Evaluation Report Strategic Area ICT.

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The structure of this report follows the one agreed during the Trondheim meeting. It is made from four parts, where, for each of them, we reflect our personal views regarding the ICT strategic area (SA). Basically,

- In the section 1, we discuss the opportunity of selecting the ICT field as SA and, in particular, the intrinsic interdisciplinary inherent to this field.
- Section 2 comments on the actual status of the ICT SA, it also covers the review of the different existing sub-areas
- In the section 3, we analyse the actual achievements of the SA with respect to NTNU goals and we also develop some ideas regarding its future positioning...
- Finally section 4 concludes by recommending the set-up of a number of instruments helping in the management and implementation process of the SA.

1. General view on ICT as a Strategic Area.

Strategic Areas for NTNU were set up with the goal to

"- achieve specific objectives and identify challenges or opportunities of strategic national importance
- generate synergy and interaction between basic research, applied research and innovation
- promote interdiciplinary cooperation
- promote international cooperation and networks"

ICT is an area with great potential to meet these goals. If NTNU decide to proceed using the "instrument" of Strategic Areas to position NTNU and for NTNU to be competitive, ICT is central and necessary as such an Area.

The general goal of a SA is to identify challenges or opportunities suites the ICT area very well. The ICT area is today the main driver for change in scientific disciplines, in business, and in society. Challenges lie in keeping pace with the extremely fast development of technology and applications, to meet needs and demand from the science community, from business and from the society in general for ICT and at the same time to continue to develop new knowledge and ICT as a scientific discipline. Still it is important to note that the ICT R&D and innovation landscape is progressively changing in the so-called traditional economies (Europe, US, Japan, etc.) with a growing interest in the innovation resulting from the applications of ICT and a more moderate interest in ICT technologies themselves. As a consequence, one can see the following shifts in traditional economies:

- From large companies to (V)SME in the ICT hardware, basic software and middleware sectors;
- An increasing demand in terms of new ICT-based services in other industries with a positive consequence for the ICT consultancy sector.

The goal to generate synergy and interaction between basic research, applied research and innovation is important for the ICT area. Most often, university ICT departments experience the problem of balancing the more basic or general ICT R&D with application oriented research. The SA ICT at NTNU shares that problem with ICT departments at many Universities. When it comes to innovation the ICT SA is not only synergetic but can drive

innovation in all disciplines in NTNU as well as in business and society surrounding NTNU. ICT is an area where spin-offs are common.

Interdiciplinary cooperation is intrinsic in the ICT R&D domain. This has been the case since ICT became a university dicipline in the 1960-1970. Interdiciplinary cooperation with ICT has included humanities, social sciences, medecine, life sciences etc. . in essence most other diciplines. The kind of interdiciplinary research where ICT has been involved has varied from ICT support to genuine knowledge development.

The SA ICT lends itself very easily to international cooperation and networking.

In addition to the above goals, Strategic Areas were intended also as a base for development of applications to Norges Forskningsråd for CoE and CRIs.
One CoE has been awarded to ICT. The CoE – as requested by Norges Forskningsråd - reports directly to Rector of NTNU.
It may be worth noticing that this means that if a SA applies for CoE and if the application is approved the CoE will be placed administratively outside the Strategic Area. The CoE awarded to NTNU in the ICT domain is not felt to be a part of the SA ICT. It is therefore not obvious why a SA director would be motivated to promote the development of new CoE applications.

2. Comments on the specific ICT strategic area and its associated sub-areas.

As explained in the previous section, ICT is interdisciplinary by nature. Thus it is clear that the SA concept is the right instrument to be used for ICT for promoting cooperation and collaboration. Still it is worth to remember that ICT has taken profit from a second instrument which is at the faculty structure level. The creation of the IME faculty made possible the regrouping a number of ICT researchers previously working in different faculties and departments. As a consequence, we can say that during the last years the ICT domain has faced a twofold cooperation challenge, both, internally at a cross ICT disciplines level and externally at the level of the applications of ICT in different domains. This double objective has definitively required a lot of energy and attention from the different involved stakeholders.

As part of our mission, the review of the ICT strategic area has been the focus point. This area is covering different sub-areas, each of them being associated with different themes and associated research programme. The different sub-areas seem to work in a quite independent way, still they all report to the SA Board and also share some common concerns. One is the IPR aspect for which the SA ICT has taken an important forward-looking initiative by developing a policy for IPR. This policy has been developed in dialogue with industrial partners.

The emergence of the different sub-areas has resulted from different factors: a pre-existing cooperation, the identification of an opportunity related to a need for a strategic positioning, the desire for cooperation between different teams and, last but not least, te presence of a ‘champion’ willing to develop the sub-area. Hereafter we review the different sub-areas and point some elements resulting from the analysis of the available reports and the interaction that we got with the sub-area leaders.

Computer science and Visualisation

The set-up of this sub-area directly follows from a pre-existing collaboration regarding the development of HPC facilities and their promotion both at the University and external levels. Regarding this sub-area, we note:

- strong in publications, the majority of them being not published in ICT journals but more in journals related to the field of application (physics, chemistry, etc) where HPC facilities have been used..
- focus on Visualisation in basic research.
- applications for CoE, CRI or YFF are not reported
- cooperation with the meteorology Institute. Note that the offer of HPC services to the outside may be the topic of important quality of services issues that we have not evaluated.
- difficult to get a picture of where the group stands in an international benchmark. integration with other sub-areas or other strategic areas could be explored.
- the development of a "Strategic research program" is planned for. Such a strategic plan is urgently needed for positioning inside and outside NTNU

Learning with ICT – LIKT

ICT technologies are for a long time involved in education activities (an e-learning service exists at NTNU). Still an important R&D component is justified both by the challenges of exploiting new opportunities enabled by new technologies (mobile, simulation, etc.). LIKT has its host faculty outside ICT (in Faculty of Social Sciences and technology management). Still however LIKT seems to have managed a good balance between ICT and other disciplines and at the same time have identified and explicitly pointed at the difficulties of interdisciplinary research. Regarding this sub-area, we note:

- an important achievement during the period has been the elaboration of a strategic plan associated with a clear R&D roadmap for the future and delineating what will be the exact R&D perimeter of the LIKT This strategic plan is important and could lead to a high visibility and a profile for ICT at NTNU.
- a well planned and strategic development of international networking and collaboration
- industrial cooperation could be further developed
- opportunities of further cooperation with other sub-areas in ICT such as BVV on simulation and visualization might be explored
- the strategic plan, the monitoring and reshaping of project that deviate from the plan , the identification of challenges etc. show that LIKT is a very well managed programme.

Security

Research in this sub-area has been going on for a long time at NTNU. Documents received about this sub-area were missing some information like: the number of postdocs, the elements regarding integration and cooperation with other sub-areas in the SA, etc.. Regarding this sub-area, we note:

- comparatively weak in terms of publications with respect to the size of the group and its important history (11 professors and an unknown number of post-docs)
- clearly identified questions to address in order to position the area in 2020
- international cooperation thru PhD students and NTNU professor as visiting professor in the US.

- cross-disciplinarily seems mainly to result from cooperation at the IME departments level
- a "champion driven" sub-area?

Language technology.
Reserch in this sub-area has been ongoing in NTNU (or its forerunner) for at least 20 years. The ICT Strategic Area has helped in the recognition of this sub-area and has offered support to the language technology area in terms of management facilities.Regarding this sub-area, we note:

- difficult to benchmark this research with international corresponding groups.
- close cooperation with SINTEF
- today research is focused around the Norvegian language.The acquisition of the Norwegian Language data and its role as research infrastructure could be explored and used to position NTNU and the area nationally and internationally.
- a spin-off company is reported.

Bioinformatics
This subarea is said to be "shared" between ICT and Medical Technology. Strategic Areas are set up in order to promote interdisciplinary cooperation. It is therefore not obvious what it means to have sub areas shared between two Strategic Areas. Bioinformatics is pointed out as a focus area in the ICT Strategic Area. At the same time, in the self evaluation , the vision for the Bioinformatics for 2020 is that the area is fully integrated with the life Science group. Its set-up seems the consequence of a strategy for positioning bioinformatics at NTNU and national level. Still this positioning remains unclear today. Regarding this sub-area, we note:

- international cooperation is not reported. This is alarming for such an established area.
- no EU projects, one application for EU project, no application for Centre of Excellence or for Centre for Research based Innovation.
- the challenges ahead for the area seem to be competition with Bergen and Oslo rather than on subject matters or on development. of Bioinformatics as a discipline.
- the possibility to strengthen cooperation with other sub-areas within ICT , for example BVV, should be explored.
- the problem of communication barrier needs to be addressed. The role of the ICT group should include a clear and identified R&D component and not be limited to the role of services provider.

e-Health
This is a typical inter-disciplinary sub-area involving ICT, medicine, sociology, organisational and legal issues. As many of public sectors, such sector is difficult in its approach because of the variety of stakeholders with different conflicting interests. Regarding this sub-area, we note:

- great potential of societal impact.
- need to clarify difference between telemedicine and e-health
- the relation to the national health initiative is unclear
- ICT research issues and focus are not described
- no EU projects within the framework Programme (two projects within the eTen program.)
- great potential for cooperation with other areas within ICT as for example eGovernment and BVV.
- with the explicit goal to become world leader within this area in 2011 it is urgent to set up and develop a strategy for how this could be achieved.

Computer games.
This is a new sub-area. The reasons for starting this sub-area are reported to be the availability of technical knowledge in combination with demand from local SME companies. Regarding this sub-area, we note:

- overlap and possibilities of cooperation with the sub-area "learning with ICT".
- the area has a good potential for external funding.
- no results reported so far.

Computer games is an area where many European university departments have had research ongoing since a number of years. In a longer perspective, the area has to develop a profile in order to be visible in an international perspective.

e-Government
This is a newly started sub-area for which no result are reported yet. Note that this sub-area presents some similar challenges and opportunities than the e-health sub-area. It is important to clarify the ICT research issues as well as to develop a strategic plan for approaching this public sector which is very applied and demand driven.

e-Mobility
Although not be presented as an actual sub-area, the opportunity of creating one has been discussed in relation with opportunities offered by the set-up of the wireless Trondheim initiative. This public/private partnership initiative offers the possibility to create a "living lab" and a research infrastructure where new e-services could be identified and developed as the result of new kind of R&D in cooperation with business and society.

3. Appropriateness of the ICT Strategic Area with respect to institutional goals

As the collection of "strategic performance data" (Objectives 2010/2020) is not yet implemented and thus the templates filled by the SA are not fully aligned with these performance data, we can only draw some partial conclusions based on the received documents and conducted interviews.

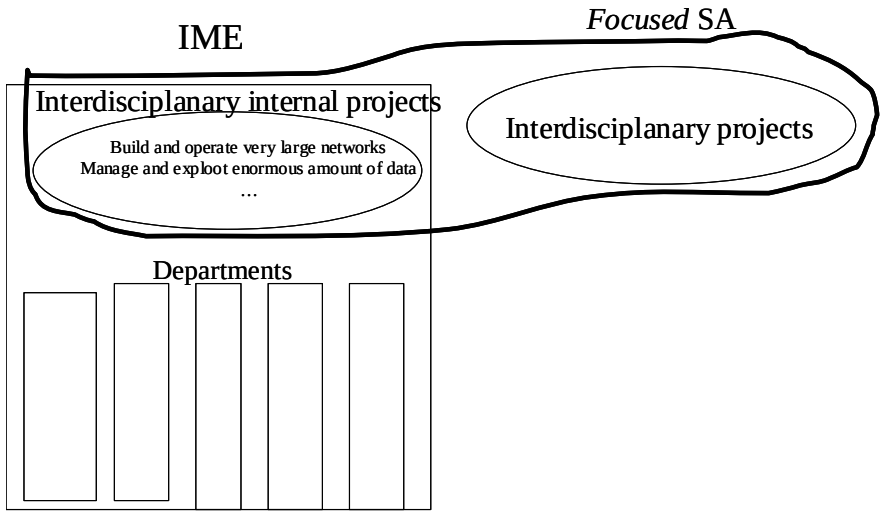
With respect to the original objectives associated with the requested evaluation, we consider that ICT has been successful with respect to some of them, namely; the strengthening of the inter-departmental and inter-faculty cooperation, the development of applications for Centres of Excellence and a window open to the public and private sectors as well as to the society in spite of the problems caused by the changing industrial context (as discussed in section 1)

Regarding the importance of ICT for both for the business and the society, associated with the intrinsic interdisciplinary approach required for ICT R&D innovation, we consider that there is a key opportunity for the ICT strategic area to further position itself in terms of a more profiled approach. This would permit to complement the actual approach and contribute to reaching additional strategic areas objectives like: international lead in focus areas, enhancement of international visibility and a sound strategic cooperation with the society.

In line with a possible new profiled positioning of the ICT Strategic Area, we suggest the following:

- Identify a more focused theme than ICT for the SA. The existing one is too large and does not enough identify the target of the R&D and innovation activities.
- In the identification of the new focus, consider the merits of ICT from a "push" perspective rather than from a "pull" perspective. While both approaches aims at supporting the innovation process, the first approach offers more research challenges and scientific visibility for the ICT R&D side
- Avoid the identification of a focus where the ICT R&D component is not clear and where there is a risk than ICT contributions be perceived as commoditized services. Encourage a multi-faculty mobilization through the selection of the team.
- Selection of the focus theme should also acknowledge the decision regarding the type of strategic relation to have with SINTEF.

Finally in such scheme we also recommend a better alignment between themes that are more managed at the IME departments level and those that will constitute the focus of the strategic area.



As depicted on the figure, some of the projects run at the inter-departments level could be transversal and provide a platform for inter-faculties multi-disciplinary projects defining the focused strategic area. For example, reading the actual strategic area report, themes like "building and operate very large networks" and "manage and exploit enormous amounts of data" could be associated with such transversal platform projects. Doing so, a better alignment could be achieved between generic ICT R&D and applications oriented R&D.

4. Processes and measures of implementation:

Whatever the final decision regarding the move or not of the ICT SA into a more focus profiled one, we think that a number of improvements are necessary for guaranteeing the sustainability of the SA concept in a long term perspective. We also recommend that additional necessary resources be devoted to the SA for supporting the implementation and the operational costs of these measures.
Suggested areas for improvement are;

Strategies and long-term vision

The process of identifying sub-areas would be facilitated by a clear and explicit strategy plan for the Strategic Area. Such a strategy must balance the need for generic ICT R&D and the application oriented R&D. For ICT there is always a risk in interdisciplinary cooperation of being primarily a service or support to the applications or to other(s) disciplines. Application areas and interdisciplinary work must be very carefully monitored in order to insure that ICT R&D questions are identified and addressed in such cooperation. This is necessary in order to develop new knowledge and stay attractive for interdisciplinary and application oriented cooperation. Generic sub areas must be integrated in and interplay with application oriented sub areas. Currently this does not seem to be the case.

A clear and sustainable long-term vision has to be defined for the SA together with an associated business plan making possible its implementation. To support it,we also recommend that a projects portfolio management approach be used for balancing between the short/long term goals of the strategic area.

Reporting

A monitoring scheme for measuring progress, for the definition of indicators of success as well as reporting mechanisms have to be put in place. Monitoring must be strengthened and Rector has to be more directive.

Indicators of success will probably be common for all Strategic Areas. However, in response to the specific challenges for the ICT area, specific indicators ((like those related to IPR, software licences, etc.)must be developed. by which success of the Strategic Area ICT could be measured.

Selection of sub-areas.

The task to prioritize among potential sub areas within the ICT SA is a difficult task. There has to be a balance between generic ICT and applications and at the same time to respond to the fast technological developments and the demands of other disciplines, businesses and society.

The process of identifying subareas within ICT SA seems to be an intuitive, democratic process which takes into account the different dimensions mentioned above and at the same time conditioned by the availability of a sub-area leader and taking into consideration perceived possibility of attracting external funding. This intuitive process may be appropriate for the initiation phase of a SA but a more well defined strategic process is necessary for sustainability and for having a chance of becoming outstanding in a national and international perspective. A formal foresight approach could be considered. Finally the identification of a new sub-area should be done together with the analysis of its contribution to goals associated with the long term vision for the ICT Strategic Area.

Leadership

Decision making - as for example hiring of personnel or allocation of resources to sub areas - is made in the hierarchic line structure of NTNU. Also, the Strategic Areas have very little resources of their own.

This combination makes the leader and the management of a SA - generally speaking - week and vulnerable.

To have the dean of a faculty serving also as the leader of a Strategic Area has its problems in terms of dual or even conflicting goals and also in terms of workload. In the case of SA ICT

the double task of the leader seems to have worked very well. However, in order to use Strategic Area as an "instrument for change" it is necessary to empower its leadership and to impose energy by strengthening the Strategic Area leader in relation to the hierarchical line structure. This however leads to the question on whether or not it is possible for the same leader to make a strategic plan for the Strategic Area as well as for the faculty.

Strengthening of the SA management and development of separate strategic plans for the faculty and the Strategic Area may benefit of a push/pull effect
where as an example

- Faculty goals could be focused on: basic research excellence, basic academic research, to attract students,
- Strategic Area goals could be focused on: long-term external visibility, applied interdisciplinary research,
- The balance between basic/applied research can be different between the faculty and the Strategic Area.

An additional aspect of management of a Strategic Area is communication:

- Internal communication: Communication on the Strategic Area as a concept or instrument to senior staff in the faculty could be strengthened.
- External communication needs to be made by the scientific leader of the Strategic Area (not by the coordinator).

Half time administrator is not enough for coordinating a Strategic Area. As the Strategic Area has hardly any money or other resources there must be some compensation for time invested by directors and focus sub-area leaders. Resources should be put into the governance of these areas, (senior people sought from across the world leading these areas?), time freed for governance of the area.

International cooperation

Report on international cooperation within the Strategic Area ICT is not sufficiently elaborated. EU projects, PhD students from India, ERCIM post doc positions and a NTNU professor as visiting professor in the US are mentioned. The origin and the strategic considerations behind these international cooperations however is not transparent. A strategic plan is needed and should include identification of strategic partnerships and planning for desired international cooperation for the different sub areas.

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