Turning Knowledge into Innovation by Certified Transfer Capabilities

A Concept Note to the Consultation Process “Green Paper - Towards a common strategic framework for EU research and innovation funding” from the European Project BONITA (BSR INTERREG 4B)

Overview and Motivation

The steps the European Commission is taking towards instituting a common strategic framework for EU research and innovation funding are important in establishing an operative Innovation Union that is able to turn knowledge into innovation. As described in the Green Paper from the European Commission, the task to develop a common strategic framework dealing with very diverse streams of developments is a complex one. The concept note is based on the results of the European Project BONITA that is financed under the Baltic Sea Region INTERREG 4B program. This recommendation will focus on one of the European key challenges: improving the efficiency of the knowledge and technology transfer process for the purpose of strengthening the link between science and research. Following the Green Paper to “make the most out of every euro that is financed by the severely constrained public budgets”, the Project BONITA emphasizes the importance that organizations participating in public funded research are capable to play a strategic role in the technology and knowledge transfer process. Even if the European framework programs have already established several mechanisms to improve the contribution of funded research projects to the innovation process, the success in sustaining these investments is far below its real potential. Technology transfer activities take place in quite different ways, depending on traditions, resources and economic structures, but always are depending on active commitment and participation of the involved actors within their organizational structures. Conventionally innovation and technology transfer is treated as a black box that is studied by comparison of its input and output or using statistical data. An approach taken in this work is a

What should be the measures of success for EU research and innovation funding?

The core advice given in this paper is to establish an European innovation and transfer quality management that will improve the transfer capabilities of organizations participating in the innovation process in addition to statistical input and output indicators.

Measuring the success of research investment in an objective and comprehensive fashion based on indicators is challenging. Available measurements only provide a snapshot of the current output situation. We recommend a continuous monitoring and evaluation of the organizational structures with mature processes and well defined transfer strategies.

Process orientation, process assessments and process improvements are standard for many businesses and have proven their benefits on economic developments. Obviously this understanding is also needed for research investments. To create successful innovations out of research funding is not the last step of a chain – it requires a continuous, skilful thinking accompanying the complete process. It is clearly a matter of capabilities and maturities of the participating partners.
“white box” approach, i.e. it is taken an attempt to express innovation and technology transfer activities as decomposition into a set of single processes and their performance descriptions.

From the researcher’s point of view, in several cases, transfer is seen as an add-on to the research process; project funding is understood to finance mainly the R&D part. Aspects like exploitation plans are not in the main focus and are often not embed in the strategies of public funded research organizations. In many cases, these elements are outsourced to other partners that are competent to take care of the valorization of the research. While it is good, in principle, to involve appropriate experts for these tasks, it should not lead to completely shifting the responsibility for the transfer: “research” is also responsible for driving the successful transfer process. It is needed, at the very least on the level of the research organization, to recognize the elements of a transfer process to be a functional part in the complex value chain of technology transfer.

“Europe needs to make a step change in its research and innovation performance” (Green Paper) and this performance and its transfer to social and economic impact relies heavily on the maturity of innovation- and transfer-supporting processes. Public funded research organizations have become more and more aware of the inherent structural conflict between holistic strategy and functional organizational design. A potential improvement of transfer-relevant organizational structures can be reached by using strategic transfer-supporting initiatives and, based on a quantitative and qualitative process analysis, creating managed and predictable transfer capabilities. The BONITA project has created the notion of a “transfer capability” to describe and analyze the preparedness of organizations to perform transfer from research to innovation. This capability is derived from an assessment of relevant processes in the complex and non-linear technology and knowledge transfer. The BONITA Innovation and Technology Transfer Model provides an innovation and technology transfer process dimension that satisfies the requirements to the Process Reference Models and Process Assessment Models established by ISO/IEC 15504. The model allows doing assessments of organizations as stakeholders within the complete innovation chain and provides a structured feedback of the current individual performance of an organization. It enables organizations to understand their activities in the context of the transfer and innovation and helps to identify strong and weaker action areas on process level. Therefore the BONITA model defines three generic roles that are involved in the transfer and innovation chain with specific activities on an abstract level:

1. Necessarily there exists a type of Knowledge/ Concept/Technology Developer,
2. the process is mostly accompanied by a kind of Technology Transfer Driver or Facilitator and finally,
3. There is any type of Recipient of the given knowledge/concept/technology who hopefully becomes an Innovator.

Moving from abstraction towards real activities, often organizations perform more than one role in the innovation and technology transfer process. For example, within a project consortium you will find a mixture of roles and organizations. The interfaces between the different stakeholders are crucial in driving the innovation chain successfully. Collaboration without knowing the positioning of partners or potential synergies is bears a high risk of inefficiency. Collaboration should be based on understanding rather than on expectations and accidents. This identifies responsibilities of the different stakeholder/roles for their individual contributions in turning research to innovation. But
finally this requires mature organizations that know about the elements of the transfer process and that are acting with commitment according a defined transfer strategy.

The core advice to this consultation process is the implementation of an obligatory innovation and transfer quality management for all public funded research organizations based on a European standard and certifiable process model.

Such innovation and transfer quality management will come along with important improvements within the innovation chain:

**Awareness Raising**

When the European Commission introduces an obligatory quality management to document the need for certain capabilities of organizations for successful transfer activities, this will increase the awareness that excellent research does not necessarily lead to innovation. It will clearly indicate that knowledge transfer is research, too and that good research has to have an active part in the transfer process. The mechanisms of technology and knowledge transfer and the awareness of the own role and responsibility of organizations within these processes will be raised by such an obligation.

**Self Evaluation**

Offering instruments for organizations to analyze their own transfer capabilities will increase transparency of their own “position” within the innovation chain. Knowing this position is an important element in improving their transfer performance. Following the classical Plan-Do-Check-Act cycle (PDCA – Deming Cycle) in process quality management it is important to enable checking the performance of an organization. The BONITA Innovation and Transfer Model provides a process assessment framework for technology and knowledge transfer that is suitable to track and document such organizational developments. A possible quality certification could document that an organization is aware of the transfer processes and that it uses an evaluation to improve the quality of its own related processes. This will help to develop more mature organizations with improved capabilities to contribute to the innovation chain. Beside this, organizations can get better support for targeted improvement of certain capabilities by making challenges more explicit to the funding body of an organization. Instead of discussing opportunities for organizational improvements on an abstract level, it will be possible to identify them on a very concrete level. This provides a better argumentation for investing in research infrastructures and makes such investments more transparent.

**Certification of transfer capability**

Moving the innovation and transfer quality management towards standardization will introduce important new opportunities. Certification will be valuable for the distribution of project funding. On the one hand, a quality certificate for transfer capability can be established as evaluation criteria for research consortia when specific transfer results are expected from a program. On the other hand, knowing about the transfer capabilities of organizations enables the European Commission to shift responsibility regarding commercialization and exploitation to the partners without increasing the detailed controlling on micro level. In practice, it has turned out that over-controlling hinders the flexibility to react on transfer opportunities. Thinking about the current discussions related to FP8 to reduce administrative overhead and to increase the degree of freedom for consortia on how to achieve certain results, certification will be an important and fair indicator. Funding in research
generally should be an investment for sustainable growth, thus it is important that the receivers of research funds can show that they are able to take responsibility of their parts in turning knowledge to innovation. Certification will be an important and objective element to implement these mechanisms

**Improved values in collaboration**

The introduction of a European transfer and innovation quality certificate helps identify suitable and compatible partners for research collaborations to ensure the quality of the value chain of transfer processes. To motivate companies, for example, to participate in framework program research, it is important for them to know that the partners in a consortium are working towards a common goal and that their work is based on shared standards. With a transfer quality certificate, research organizations could document their interest to be a valuable partner for innovation. This establishes an important new aspect of quality for organizations, and will motivate them to improve for competing as best partners for innovation.

The BONITA transfer model has been developed to contribute to these challenges. The model has been evaluated in over 30 assessments of research and transfer organizations in 10 European countries. Currently, extended organizational assessments in three additional countries are in preparation. The Model is an integrated framework that allows assessment of the innovation chain to its full extent. The model has already reached implementation level, so it can already be applied and in principle put into standardization process. Currently the model is mainly used to provide self evaluation and to support an intra-organizational PDCA-Cycle. Understanding the potential behind the process assessment of transfer capability opens huge opportunities for improving the contribution of research to economic growth.
Background Information

Innovation and technology transfer process capability maturity modeling

Transfer of scientific knowledge is an important building block for European Regions of Innovation. Therefore scientific organizations need to be encouraged for proactive transfer of their results and to increase their own responsibility first. Establishing a continuous development program of capabilities for research professionals and creating a roadmap for improvement actions means improved efficiency of research funding. But it was realized that for the improvement of research performance and its transfer to social and economic impact, Europe has to focus on the maturity of transfer supporting processes in organizations.

Narasimhalu [Narasimhalu] already 2006 offered a framework for codifying the tacit knowledge about technology transfer into a model that would benefit others. “To understand the linkage between the public funded research and technology transfer performance, a deeper understanding is needed of the research itself, of its internal structure, multiple objectives, and interactions with industry, political stakeholders and the rest of the regional economic environment.” And while technology transfer is often perceived to be transfer of intellectual property, Reynolds renders more precisely that very few realize that there are other means of transferring technology like:

- “assess organizational status quo
- assess people’s current level of competence and skill
- stimulate thinking”

IP such as patents, trademark and copyrighted material can easily be transferred. Narasimhalu suggests that this is the lowest level of technology transfer possible [Narasimhalu]. According to his approach the next level of technology transfer is the ability to handover technology from the originating team to the recipient team. This involves having the creator(s) of technology innovation working with a team from the recipient side handing over technology and know-how.

BONITA created the Innovation and Transfer Model that supports public research organisations, incubators, technology parks and innovation and transfer agencies in successfully addressing transfer issues from basic research to economic value. Innovation and technology transfer process capability maturity approaches have been investigated for around two years now (i.e. Peisl, 2009). The concept originated from capability maturity models (CMM) of the Software Engineering Institute (SEI) of Carnegie Melon University and from ISO/IEC 15504 Process Assessment framework known as SPICE (Software Process Improvement and Capability dEtermination). The generic approach is based on the assumption that systematic product or output quality can be achieved by means of process quality/capability. Process capability obviously cannot be established at once during the launch of any activity but has to be improved by applying an iterative procedure of process capability assessments and improvements. Hundreds of various generic and specific CMMs that can be treated as results of codifying process-oriented knowledge have been developed. Process capability maturity modeling is a method: a system of notions and language for knowledge systematization of process oriented activities. ISO/IEC 15504 represents the third generation of process capability maturity models that refer to an external process reference model and a process capability assessment framework defined in the normative part of ISO/IEC 15504-2. Any external process reference model must satisfy the requirements of process definition in terms of process purpose and outcomes. The BONITA Model
for Innovation and Technology Transfer was created accordingly. In addition to the process reference model, a process assessment model (PAM) was developed and validated in all participating organizations of the project. PAM ensures the possibility to assess the overall capability of various institutions and to define a current process capability profile. The process capability methodology allows afterwards to define a target process capability profile and to update innovation related process implementation for achieving the defined target process capability profile.

BONITA understands the task of assessing organizational transfer capabilities as always embedded in a regional context. Based on qualitative interviews, the performed organizational activities are collected and analyzed in their regional context first. The interviewees are individuals or teams on management level. The interviews were also used to find out expected trends and stated possible improvement actions. On a regional level, this allows the consideration of structural changes when making impact analysis for specific scenarios. The Innovation Union aims to reduce knowledge fragmentation; therefore it is clearly prerequisite to establish a convincing strategic vision of the implementation of continuous asset management in the involved organizations.

Secondly, these activities are mapped to the external process reference model satisfying the requirements of ISO/IEC 15504-2. A variety of 52 processes with quality and dynamic-numeric indicators relevant for the process performance is addressed. Therefore it defines on abstract level three roles that are involved into the transfer and innovation chain with specific activities (see Table 1):

**Table 1 Roles in the technology transfer process.**

<table>
<thead>
<tr>
<th>Roles</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Developer</td>
<td>Its activity is developing new technologies/concepts/knowledge.</td>
</tr>
<tr>
<td>Technology Transfer Driver</td>
<td>Its activity is driving the technology commercialization from the technology developers to the technology recipients/acquirers (innovators).</td>
</tr>
<tr>
<td>Technology Recipients/Acquirer and Innovator</td>
<td>Its activities are:</td>
</tr>
<tr>
<td></td>
<td>• identifying and selecting innovations to be introduced</td>
</tr>
<tr>
<td></td>
<td>• acquiring new technology to be introduced into the organisation's products and/or services to perform the innovation</td>
</tr>
<tr>
<td></td>
<td>• introducing innovations into products, services and processes</td>
</tr>
</tbody>
</table>

Moving from abstraction towards real activities, often organizations perform more than one role in the innovation and technology transfer process as well as one role can be performed by more than one organization.

In detail, the BONITA model also consists of an innovation and technology transfer process reference model and a process assessment model and an activity model. Processes are according to ISO/IEC 15504 represented by a process purpose, outcomes and base practices. As foreseen, the BONITA
model grouped processes are into Organisational, Primary and Support categories. For the adoption to innovation and technology transfer, the Primary process category is split into subcategories that are structured according to the mentioned roles.

This methodology is straightforward and produces the final results in form of tables, which allow benchmarking (example result figure 1). An added value of the methodology was observed and stated up to now by all participants: the development of a deeper understanding of the interrelation of their organizational structure and intangible assets.

**Figure 1: Example results**

![Table Example](image)

Afterwards, the methodology foresees the definition of an organizational target capability profile according to the regional stakeholder-environment. While process capability is related to process predictability, organizational maturity expresses the way to which activities are performed. The idea of maturity indicates the improvement path of organizational activities to achieve better results. The process capability concept therefore allows the measurement of the state of performance of an organization’s activities and the planning of individual steps of processes capability improvement (Fig.2).

According to ISO/IEC 15504 the achievement of a process and its related activities is measured in terms of a percentage scale. The exact values correspond to simplified rating values as follows:

- **N** not achieved - 0% - 15% achievement
- **P** partially achieved - 16% - 50% achievement
- **L** largely achieved - 51% - 85% achievement
- **F** fully achieved - 86% - 100% achievement
Future improvement strategies in the context of the European Innovation Union - Interpretation of assessments

The management level is responsible for the correct and targeted operation of an organization, and hence, for guaranteeing effective processes internally and externally. They are thus responsible for initiating, controlling, and monitoring innovation-supportive processes. We propose a methodology how to codify innovation and transfer related knowledge and experience to make it accessible for economic growth and societal value. The most interesting challenge will lie in the discussion of the relative values of improvement of the supportive processes related to an organization's core business.

A variety of financial instruments of the EU has been addressed in the Green Paper which is relevant for future measures and will hence be addressed by the future studies. We see a large share of our future tasks in contributing to the implementation of the European Innovation Policy. In addition, we estimate that it would be interesting to include other factors (e.g., dimension of economic agents, strategic alliances, strategic planning and organizational adaptation capability to a changing economic environment, policy coordination or internationalization) in order to conclude necessary policy strategies contributing to the fulfillment of the objectives of the Innovation Union.

We consider it could be also interesting to add an analysis of structural cooperation between different managing public authorities competent for innovation policies at different public administration levels in aspects like strategic alignment, co-operation measures methodology, result and impacts, in order to benchmark and transfer such good practices. The analyses in this supra-political context would also take up elements of networking capability.

From macro-level to operational level: Conclusion

Using an ISO/IEC 15504 conformant methodology for measuring the organizational capability to efficiently transfer knowledge, concepts or technologies into economic and societal impact, we have
shown that innovation-related knowledge and experiences can effectively be codified into process-oriented modeling for process capability assessment and improvement. The BONITA model follows the a priori expectation that improved organizational processes will lead to subsequent impacts on the organization's performance.

An added value of the methodology, one that was stated by more than 30 participating organizations up to now, was the development of a deeper understanding of the interrelation of their organizational structure and intangible assets. They defined first their starting point ("here we are") for initiating a structured improvement approach.

The participative approach is in the core of the improvement methodology: by analyzing the organization's activities towards a process model, and afterwards performing a guided self-assessment, the management of the participating organizations developed a detailed insight to their paths of structured improvement. Since the Innovation Union aims to reduce knowledge fragmentation and enhance R&D and innovation intensity and focus on outputs and impacts and to indentify best reflecting macro level indicators, the BONITA model provides the system of operational level indicators and methodology for participative-approach-based process improvement, including a prerequisite to establish a convincing strategic vision of the implementation of continuous innovation and transfer quality management in the public funded research organizations.

References
Communication from the Commission to the European Parliament, the Council, the European Economic Committee and the Committee of the Regions (2010). "Europe 2020 Flagship Initiative Innovation Union", SEC 1161


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