site-specific service to enhance innovation management

This chapter describes an innovation platform concept developed for ULs. Innovation platform concept describes key elements ULs should have to foster innovativeness and to find innovative ways to utilize their physical and intangible assets. It provides a guideline for building service offering and to support ideation and innovation processes. The usage of the innovation platform concept can help an UL to recognize site-specific strengths and weaknesses and to develop and enhance innovation management capabilities. Included in the concept is a top-level innovation management process description that illustrates how ULs may select a different business model and profile and – based on a strategic decision – have a different role within innovation management process.

4.1 Identifying competencies, resources and services to be developed

ULs may develop their capabilities to accelerate creating new innovative ideas to utilize their facilities, find new R&D fields that would benefit testing or operating in the given UL, or attract new customers to utilize its facilities. Table 1 summarizes these capabilities to 1) essential customer requirements each UL needs to meet, 2) competencies and resources an UL may provide, 3) additional services that complement essential services, and finally 4) capabilities that will create a competitive advantage and differentiate the UL from the others.

*Table 1. Site-specific competencies, resources and services provided by an UL. "Minimum must" requirements that all the ULs need to meet are **bold**.*

Essential customer requirements an UL needs to meet	Competencies and resources an UL may provide	Additional services (complement essential services)	Competitive advantage bringing benefits to an UL	Role and profile an UL may take
High speed internet access	**Technical expertise**	IPR managment	Annual "Customer Visiting Day"	Innovation Hub
Electricity, water supply	Scientific expertise	Funding services	Common or customer specific exhibitions	Project Initiator
Boreholes (drill holes)	Communication and PR expertise	Project managment and coordination	Ecosystems and networks of companies, researchers, public organizations	Project Partner
Vehicles for transportation	Legal advisor	Innovation managment		Subcontractor
Undisturbed (tunnel) space	Economic advisor	Organizing workshops	International co-operation	Facility Provider
Equipment storage	First contact person(s) (¨Account manager)	Managing the practicalities of courses		
Meeting office	Experienced staff	UL-related info material		
Easy accessability		Qualified visiting services, e.g., a showroom		
Data security		Standardized contract template (price, time mgmt)		
		Building consortiums		
		Industry specific machinery and equipment		
		Demonstrations		

The essential services required by the customers are primarily technical and related to physical facilities such as high-speed internet access, electricity and water supply, and open boreholes. What comes to competencies and resources, availability of technical support is a must and essential requirement customers address to each UL. In addition to that, different competencies and resources – like the availability of scientific, communication, legal and economic support – strengthen the attractiveness of the given UL. ULs may also consider providing number of additional services that complement essential services and which customers appreciate: management of IPR, funding services, project management and coordination, organizing workshops, managing practicalities of courses, qualified visiting services (e.g., a showroom presenting different ways of utilizing the given UL facility). The innovation management itself can be a valuable additional service. Some customers may also need support building a project consortium and there an UL may also consider taking an active role. Finally, one can define capabilities and services that are not a must for an UL to have, but which definitely would create competitive advantage and differentiate the given UL from its peers. If an UL would like to differentiate, it should be creative and proactively innovate new services. Regarding this, there are few examples shown in Table 1. An UL may, for example, orchestrate extensive company and researcher ecosystems or networks that are valuable assets when customers need to find partners for project consortiums.

The portfolio of services provided by a given UL defines its possible roles and profiles within the innovation process and its relationships to its customers and partners. If the UL services are limited to meet basic customer requirements (i.e., column 1 in Table 1) and to provide only essential technical support, the role is limited to act *as* ***facility provider*** **or** ***subcontractor*** within their customer's R&D projects. Becoming an acknowledged ***project partner*** **or a** ***project initiator*** requires that UL enhances its competencies, resources and services by further developing them. The most comprehensive role in innovation process is ***an innovation hub***, where UL is active in screening, generating and collecting new ideas and has competencies, processes and tools for systematic innovation management. An innovation hub has potential to initiate R&D projects in a variety of UL related research fields. Part of the capabilities of an innovation hub is an existing and well-developed customer and partner network in the corresponding research fields and an extensive company and researcher ecosystems or networks.

It is a strategic decision for an UL to define its business model, role and profile within the innovation process. Once the targeted profile decision is done, an UL should follow a systematic approach to develop competencies, strengthen resources and design site-specific services to become what it wants to be. As illustrated in Figure 13, innovation process capabilities can be divided into three focus areas, which support each other:

1. People and staff,
2. Processes and services, and
3. Physical UL facilities

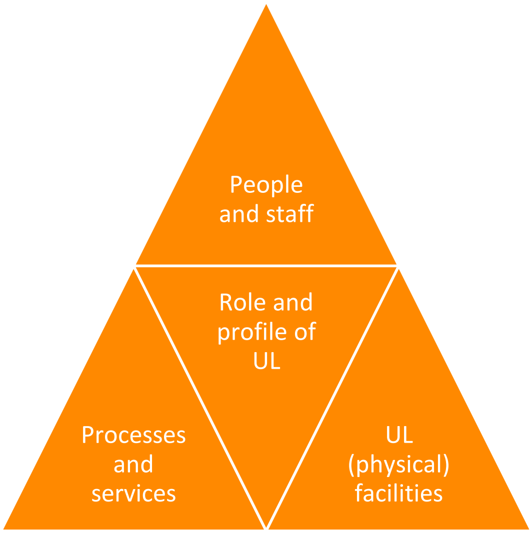

Figure 13. Innovation management process capabilities can be devided to three focus areas: "People and staff", "Physical facilities", and "Processes and services". Depending on its target role and profile, an UL may develop competencies, strengthen resources and design site-specific services in each focus areas accordingy.

In the following we provide a simple systematic approach an UL may follow to enhance its innovation management capabilities and service offering:

1. Conduct a SWOT analysis and "Current State Analysis" (CSA) of each three focus areas shown in Fig. 13. Results of these analyses will provide a detailed knowledge of the current state and identify UL's strengths and weaknesses in its internal business environment as well as opportunities and threats its external business environment may cause. The report on WP3.4 "Underground laboratories – Quality assessment and analysis" comprises already some key elements of a CSA for the BSUIN ULs.
2. Make a strategic decision regarding your UL's targeted role and profile in the innovation management process.
3. Create a development roadmap to reach the desired new state of affairs. Figure 14 shows a schematic example of such a roadmap and some key activities and services.

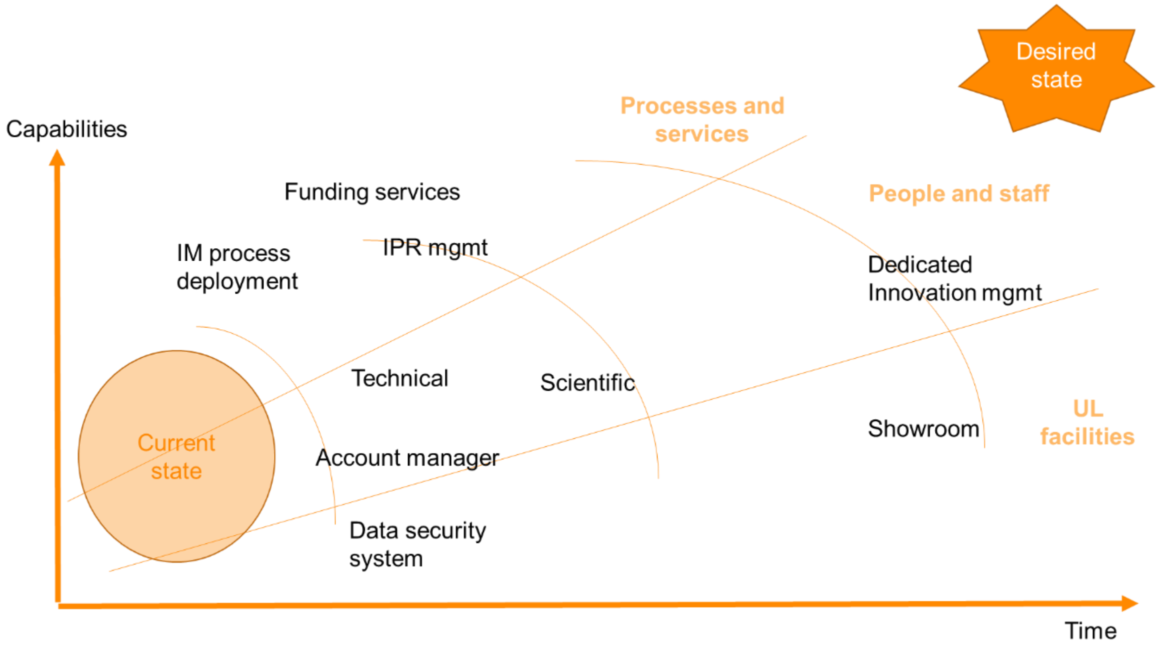

Figure 14. Schematic roadmap of an UL to its desired new state or profile within the innovation process.

4.2 Innovation Management process

The aim of the Innovation Management Process (IMP) is to support a given UL to accelerate creating new innovative ideas to utilize its facilities, find new R&D fields that would benefit testing or operating underground, or attract new customers to utilize its facilities (Figure 15). An UL's key actions and activities in different IMP process phases depends on its business model, and the role and profile it has decided to take (Table 2).

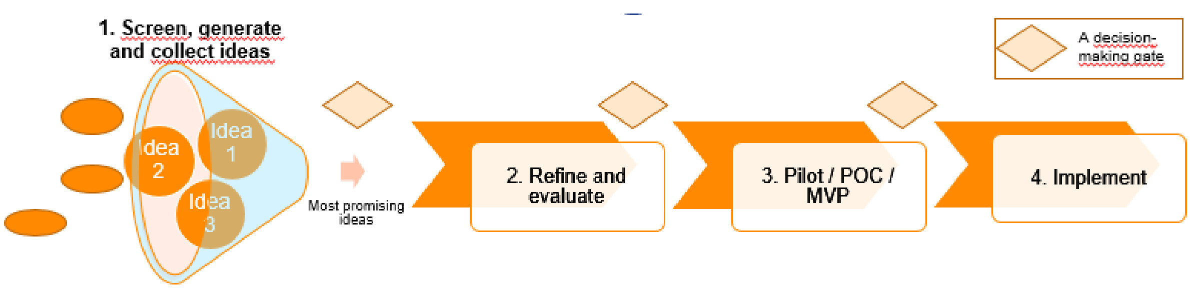

Figure 15. Phases of the Innovation Management Process

The Innovation Management Process introduced in Figure 15 has four phases. The process operates like a funnel, where number of new ideas are fed into the funnel where ideas are processed through four phases, while only the most potential ideas pass all the decision-making gates between the phases. In the **screening phase** one searches, generates and finds innovative ideas and innovation potentials, i.e., opportunities for innovations. This can be a customer requirement, a new technical solution, or a new research field. The outcome of the screening phase is a selection of the most promising ideas for further processing. In the **refine and evaluate phase** ideas, potentials and insights are further developed to shape and elaborate them. Target is, as an outcome, to have a concreate and releazed idea with goals and expectations. Depending on the idea and its characteristics, in the third phase of the IMP **pilot[1], Proof of Concept[2] (POC) or Minimum Viable Product[3] (MVP)** is conducted. This is an intensive analysis phase to gather extensively information about, for example, customer requirements, risks and the feasibility of the idea. This phase may have several iterative steps where initial POCs and MVPs are continuously developed. Finally, best innovative ideas that have passed all previous IM process phases and related decision-making gates are passed forward to the last stage of the IM process: the **implementation** phase. In the latter, a project that will realize the idea is set up.

Table 2. The UL's key actions and activities in the Innovation Management Process phases regarding their respective roles that change from case to case between Facility Provider (FP), Subcontractor (SC), Project Partner (PP), Project Initiator (PI) and Innovation Hub (IH).

[1] A Pilot is a small-scale preliminary study conducted prior to a full-scale research or implementation project.

[2] A POC is a small exercise to test the design idea or assumption. The main purpose of developing a POC is to demonstrate the functionality and to verify a certain concept or theory that can be achieved in development. POC shows that a product or feature can be developed.

[3] A MVP is a version of a product with just enough features to satisfy early customers and provide feedback for future product development.

IH	- Dedicated IM Resources. - Systematic IM processes, methdos and tools. - Using networks and ecosystems to actively and systematicly promote UL to existing and potential customers. - Organize ideation events.	- Dedicated IM Resources - Systematic IM processes, methdos and tools	- Provide contact network to find needed competencies - Support building R&D consortiums	- Provide contact network to find needed competencies and build R&D consortiums - Organize events supporting dissemination and exploitation, e.g., exhibitions, congresses - Support genereting spin-offs
PI	- Initiate project ideas - Identify and contact potential partners	- Active driver - Make go/no-go decision	- Active driver - Make go/no-go decision	- Build R&D consortium - Project coordinator
PP	Contributor (case dependent)	Contributor (case dependent)	Contributor (case dependent)	Contributor (case dependent)
SC	Contributor (case dependent)	Contributor (case dependent)	Contributor (case dependent)	Contributor (case dependent)
FP	Provide facilities	Provide facilities	Provide facilities	Provide facilities

The chapter closes with some highlights for enhancing innovation management at the ULs:

1. ULs are recommended to develop site specific services and implement innovation management process to foster innovativeness and facilitate customer cooperation.
2. ULs are recommended to define their role and profile within the innovation process and their relationships to their customers and partners. As an example. ULs should try not to act as simple “test place provider“, but as a scientific cooperator. This role would include, for example, publishing common scientific articles, and introduce customer achievements in the given UL by applying their own channels of information dissemination. These activities would lead to better engagement with other interested customers and value creation of the developed product/service.
3. It is recommended that each UL assigns one contact person or *account manager* (Table 1), with whom a customer can contact with any issues they may face (e.g., in case of emergency even in night time). Another recommendation for each UL is to clarify in a very early stage what exactly are the needs and especially expectations of each of their new customer. New customers are not necessarily familiar with ULs working environments and may hence need comprehensive guiding and advice, especially in the beginning of the cooperation.

4. Finding new research fields with possible customers require ULs to be open minded and proactive. Even the craziest ideas should be considered. Innovation happens when new things are tried, and ULs are unique places form an excellent platform for that.
5. Consider making public outreach activities obligatory in the Innovation Management Process of your UL. You may organize an annual ”customer visiting day“ to show your UL’s possibilities to your potential partners and showcase successful collaborations with your existing customers. This would encourage new customers to engage. Additionally, the ULs should present and promote their possibilities in regional and national conferences, seminars and exhibitions.

5. Best practice case studies

The questionnaire send for the industrial partners raised up some best practice case studies, summarized below:

1. ULs flexibility and client-oriented thinking is a key for good collaboration. ULs quick reaction time to fulfill customer needs, even changed needs in very short notice, enhances cooperation between the UL and the customer. This flexibility and client-oriented thinking for every client should be thinked through and fixed in ULs innovation management.
2. Communication is always important and even small drawbacks in this might lead to customer dissatisfaction. Communication was named as one of the most important aspects for a good collaboration with research institutions. To prevent drawbacks, it is recommended that each UL sets up a fixed communication protocol with every client in its innovation management system. This protocol is a guideline how to communicate with the client, e.g., who are the contact persons, how many decision levels are to be expected, what are the minimum and/or maximum reaction times in the given UL, etc.

In general, questionnaire showed that satisfaction levels of customers of the ULs, and therefore good practices, have a tendency to grow in time.

The story line of the BSUIN webpages comprises a collection of best practice case studies such as the R&D project "Next Generation Impact Source (NGIS)" between BSUIN partners German Research Centre for Geosciences and Amberg Technologies AG. This project went successfully through all phases of the innovation management process shown in figure 14.