SECOND THEMATIC CALL WITHIN THE RESEARCH, DEVELOPMENT AND INNOVATION PROGRAMME ICT 2023: ICT SENSORS AND ACTUATORS

Research, development and innovation programme ICT 2023

The research, development and innovation programme ICT 2023 is jointly coordinated and funded by the Academy of Finland and Tekes, the Finnish Funding Agency for Innovation. The aim of the programme is to further improve Finland's scientific expertise in computer science and to promote the application of ICT. The programme is based on the report *21 Paths to a Frictionless Finland*[1] by the ICT 2015 Working Group. According to the Finnish Government's 2014 budget, at least EUR 10 million of the Academy's allocation authority for 2014 will be used to implement the ICT 2023 programme.

The ICT perspective must be significantly expanded in all sectors and in public administration. Therefore, the theme selected for the second thematic call is **Research on ICT sensors and actuators**. In line with the case "Billion-euro business from microsystems" described in the report of the ICT 2015 Working Group, "embedded, sensing microsystems are required in ever increasing numbers, both in consumer products and in society generally"[1]. The call theme is both technologically and societally cross-cutting and closely associated with, for instance, traffic, urbanisation, environmental safety, industrial renewal, comfort and usability as well as a well-functioning society. Finland is highly capable of applying ICT, which can open new opportunities for renewal, particularly if the applications are used broadly.

New sensors and actuators offer great potential for monitoring, for instance, homes, traffic, industrial plants, water, air and food quality, as well as lighting. They can also contribute to identifying problem situations and facilitating problem-solving. The rapid development of nano- and material technology and manufacturing technology provides increasingly new approaches for measurements and functionality. Different sensor and actuator combinations in particular make it possible to reach functionalities such as self-start, self-warning and self-correction or energy self-sufficiency. These are key elements in further improving Finland's ICT competence on a broad base. On the other hand, there are also special challenges concerning ICT and parallel functionality, associated with, for instance, the operating environment, reaction rate and sensitivity, and multi-usability. Novel device solutions can facilitate broadening the national competence base and accelerating the use of technology. The call theme is closely associated with a number of fields presented in the report by the ICT 2015 Working Group. The thematic areas - and particularly their combinations - are expected to generate significant scientific knowledge and knowhow that will reinforce Finland's ICT expertise in the long run.

Thematic areas

The call covers two interlinked themes that can be grouped under the heading Parallel sensor and actuator units:

1) Natural science and technological understanding of technologies and materials that facilitate parallel sensor and actuator units

There are relatively few studies on parallel functionality and its potential in ICT. Novel macro- and micro-scale manufacturing and integration technologies can create a solid foundation for such applications. Nanoscale and quantum coherent phenomena can provide a basis for unique solutions for parallel

[1] https://www.tem.fi/files/36671/TEMjul_18_2013_web_15052013.pdf

functionality, as they make it possible to reach an unexceptional accuracy and speed of function thanks to a low thermal mass and short distances. Quantum technology, in turn, can provide great potential to implement new measurement and function principles and to automate functions.

2) Integration of sensor and actuator combinations through device and software solutions, and their use in Internet of Things

Potential research topics include:

- adaptive sensor and actuator systems and their coordination with device and software solutions, software architectures for service networks including systems, energy efficiency of systems, as well as efficient assembling of distributed sensor data and real-time analysis of sensor data
- Cyber-Physical-Systems (CPS), integrating embedded and smart sensors, devices and systems via the internet (Internet of Things and Services), facilitating that production and other resources, data, things and people form a real-time network, use of extensive wireless sensor networks also requires novel network solutions, such as IPv6 and self-organising networks; key elements also in the implementation of an Industrial Internet
- use of sensors and actuators in novel solutions for networked and embedded technologies (e.g. in homes, traffic, wearable technology and machine automation systems), device-to-device interaction by means of sensors and actuators, use methods and user experience, as well as crowdsourcing based on large amounts of distributed sensor data.

Review of applications

The review of applications and the decision-making will follow the Academy's general review criteria for research programmes (see www.aka.fi/eng > Funding & guidance > Review of applications). In addition, special attention will also be paid to the following issues:

- international engagement
  - attracting young, high-level and promising researchers from abroad to Finland or hiring researchers who have recently come to Finland to work on the project
  - research visits by Finnish researchers to leading-edge international universities and research institutes
- business cooperation
  - cooperation between universities, research institutes and business companies
  - problem-setting in research
  - application potential of results
- intersectoral mobility of leading-edge researchers
  - mobility from universities to business companies
  - mobility from business companies to universities
- use of universities' and research institutes' own resources in the research
  - use of resources of the site of research and the partners
  - level of commitment and contribution of funding by the site of research.

The call has two stages. Academy funding for this call is a maximum of EUR 5 million.

Based on the letters of intent, the Academy will decide which projects will proceed to the second stage. Projects selected to the second stage will be invited to submit full applications. The non-negotiable deadline for submitting full applications in the Academy's online services is 15 September 2014 at 16.15. Applicants may be invited to interviews during the review process.

A panel composed of members of the Academy's Research Council for Natural Sciences and Engineering and any other experts will be responsible for the review of the letters of intent. The full applications will be reviewed by an international expert panel.

The funding is granted for two years and it normally starts on 1 January 2015.

Consortium applications

If the applicant is a consortium, see detailed guidelines on our website under Consortium application. However, **please note the nonstandard procedure**. At the first stage (letters of intent), **the applications of all subprojects of the consortium must be submitted by the deadline**. The consortium application will be processed only if the applications of all subprojects have been submitted by the deadline. The composition of the consortium cannot be changed after the first-stage deadline.

Intersectoral consortia

Applicants must clearly indicate in their research plan if the consortium involves parties who apply for funding from both the Academy of Finland and Tekes. In the Academy's online services, enter only those consortium parties who apply for funding from the Academy. Within this call, Tekes is prepared to fund only such projects by companies that are parallel with the proposed research projects.

Funding from Tekes is applied for in line with Tekes' guidelines. The deadline for letters of intent addressed to Tekes is 29 April 2014 at 16.15, submitted via Tekes' service at www.tekes.fi/en/funding/tekes-customer. Click on *Test your idea* and proceed to fill out the form. Enter the code **ICT 2023 Sensors and Actuators** under *Main development areas, Other, please specify.*