



13 September 2010

SWEDISH FOUNDATION *for*
STRATEGIC RESEARCH

The Swedish Foundation for Strategic Research announces research group grants for research on Software-Intensive Systems

Five-year research group grants for research on Software-Intensive Systems within a framework of maximum SEK 160 million are announced. The aim is to strengthen Sweden's competitiveness in the development of software-intensive systems and products. Applications should combine research and knowledge bases within system-oriented research with contributions from disciplines that can be utilised in a demonstrator relevant to a selected area of application.

The announcement concerns a number of research group grants for strategic research. The grants are intended to finance cutting-edge research of high international class and of strategic relevance to present and future industry & society. The Foundation's interpretation of strategic relevance indicates several different possibilities for deriving benefit from the research. How benefits can be derived from the proposed research should be described in an exploitation plan appended to the proposal.¹

¹ To the Foundation, benefits can be assessed based on one or more of the following aspects:

- research, the results of which may serve as a basis for the development of existing or new companies
- well-educated graduates, who through broadened and improved graduate training are attractive for employment primarily in industry and society, but also in universities and research institutes
- the ability of internationally high-class research environments to attract uniquely qualified researchers and international investments to Sweden
- research that serves as a focus for international cooperation, whereby knowledge of interest to Swedish industry can be accumulated

All of this also contributes to a higher quality of life via more employment opportunities, improved working conditions and better health, as well as to a more sustainable society.

The SSF research group grants are intended to be within the range of SEK 3-7 million annually (including overhead) and to finance goal-oriented projects. Each application should have a main applicant who should coordinate the project envisaged. Each scientist can submit only one application as a main applicant in this call. The grant period is five years, although the funding for the two last years will depend on the outcome of a mid-term evaluation.

The importance of information technology

Information technology (IT) and its applications form a basis of our modern society. All industrial systems, all public administration and almost all production of services with an intellectual content are based today on IT products. Our society is changing, and in ways we cannot really predict in detail. The service content is increasing, not least in traditional industrial products, and the production of services is in itself based on information technology. The more advanced the range of services, the more evident is the role of information technology. It is getting successively cheaper to manage more and more items in software systems, for example, services that combine multiple basic services, provided that suitable methods, technologies and tools are developed for these purposes. Several international R&D programs are addressing challenges towards a single ICT-enabled market based on the next generation internet. Gradually, software-intensive systems are also embracing more and more areas of application. New kinds of flexible and evolving systems pose new challenges related to design, implementation, and combination and coordination of ensembles of software components meeting functional as well as non-functional requirements such as trustworthiness.

The role of Swedish research is to support this development and to strengthen the position of the country in this field. The fact that Swedish industry is to a very great extent systems-based and moreover based on complex systems should be reflected also in the more discipline-oriented research that is supported by the Foundation. Swedish industry is particularly strong in fields like telecommunications, vehicles, automation, aviation and space, as well as in the process industries based on raw materials such as timber and ore. At the same time, other fields are developing rapidly, albeit from a lower level. These include various parts of the entertainment industry as well as energy and environmental technology in which information technology can be utilised in various ways and for various purposes. In addition, there are extensive and largely unexploited possibilities within central public sectors such as health care and government administration. Here, but also elsewhere, there needs to be interaction with the legislative field, which is, of course, outside the domain of research but which nevertheless needs to be taken into account in the consideration of the research carried

out. Legislation concerning manufacturer responsibility has not, for example, provided the exceptions from liability that makers of software have traditionally required for licensing terms.

If Sweden is, in the long term, to maintain a domestic industrial base, it will need to have a powerful ability to develop and renew research in the fields of information, communication and systems technology. Research of this kind focused on software-intensive complex systems also provides a necessary base for the academic education of engineers and researchers that a local systems industry will depend on. There have been dramatic improvements in industrial productivity over the past few decades and these achievements have been necessary to retain Sweden's competitiveness. Continuing increases in productivity will probably be necessary for the same reason and to at least the same extent in the future as well. Information, communication and systems technologies can make valuable contributions to such increases in productivity.

The area and the priorities

The field of software-intensive systems comprises a large number of separate disciplines and connections between them. More detailed descriptions of most of these, as well as important applications, may be found in the report [*Små som sandkorn, stora som städer: Strategidokument om komplexa mjukvarubaserade system*](#) (Literally: "Small as grains of sand, large as cities: Strategy document on complex software-based systems" – only available in Swedish) presented by the Foundation's Strategy Panel for Information, Communication and Systems Technology (Software).

Research fields with high priority

This call for proposals focuses on a number of high-priority research fields with a large potential for important areas of application: areas with particularly good prospects of contributing to increased economic growth and of creating improved chances for companies to grow in their markets and provide large benefits to customers.

- There is intensive research in the *Networks* field all over the world, but Sweden holds a strong position. The focus in this field is almost exclusively on packet-switched networks aimed at providing a basis for future Internet applications.
- *Embedded systems* deal with computer systems integrated into other products like a car or a mobile phone. Autonomous systems are embedded systems that act independently. They are also interesting in complex environments such as robots or unmanned planes.



- *Systems architecture* focuses on the interface between hardware and software and deals with the structures that define how systems consisting of hardware and software components are built up.
- *Radio* deals with various aspects and applications of the ways in which radio waves can be used to transfer information, for example, mobile broadband. The fact that more and more objects are being provided with radio transmitters/receivers makes this a field of growing importance.
- The field of *Operation and Maintenance* is of increasing importance in Swedish industry. It deals with supervising and managing the operation and maintenance of factories, equipment, vehicles and large complex systems. New possibilities are created for analysing the large amounts of data that come from sensors, historical data and the connections that exist in modern systems.

Application areas with high priority

Software is extremely important in many application areas not normally thought of as related to software-intensive systems. Several of these are well suited to research within this announcement. From a strategic Swedish perspective, there is good reason to give priority to:

- Telecommunications and in particular high-speed and mobile broadband for effective internet access
- Vehicles of different types, and intelligent transport of people and goods, in particular with a view towards a sustainable society
- Production and distribution of electricity (smart grid) including end-user functionality for optimal utilization of resources
- Process industry and automation in e.g. the manufacturing industry, in particular oriented towards maintenance, repair and operations
- Media, content & entertainment, including production, distribution and consumption of rich and complex data e.g. 3D, usage of metadata and ubiquitous, multimodal end-user data interaction
- Sustainable society (smart cities), especially energy and environmental technology, including both how ICT can be utilised and how the ICT industry itself can improve
- Tools and methods with demonstrated positive impact on the development of software intensive systems and products.



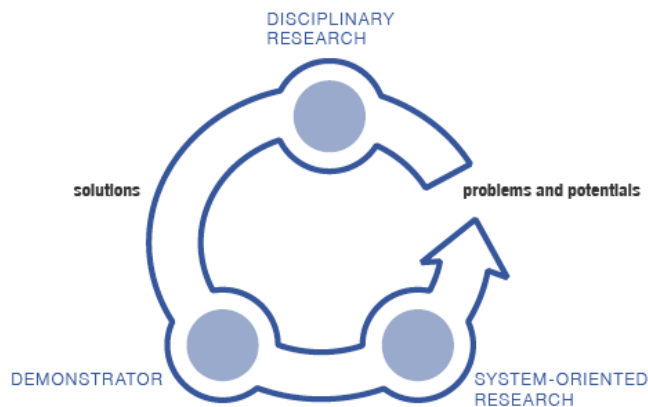
Other areas of possible interest include space and aerospace, eHealth, and national security.

Prioritised working methods

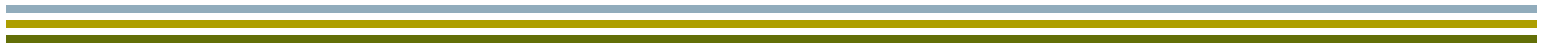
The Call focuses on projects that are based on a clear systems perspective and which, with milestones/stage goals that can be evaluated, integrate the following aspects:

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 methodological research should also be included

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



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 various actors will be indispensable.



The focus of this systems-oriented research may be represented by systems technology, software technology or interaction design. Systems-oriented research may appear under other labels such as complex systems, systems theory, software systems, etc.

Methodological research may concern important aspects of software-intensive systems in all the relevant research disciplines, including various forms of applied mathematics. Such aspects may, for example, deal with new value creation/new functions, modelling/analysis/understanding, usability, simplicity, robustness, reliability, security and other quality attributes.

To receive funding, the project must include fundamental competence of all the three kinds represented in the figure, but it may have a clear research emphasis on one of the three particular components.

Other aspects

Due to the inherent complexity of software-intensive systems, it is generally a challenge in their development to get the full functionality right. Functionality alone is also not enough to ensure the targeted use of the system. Securing the system quality attributes is of vital importance. Such attributes common to software-intensive systems with high demand include integrity, reliability, maintainability, safety, security and cost. This call encourages proposals that take quality attributes into consideration when finding technical solutions.

Of particular interest is work that promotes robustness, security and reliability in large software-intensive systems, often with an expected long life. Such systems may be so large that their lifecycle also raises issues concerning economic, social and environmental durability. A typical issue may refer to the way in which a system will cope with changes in, for example, technology, demands, organisation and business logic throughout the whole lifecycle.

The development of systems with a long lifecycle often involves very large investments; quite often it is also necessary to make use of investments from previous system generations. One important aspect of systems research is to take into account the heritage of existing systems when developing a next generation. A proposal for systems research that takes this into consideration is of great interest for this Call.

System-oriented research may also include economic aspects that affect, for example, product development efficiency, costs for maintenance and tests as well as various methods of program development.



Priorities according to strategic relevance

The purpose of the Swedish Foundation for Strategic Research is to support research in order to strengthen Sweden's competitiveness in future. In the research financiers' landscape, SSF positions itself between the Swedish Research Council (*Vetenskapsrådet*) and Vinnova, as illustrated below. The practical definition of strategic relevance, to be used when ranking the applications, is that the research shall evince a clear vision of exploitation in Sweden over a time span of 5-15 years, after the project is finished. In addition, applications judged able to make a large contribution to Sweden's future competitiveness will receive higher priority than those judged to make a smaller contribution.

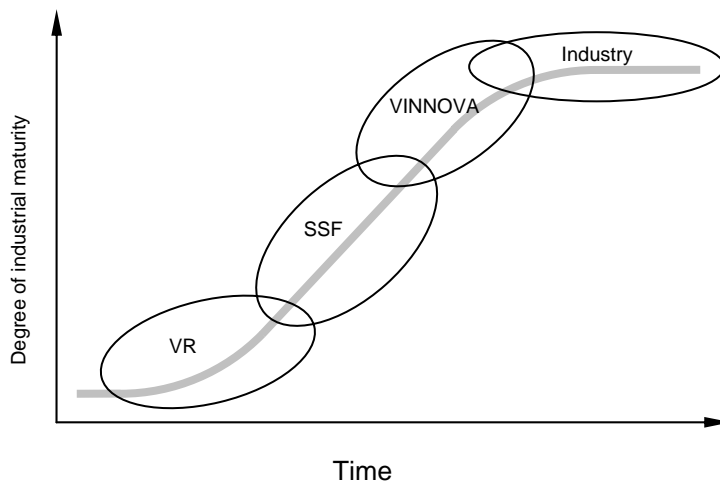


Figure 2 The areas of priority of Swedish research financiers

Priorities according to exploitation plans

The Foundation's interpretation of strategic relevance indicates several different possibilities for deriving benefits from research. In order to increase the likelihood that the research results will actually come to good use, applicants should consider the ways the eventual results will be taken care of so that this process is actually initiated during the grant period. The exploitation plan should preferably cover the following aspects:

- Background description
 - What societal need does the project address?
 - How will the project improve on current practices?
 - Why has this not been done before?
 - How will the project contribute to sustainable development and growth in Sweden? In what time frame?
 - How will you measure the success of your work?

- How does the exploitation plan relate to the research- and innovation strategy of the research group/department?
- Activities supporting exploitation during the grant period
 - Which other stake holders that need to be actively involved must be identified for the intended objectives to be realised?
 - How will the project interact with the potential stake holders? Possible examples include direct project participation, development of standards, publication under Creative Commons license and/or as Open Source, work shops, education, articles or blogs, patents, new companies, conferences, competitions, licenses, teaching aids, videos, etc.
- Expected exploitation results during the grant period
 - In what ways will the demonstrator be useful to stake holders?
 - How will you publish your results on the internet?
 - How would you like intellectual properties to be handled, in particular in relation to cooperation with companies, institutes and universities? What measures will you take before the start of a granted project?

Application

A complete application must contain, among other data specified in the portal, a full description of the research programme and details of the relevant competence. It should contain a clear presentation of the strategic significance of the research programme.

The application is submitted via the SSF portal at: <http://apply.stratresearch.se>.

To get a complete view of all data required for submission it is necessary to consult the information in the portal. Please log on to the portal in due time before the deadline.

Each proposed project should contain a description of the three parts: (a) demonstrator, (b) system-oriented research and/or expertise and (c) disciplinary research. The description should indicate the methods, expected results with stage goals/milestones which can be evaluated and the actors who will work on the various parts of the project. Projects must involve fundamental expertise in all three parts to receive financing, but may have a clear research emphasis in one particular corner of the triangle/one particular main component. A description of the ways in which collaboration will be carried out is of major importance, preferably with references to previous successful experience, together with specifications of the applicants' individual contributions to the project work. In addition, a brief contingency plan should be included indicating how important changes in the project will be handled.

Applications should also contain a Relevance Appendix describing the project's strategic relevance and this should include an Exploitation Plan for the expected results. Several of the following results of the completed project are expected: demonstrators, methods, models, standards, dissertations, articles, network-building and collaboration – both national and international – as well as attractive PhDs and the exploitation of results that can bring value to industry or society.

Who may apply

The application must be submitted by a main applicant who should be a researcher associated with a Swedish university/university college or research institute. If the main applicant is active at a research institute, at least one co-applicant must be working at a university. A presumptive project leader must be prepared to assume the scientific responsibility for the project during the whole period of the grant. However, co-leadership and succession planning is encouraged. The number of co-applicants must also be in proportion to the amount applied for, preferably not exceeding three persons with relevant complementary competencies, from the same or different research groups. A maximum of 25% of the grant may be used for salary for the main applicant and/or the co-applicants (i. e. the senior scientists), but only to cover up to a maximum of 25% of the salary of each applicant. Each scientist can submit only one application as a main applicant in this call. Please note that principal investigators from ongoing five year SSF-projects within the Software-Intensive Systems call 2008 (Rambidrag 2008) may not apply as main applicants in this call.

Evaluation process

Applications will be assessed by an evaluation committee. A first selection will be made in which the applications will be assessed solely with respect to how well they correspond to the prioritised working methods and with respect to strategic relevance. The selected applications will then be assessed in full by a group of international scientific experts with respect to scientific quality. The result of this scientific evaluation and the structure and strategic value of the applications will then be weighed together by the evaluation committee in order to produce a final proposal on which the SSF Board will base its decision.

The overall picture created by the combination of the various components in the proposal will form an important basis for the allocation of grants. In addition, the following aspects will be taken into account:

In the first place, and for each component in the application:



- assessment of goals, choice of problems and working methods on the basis of novelty and the priorities and limitations presented in the Call.
- scientific quality of the project and the applicant(s)
- the demonstrated commitment of the applicant(s) to the task

Further:

- active involvement with industry
- synergistic effects with other related work, with or without support from the Foundation, and
- initiatives towards national and international collaboration between research groups.

The demonstrator in particular will be assessed also on the basis of its feasibility and its commercialisation potential.

It is vital that the application gives a clear picture of the resources available and demonstrates that the proposed research constellation will be effective. The budget should include information on the actual work input that the applicants intend to make in the project.

Active commitment on the part of industry is positive. However, none of the collaborating industrial partners may be funded by the grant. SSF makes no formal demands regarding co-financing.

Timetable

Last date for applications is November 24, 2010, 14.00 hrs.

The application portal <http://apply.stratresearch.se> is open from September 14, 2010 at 10.00 hrs.

The decision of the Foundation's Board is expected to be made in March/April 2011.

No additional material submitted after the deadline will be considered.

The instructions to the international evaluators will be available at the portal.

Note that SSF follows the principle of public access to official records. For this reason, do not send material that may not become public at present, e. g. anything that could prevent possible patenting.

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