SSF Call for Proposals:

Framework Grants for Research on

Smart Systems

The Swedish Foundation for Strategic Research announces SEK 300 million in a national call for proposals for problem- or application-driven research projects that meet the highest international scientific standards. The call aims to stimulate collaborative interdisciplinary research within the area of smart systems, of relevance to present or future Swedish-based industry and to society.

Selected projects will be supported by grants of SEK 4-7 million per year for a period of 5 years (incl. overheads) to be used for salaries (senior researchers, postdocs, PhD students, etc.), research tools, and running costs according to the needs of the project. Funding for the last two years will be contingent upon a successful midterm evaluation.

Background

Information technology provides ever increasing capabilities for enhancing and improving industrial and service products throughout society. It is a prime facilitator of higher productivity in human endeavours and offers new opportunities for virtually enhancing people's working and private life.

The massive introduction of information and communications technology (ICT) greatly improves our handling of complexity in everything from genome research to effective manufacturing. Yet, needs and ambitions tend to grow at a higher pace than the system engineering abilities, and the spectre of complexity remains a moving target. ICT offers possibilities to develop functions that go far beyond human abilities, e. g. in memory, text search, computations, endurance, etc. Recently, it has also mounted a serious challenge to the previous human supremacy in object recognition and related areas.

Sweden's substantial systems-based industry has retained its ability to compete successfully at the international level across various technological developments and market changes by being top-notch in system integration and cooperation. Nevertheless, ICT leads to significant reorganisation of many industries and business models, with globalisation exerting substantial pressures on incumbents to raise their innovation level and productivity to remain competitive. ICT offers many opportunities to achieve this goal, but the risk level extends to new and potentially disruptive developments that may occur.

Similar arguments pertain to EU research funding in these areas. In particular, this call presents a possible opportunity to participants in the Flagship Human Brain Project, which will run into the 2020's, to complement the EU funding for critical mass, if the project objectives overlap.

Scope

This call takes aim at the ICT's abilities to improve the designs and functionalities of existing kinds of technological system or to create entirely novel types. A system exhibiting smartness should be expected to analyse and communicate with its environments, respond to changes autonomously, and learn from its experience. It might blend into a human environment with its inner complexity largely hidden from users.

Smart systems may offer adaptive, predictive, and robust behaviours and capabilities even under hostile conditions. They could also provide compensation for uncertainty or variability in contexts, e.g., self-healing or add possibilities to augment human capabilities in settings from decision making to surgery. Safety and security can be features of a target system, while flexibility and upgradeability are normal parts of the specification. Other non-functional demands, such as reliability, cost or legacy requirements, can be crucial to applications.

Successful proposals should be developed from a system perspective, and include systems-oriented research and/or components-oriented research and development, disciplinary and methodological research, and efforts to push state-of-the-art technologies into concrete system-level demonstrators. The demonstrators shall offer smartness to support real systems in industrial settings or in other, more public, applications.

Research areas included in this call that are considered strategic for Sweden, alone or in combination, are:

- **Cyber Physical Systems**
  Cyber-Physical Systems combine computing and physical entities, and span from small wearables to the Internet of Things. Embedded systems have been the prototypical building-blocks here, as well as for automation solutions. Combinations of embedded systems, the Internet of Things, autonomics, sensor and actuator networks provide smart functions in a multitude of products for, e. g., consumer and industrial, automotive, medical, commercial and military applications.

- **Integrated Systems**
  This area concerns the construction of systems from several task-oriented subsystems resulting in higher functionality and improved performance. New modi operandi have emerged following recent technology advancements, allowing devices to utilise, e. g., cloud computing and mobile platforms in complex information environments.

- **Systems of Systems**
  Complexity and cooperation are ultimate challenges, and robust cooperation and coordination between systems of humans and computing devices is crucial for progress in many important applications. Communications, service provisioning, functional safety and security are important issues in those complex environments. Solutions must attain high robustness and trustworthiness, and will have designs to successfully accommodate further technological development for extended periods of time.

- **Automation**
  Labour-substituting automation of mechanical work has been a primary productivity driver in the industrial revolution. The smart use of IT widens the scope beyond the factory floor to include product life-cycles, just-in-time organisation, etc. New frontiers are opening, like automation of decision-procedures or design automation.

- **Autonomous systems**
  Autonomous systems provide an increasing degree of unsupervised action, as in unmanned or connected vehicles, goods tracking, smart metering, and can also consist of robots that can act independently. They typically require communication systems, in particular wireless and energy-efficient ones, with ultra-short delay times. Autonomous mobility, sensing, and exteroception combined with cognition will have high impact on applications and completely autonomous systems may be within reach. Machine learning and systems architectures can provide the capability of performing humanoid tasks, including sophisticated interaction with the contexts, physical environments and with humans.

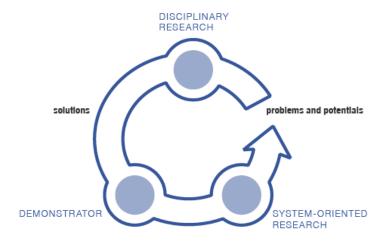- **Artificial Intelligence-Based Information Systems**
  Machine intelligence can be an integral part of a smart system, such as a smart agent. More refined perception of the environment and more precise action based on the gathered information is central to AI-research. Cognitive companions and other approaches can support more elaborate, as well as more intuitive, co-operation between computer systems and humans.

Prioritised working methods

Projects should be based on a clear systems perspective and, with milestones/stage goals that can be evaluated, integrate the following aspects:

> 1. The project should result in a concrete demonstrator, which may be physical with software components or virtual in the form of functioning complex software

> 2. The project should include systems-oriented research and/or components

> 3. Disciplinary and methodological research should also be included

The interaction between these three components is illustrated in the following figure:

The demonstrator should be designed from a systems perspective, and concrete problems for disciplinary research should be identified from the demonstrator concept. Solutions derived from disciplinary research should then be integrated in the demonstrator, which will ensure that every stage of the project contains aspects of the complexity and integration issues. At the same time, the feedback of information can be utilised in coming iterations. Collaboration between the project participants and stakeholders will be indispensable.

Eligibility

All projects should be based on a credible collaboration between, typically, two to four applicants with different kinds of relevant complementary scientific expertise, from one or different research group(s) - not necessarily co-localised. All applicants should take active part in the project and their activities should be at least partly financed by the project budget.

The proposal must be submitted by a main applicant who is a prominent researcher prepared to assume responsibility for the project during the entire grant period. The applicant must be employed by a Swedish university, university college, university hospital, or by a public or private non-profit research institute. At least one of the applicants must be employed by a university or university college.

Project participation from industry, public authorities or other relevant organisations will be considered a merit. However, such participants must not be funded by the SSF grant but may participate on their own budget. The same goes for international scientists working outside Sweden unless the project plan itself includes, e.g., visits by foreign-based scientists to an applicant working in Sweden.

The proposal budget should be in the interval of SEK 4 to 7 million per year for five years. A maximum of 25% of the grant may be used for salary for the main applicant and/or the co-applicants, but only to cover up to a maximum of 25% of the salary of each applicant.

Please note:
- each applicant is allowed to be represented in one application as a main applicant.
- each applicant is allowed to be represented in one application as a co-applicant.

Applications not conforming to these conditions will not be considered. It is the responsibility of the main applicant to inform all the co-applicants and to check the proposal for compliance with the rules before submission.

Proposal and submission

A complete application must contain, among other data specified in the portal, a full description of the research plan and full details of the relevant expertise of the participating groups. It should contain a clear account of the strategic significance of the research, including a vision of utilisation/exploitation of the results in Sweden during the project's lifetime and/or up to 10 years after completion of the project.

Each proposal shall clearly describe the state of the art within the area(s) addressed. It is also important for the proposal to give a clear picture of the resources available and to demonstrate that the proposed constellation of research groups will be effective in view of its objectives.

A Letter of Intent from the Head of the main applicant's department is compulsory.

The proposal must be written in English and submitted via the SSF portal at: http://apply.stratresearch.se. **Note that in order to get a complete view of all data required for submission it is necessary to consult the portal.** Please log on to the portal well in advance of the deadline. Please also submit the application in due time before the deadline. When the application is submitted, the system will reject it if some data field is missing. As long as this is done before the application deadline it is possible to submit and re-submit as many times as necessary.

All applications must be submitted by **14:00 hours (2:00 pm CET) on 17 September 2015**. No additional material will be considered after this deadline.

Evaluation

Applications will be assessed by an evaluation committee consisting of generalists and specialists from industry, academia and research institutes. In a first selection the applications will be judged primarily with regard to scope (as described above), relevance and impact. Furthermore, applications that are judged unable to compete in the final step of the evaluation, or that are considered too incomplete to be meaningfully assessed, will not pass this first step. The selected applications will be sent on international peer review. The results of this expert review will be taken into account by the evaluation committee in order to produce a recommendation on which SSF will base its decision.

The applications will be reviewed using the following criteria:

- Conformity to the scope and eligibility as outlined above
- Scientific quality; originality, strengths, weaknesses, degree of interdisciplinarity and feasibility of the research plan
- Strategic relevance and impact of the proposed research to Swedish industry and/or society
- Qualifications of the applicants, previous scientific achievements, international experience, and networks, and leadership/management of research teams.

Timetable

- Last date for applications: 17 September 2015, 14:00 CET at the latest
- Decision by the SSF Board: Spring 2016
- Project start: 1 July 2016

No additional material submitted after deadline will be considered.

Please note that the Foundation is subject to the Principle of Public Access to Official Records (Offentlighetsprincipen). Thus, applicants should avoid submitting material that they do not wish to be made public, e.g. information that could prevent patenting.

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