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SWEDISH FOUNDATION *for*
STRATEGIC RESEARCH

The Swedish Foundation for Strategic Research announces research group grants for research on Information-Intensive Systems: Making good use of ever-increasing data volumes

Five-year research group grants for research on data rich information management systems within a framework of maximum SEK 100 million are announced. The aim is to strengthen Sweden's competitiveness in the development of information 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 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 4-7 million annually (including overhead) and to finance goal-oriented projects. Each application should have a main applicant who should coordinate the project envisaged. A main applicant may submit only one application. The grant period is five years, although the funding for the two last years will depend on a mid-term evaluation.

The importance of information technology

Information technology (IT) and its applications form a basis of our modern society, and enables and fuels much of its development. All industrial goods and systems, all public administration and almost all products with an intellectual content are based today on IT. Our society is changing, and in ways we cannot really predict in detail. This is accentuated by the continuing increase in information volumes. This increase, which is often exponential in nature, puts pressure on not only storage, computational power, and communication, but also on algorithm development and interaction design. An increasing ability to handle large data volumes can be put to good use in new areas of application. And it permits the development of new technology, used e. g. for context awareness or machine translation, to access, analyse and transform data from large repositories.

We can foresee a situation where information intensive systems to an increasing extent handle distributed real-time data collected via different sources, e. g. sensors. The emerging Internet of Things will dramatically change information systems as real-time analysis of real-time data becomes a common requirement. Decisions within companies and public authorities will become more and more dependent on awareness through these large amounts of data.

In addition to the public sector and industrial data, there are also rapidly increasing amounts of data generated from personal behavior, e.g. data from social networks, purchase patterns or equipment usage. This triad of data sources in combination can contribute to completely new fields of business as well as for research

Swedish research should support this development and strengthen the position of the country in this field. The fact that the Swedish public sector produces considerable amounts of reliable and valuable information is a great opportunity. That Swedish industry has a strong foundation in systems, and often complex systems, will facilitate the exploitation, and the combination of strengths should be reflected also in the more discipline-oriented research that is supported by the Foundation. Handled properly, these emerging enormous data sets may reveal answers to hitherto unasked questions and perhaps even replace simulations as a tool of understanding or operation. There should be extensive and as yet 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.

An improved ability to extract value from the emerging giant data sets is vital to Sweden's competitiveness in the area of products and services based on information intensive systems. Demonstrators are important to the education and research in software and information engineering, as well as to the training of practitioners. Swedish strengths in classical system engineering and in IT maturity will enable novel hybrid system. Those systems are based on interactions between humans, technical systems and environment generating context dependant webs of information. Good use of those information rich structures requires new models of data management and access as well as for information protection assuring trustworthiness by and among stakeholders.

The area and the priorities

The field of information technology 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 and application areas 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 efficiency and of creating improved chances for companies to grow in their markets and provide large benefits to customers.

From a strategic Swedish perspective, there is good reason to give priority to:

- *Information systems and data base technology* has grown in importance with the internet and its many applications. Having tools that can identify what is important information in a vast sea of data is akin to methods for the somewhat unreal finding of the proverbial needle in a haystack.
- *Embedded systems* deal with computer systems integrated into other products like a car or a mobile phone. A special branch of embedded systems is



autonomous systems which are systems that act independently , e.g.,as mobile robots or unmanned planes. Common to these systems is that they operate in a very complex environments and both produce and consume lots of data. The information demands and the possibilities to draw advantages on this data is tremendous. .

- *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. A well designed architecture is vital to be able to support vast amounts of data, especially when it comes to streaming real-time data in a distributed manner.
 - *eScience*, gathering various forms of computer-supported research into topics only recently accessible thanks to the technical progress.. New communication, computing and information gathering tools need to be developed.
 - *eHealth*, including the well-being of an aging population and the efficient organisation of health care in its many shapes. Data intensive eHealth systems could e. g. monitor large patient groups, or facilitate international cooperation on certain treatments.
 - *eGovernment*, because agencies, utilities and other public organisations provide important data sources, and are possible agents of change, but also because new technology is opening new opportunities.
 - *Process industry and automation* in e.g the manufacturing industry, in particular oriented towards maintenance, repair and operations. The automation industry is information intensive already today and the growing amounts of available data, from both the process under control as well as business data, gives opportunities for new business as well as research.
 - The area 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.
 - *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.
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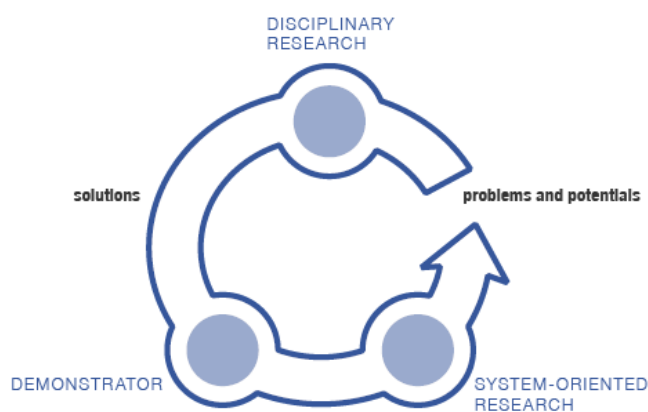
- *Sustainable society* (smart cities), especially applications to transport, energy and environmental technology, including both how ICT can be utilised and how the ICT industry itself can improve.
- *Management of smart grids* for production and distribution of energy including end-user functionality for optimal utilization of resources. With the introduction of smart electrical grids there will be a change in both how electrical appliances are used as well as how these interact with the grid. All equipment connected to a smart grid will both generate as well as use vast amount of data. An additional aspect is that integrity of the data is of vital importance for smart grid control, due to legal regulations and civil rights.

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 information-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.

Important aspects

Information intensive systems frequently deals with highly complex issues. Functionality alone is not enough to ensure the targeted use of the system. Securing the system quality attributes is of vital importance. Such attributes common to information intensive systems with high demand include scalability, 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 scalability, security and reliability in data rich systems, often with an expected long life.

The development of systems that handle huge data sets can eventually involve 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 then to take into account the heritage of existing systems when developing a next generation.

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.

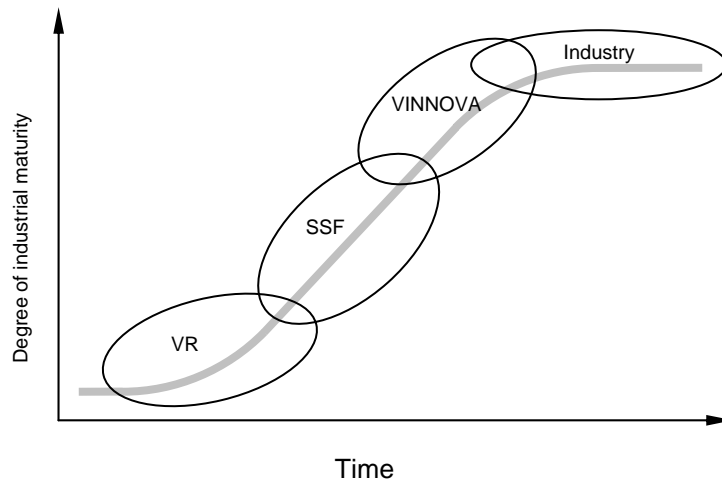


Figure 2 The areas of priority of Swedish research financiers

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, procurement, 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, tools, 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 programme (Rambidrag 2008 or 2010) 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/society
- 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 usefulness or 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 or society is positive. However, none of the collaborating industrial or societal partners may be funded by the grant. SSF makes no formal demands regarding co-financing.

Timetable

Last date for applications is April 18, 2011, 14.00 hrs.

The application portal <http://apply.stratresearch.se> is open from February 8 at 10.00 hrs.

The decision of the Foundation's Board is expected before the end of the year.

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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