BRIDGE

A new funding scheme BRIDGING research and innovation

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Executive Summary

BRIDGE is a new concept for jointly funding research and pre-competitive innovation in Switzerland in the domain of Engineering Sciences. It proposes to *strengthen the translation of publicly-funded research results into pre-competitive innovation*. To do so, it plans to better connect academic and industrial players through ambitious research projects, thus creating suitable platforms for collaborative *knowledge and technology transfer* based on cross-exposure and inter-connection of personnel, with a special focus on junior researchers/engineers. The domain of Engineering Sciences has shown to be a very fertile ground for the successful translation of research into products on a world-wide scale.

The goals of BRIDGE will be achieved by creating a new funding instrument that: i) Integrates a granting mechanism addressing both *research and innovation* deliverables; ii) Introduces a *continuous interaction* between researchers and industrial players to leverage the influence of both research achievements on new product ideas and of market needs on research directions; iii) Relies on a new dual evaluation mechanism involving both *scientific and economic* dimensions.

BRIDGE is intrinsically positioned at the frontier between research and innovation, and its launch and operation will require a concerted effort of institutional players (SERI, SNSF and CTI), as well as a consortium involving the Polytechnics, the Cantonal Universities, the Universities of Applied Sciences and Swiss Research/Innovation Centers (e.g., CSEM, EMPA, etc.). Representatives of the Swiss economy will also be integrated through an *Industrial Advisory Board*.

While the long-term objective of BRIDGE is the set up of a broad funding instrument, the proposal for the budget cycle 2017-2020 will focus on Engineering Sciences and leverage the scientific community built within the *Nano-Tera.ch* program funded by the SERI from 2008 to 2016. In particular, further strengthening the link between an active research community and the Swiss industry will contribute to turn successful research outputs into a strong stimulus for the economy. Furthermore BRIDGE will also benefit from the outputs of the *precoR* initiative launched in 2014 by SNSF to fund pre-competitive innovation.

The BRIDGE proposal targets a funding of 80 MCHF in the form of a specific Federal budget under the responsibility of the SERI for the period 2017-2020.

Motivation

Despite the strong research funding in Switzerland, the high ranking of academic/research institutions and the largely recognized competitiveness of Swiss innovation, more detailed indicators show that the economic exploitation of the created intellectual property should and could be higher to improve significantly the return of investment in Swiss research to the economy.

Various analyses show that the translation of scientific results generated by publicly-funded research into precompetitive innovation activities is inefficient and represents a real impediment to bringing successful research ideas to industrial products. This *innovation gap*, often referred to as the "valley of death", indicates that there is a general lack of funding – and related motivation – for *pre-competitive innovation* that could carry successful research ideas to the stage of prototypes of future products. A notable exception is the recent, but small scale, *precoR* program launched in 2014 by SNSF.

In this perspective, the first challenge of BRIDGE is to correct the fact that current research and innovation funding models in Switzerland address the transition from research to innovation in a *sequential way*. In particular, funding focuses on research first, with objectives related to the advancement of science and technology, and only later considers (usually competitive) innovation, with goals specifically related to the realization of well-defined products or services in collaboration with industry. As a consequence, industrial partners are rarely involved in publicly-funded research initiatives, while they typically contribute to innovation projects based on acquired research results, thus renouncing to contribute to and shape research directions. BRIDGE, on the contrary, introduces a *continuous interaction* between researchers and industrial players to leverage the influence of both research achievements on new product ideas and of market needs on research directions.

The second challenge is linked to the way graduate education is currently carried out in the Swiss Polytechnics and Cantonal Universities. In these institutions, where most research is performed by doctoral and post-doctoral researchers under professorial supervision, funding is specifically targeted to research and success/reward indicators mainly related to publications. As a consequence, there is little interaction with industry, and doctoral students have limited exposure to Swiss industrial players and needs. Moreover when doctoral students graduate, job search in the fields of competence is often problematic, leading many to either work abroad or to find positions in other fields (e.g. in financial institutions), which strongly limits their chance to exploit and transfer the specific knowledge acquired during graduate or post-graduate education.

By comparison, the educational model in Silicon Valley forms graduates in constant interaction with industry, through regular meetings and mutual visits. Academic research is often supported by a blend of funding sources, including governmental and industrial grants. As a result of this osmosis, graduates are very aware of the industrial surroundings, often receive job offers before graduation, and their research effort is aligned with the projected work plan after graduation. The end result is that the capital invested in supporting graduate students has a high return of investment, as it gives industry efficient means to capture new research ideas and steer research toward common objectives, without hampering its intrinsic quality. It is interesting to notice that the Flanders, with a size, population and culture close to Switzerland, also have doctoral programs tightly-knit to the local industry, as well as research/innovation schemes that blend multiple sources.

The BRIDGE model

BRIDGE is a new concept for jointly funding research and pre-competitive innovation, to overcome both the current disjoint and sequential model of funding research and innovation and to better link (mainly junior) researchers with industry and (freshly graduated) engineers with research.

In essence, BRIDGE plans to better connect academic and industrial players by the set up of ambitious research projects (referred to as platforms), representing suitable contexts for continuous interaction between researchers and industrial players through coordinated innovation activities leading to knowledge and technology transfer. Within each platform, research activities are funded for four years while related innovation activities are funded for shorter one-year or two-year periods. Joint research and innovation activities will leverage the collaborative efforts of scientists and engineers with a diversified background and skills.

BRIDGE will overcome the present innovation gap by means of a concerted effort of institutional players (SERI, SNSF and CTI), as well as a consortium involving the Polytechnics, the Cantonal Universities, the Universities of Applied Sciences and Research/Innovation Centers (e.g. CSEM, EMPA, etc.). Representatives of the Swiss economy will also be integrated through an *Industrial Advisory Board*. BRIDGE will target the domain of Engineering Sciences, because it has shown to be a very fertile ground for the successful translation of research into products on a world-wide scale.

BRIDGE aims at advancing research in a way that better impacts the Swiss economy. This will be achieved by creating new funding instruments that: i) Integrate a grant/reward mechanism addressing both *research and innovation deliverables*, ii) Introduce a *continuous interaction* between researchers and industrial players to leverage the influence of both research achievements on new products and of market needs on research directions, iii) Rely on a new dual *mechanism for proposal evaluation* and project review involving both scientific and economic dimensions and including criteria that integrate the valuation of collaborative efforts as well as the extrinsic impact of the research on the economy and society.

As a corollary, research projects funded within the BRIDGE framework will involve a plurality of facets, including a continuous confrontation of the intrinsic merit of the research with the needs of the economy and the society. Research efforts will blend academic directions with industrial consultation: industrial experts will be involved in projects from their inception, and both professors and graduate students will pay regular visits to industry.

We believe that Switzerland is well positioned to support the BRIDGE model, because of the presence of SNSF and CTI, who are both successful in supporting research and innovation efforts. We claim that a joint action of SNSF and CTI in the BRIDGE effort for the engineering sciences can serve as a blueprint for future broader deployments of the targeted funding scheme. Furthermore, the BRIDGE model is fully in line with the decision of the Swiss government to strengthen the synergies between publicly funded research and publicly funded innovation under the Federal Department of Economy. In this perspective, BRIDGE will contribute to identify the proper operational mechanisms required for SNSF and CTI to efficiently convert the political decisions into successful results in the field.

The BRIDGE application domain

While the long-term objective of BRIDGE is the set up of a broad funding instrument, the proposal for the period 2017-2020 will focus on Engineering Sciences, in order to be faster to deploy and easier to evaluate. Specifically, BRIDGE must target a research/innovation area wide enough to attract potential stakeholders but also circumscribed to provide a clear research and innovation message and to make competitive evaluation tractable.

Building upon the successful experience of *Nano-Tera.ch* in engineering complex systems for health and the environment, BRIDGE will address the design of engineering systems that leverage the creation of data through sensors as well as their elaboration and communication through hardware and software means, thus encompassing various disciplines ranging from physics to engineering and to computer and communication sciences. Examples of relevant domains include, but are not limited to, the *Internet of Things*, and systems for *Personalized Health Management* and *Environmental Monitoring.* BRIDGE will leverage a network of specialists that are the best in the country and among the best in the world, while remaining in an area of potential strong economic growth well suited for the Swiss industry.

Furthermore, BRIDGE will offer promising synergies with several strategic initiatives planned by the ETH Board for the period 2017-2020. For example, the design of devices and systems able to process Internet of Things data streams may strategically complement the enabling technologies targeted in the “Big Data and Digital Sciences” initiative. Similarly, advanced wearable and/or implanted bio-sensors may extend the personalized data acquisition capabilities of the high speed data acquisition platforms envisioned in the “Personalized Medicine and Bioengineering” initiative to real-time, everyday life bio-data acquisition. Pre-competitive innovation in BRIDGE will address both the achievement of prototypes and of new fabrication processes, thus providing a link to the “Manufacturing” initiative.

The BRIDGE operational scheme

BRIDGE proposes to operate along the following scheme: i) The program is embodied by a consortium of partners, grouping the Polytechnics, the cantonal Universities, the Universities of Applied Sciences and Swiss Research/Innovation centers in Switzerland; ii) The partners, represented by their leaders (e.g., Presidents/ Rectors/CEOs) in a steering board, nominate an Executive Committee to run the program and an Industrial Advisory Board to provide the proper economic perspective; iii) Separate funding is made available for research-related activities (the research budget) and for innovation-related activities (the innovation budget); iv) The research and innovation budgets are allocated through open calls for proposals, written by the executive committee on behalf of the leaders of the consortium; v) While the research budget is allocated once for the whole duration of a project to guarantee the stability of the project consortium, the innovation budget is allocated in several (typically yearly) slices to allow for a flexible adaptation to the evolution of the research and the targeted innovation goals; vi) Proposals are evaluated by a *Joint Evaluation Panel* consisting of experts proposed by both SNSF and the CTI; vii) Projects are granted on the basis of both their medium-term scientific and engineering research goals and their expected impact on innovation and technology transfer; viii) Projects are monitored by the Joint Evaluation Panel, with scientific experts taking the lead for the research content and industrial experts for the innovation aspects.

The distribution of funds to research and innovation may vary from project to project and during the execution of a project, but both aspects must be present throughout the lifetime of a project. In particular, some industrial partners should be involved from the beginning, to guarantee that realistic market needs are addressed by the research. However, it is likely that the involvement of the industrial partner will vary in nature and intensity over the lifetime of a project. Typically, it may be expected that the industrial participation may first mainly consist of framing discussions related to the general objectives and progressively be made more intensive (exchange of personnel, deployment of concrete use cases), while the targeted research results will be acquired. In addition, over their lifetime, the funded projects should serve as a training framework to immerge doctoral students and postdocs in applied academic/industrial ventures, exposing them to concrete entrepreneurial issues.

Preliminary discussions with various industrial players led to the identification of several possibilities for the type of innovation actions that could exploit the research activities in BRIDGE projects. Examples include: i) Organizing short bilateral stays of senior representatives from industry and academia to share knowledge and vision. Such exchanges are particularly important to guarantee that the performed research activities remain in line with the targeted industrial outputs, which in term will need to be continuously updated based on the progress made at the research level. ii) Hosting of doctoral students by industrial partners and of R&D engineers by the research teams. These various types of personnel exchange will be crucial to enable that a true (bilateral) transfer of knowledge takes place because the involved academic and industry staff will have concrete opportunities to work together. Examples of targeted collaborative tasks include the tuning of the technologies developed at the research level to specific applicative constraints related to the applications targeted by the industrial partners, and/or the deployment of industrial field tests to validate the research. iii) Involving specific experts (coaches, mentors, business angels, etc.) to set up viable transfer and valorization scenarios, including start-up support. These activities may be of particular interest at the beginning of the project where they can help to concretely frame the collaborative objectives and at the end of the project where the achieved results will provide true perspectives for technology transfer in the form of competitive product development (to be funded separately in the framework of coordinated CTI projects).

Budget

The BRIDGE proposal targets a funding of 80 MCHF in the form of a specific Federal budget under the responsibility of the SERI for the period 2017-2020.

Summary

BRIDGE aims to close the present gap between research and innovation in the domain of engineering sciences, by means of a concerted effort of various players in Switzerland, namely the SERI, SNF and CTI, as well as a consortium of the Polytechnics, Cantonal Universities, Universities of Applied Sciences and Swiss Research/Innovation Centers. BRIDGE will connect Swiss industry to academia through the setup of research projects representing suitable platforms for collaborative *knowledge and technology transfer* based on cross-exposure and inter-connection of personnel, with a special focus on junior researchers/engineers. Overall, BRIDGE will enhance the rate of innovation of academic and research sites, provide more effectiveness to research funding instruments and stimulate the economy with innovative research results.