RESEARCH STRATEGY 2012-2016 FIRST DRAFT

Research Board, IT University of Copenhagen,
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Table of contents

1. Introduction

This document is the IT University's research strategy for the period from 2012 to 2016. It is part of the overall strategy of the university for 2012 - 2016 which includes other sub-strategies such as educational strategy, communication strategy, globalization strategy, and IT strategy. Though the research strategy will be made publicly available, its primary intended readers are current and potential staff and students.

The strategy is intended to be a tool used by everybody across the organization - faculty, administrators, and management - when making decisions regarding research. It provides guidelines enabling synergy and consistency in both daily and long-term decisions, yet leaves room for everybody to use their creativity, personal strengths, and common sense to make what they believe are the right choices in specific situations.

The process of creating and writing the document has itself been undertaken with an eye toward ensuring that input from the entire organisation is used in formulating the strategy detailed here. The Research Board of the IT University, made up of both management and faculty members, has been responsible for soliciting feedback from various branches of the organization and, ultimately, the final

wording of the strategy.[1] In the Spring of 2011, various meetings were conducted amongst faculty regarding the nature of a strategy document, possible goals, and some of the key elements. Similar feedback back was solicited from other departments (for example, the teaching branch of the organization), the Foresight Panel, and the University Board. The process is an attempt to be primarily bottom-up and one that taps into the new organisational structure with its various boards. Thus, the Research Board takes the responsibility to anchor the document amongst the organization responding to their input and drafting the strategy accordingly. The resulting current version of the strategy is thus this document, *Research Strategy for 2012-2016 First Draft.*

During September and part of October 2011 there will be hearings (both at the group and departmental level) focusing on the details of this draft. Possibilities for any interested party or group to give feedback will be provided both via face to face and online means. The input provided will be incorporated into a *Second Draft* that will be made available for a short (mainly on-line) hearing in early November 2011. The strategy will then be finalized by the Research Board and submitted to management for their approval and integration into the overall strategy of the IT University which is expected to be finalized before the end of 2011.

The goal is that the research strategy will support and strengthen research at the IT University during the years 2012 to 2016 and be an important document in shaping the institution as it grows, providing values and guidelines that can be used at a variety of levels. Ideally the research strategy will serve to foster individual faculty growth, as well as various research collaborations, and overall organisational development. The first step to this is to ensure that it is developed by, known, accepted, and used by those who make strategic choices and are affected by them. Furthermore, to make the strategy viable, it must be simple enough that everybody can have it in the back of their mind as they carry out their work. The strategy introduces a number of well-defined key elements, defines values and sketches goals that we hope can be clearly communicated clearly and easily understood. The document should be read as a specification, the concrete implementation is left to the boards, the department, groups, and individuals. The ambition of the authors is that the document provides the necessary guidelines to make the implementation happen seamlessly and efficiently.

2. Framework

The following quote from Professor Jay Strother Moore from University of Texas captures the essence of this section:

> The most important question[:] *Where do you want to go*? [...] The real question is *how do you get the resources*? [...] Vision without financing is hallucination.[2]

[1]The members of the research board (as of fall 2011) are: Lars Birkedal, Iben Bruhn, Jens Chr. Godskesen, Peter Kamph, Carsten Schürmann, and Jørgen Staunstrup (chairman), and T.L. Taylor. In addition Thore Husfeldt (representing the PhD Study Board during Carsten's absence) has participated in the discussions and writing of the first draft.

[2]Presentation at Informatics Europe Summit, October 2008: http://www.informatics-europe.org/ECSS08/papers/strotherMoore.pdf

Such key issues are something all organizations face, including universities. Matters become even more complex when we also acknowledge that the term "resources" is not simply about money, but also refers to the legal and political constraints determining the playing field in Denmark, Europe and the World. This overall context for organizational development - one that traverses economics, politics, and global trends - is the underlying framework of the strategy initiative.

The framework for this strategy consists of two parts. The *external* framework is defined by external forces that are beyond the control of the IT University and are mostly independent of our decisions, for example Denmark's financial situation and EU policies. The university is dependent on resources residing in Denmark and will continue to do so. Danish politics and legislation will therefore have a significant influence on the decisions implemented at the IT University for the foreseeable future. The other part is the *internal framework,* which is already established and largely defined by decisions taken by the IT University in the past, for example in terms of hiring, space, and strategic decisions.

2.1 External Framework

The external framework is determined by forces that are in many ways "a given" and can only very indirectly be influenced by the IT University. The three most important aspects of the external framework are: national IT politics and finances, the EU, and international trends.

2.1.1 National IT politics and finances

The Danish economy is strongly influenced by the international financial crisis, and by a long period where the growth in GDP and productivity has been weak combined with a large deficit on the state budget. Concretely, the state budget for the coming years may bring a significant drop in research funding, both the base funding and the competitive sources such as the research councils. On top of that, the low growth of GDP and productivity is likely to reduce the private investments in research.

There is a growing realization in Denmark that IT is a key factor for developing the country, its financial strength, its educational system, and the health/care sector. Parts of the investment in this development will be in IT and provides opportunities for IT research funding, for example investments in new hospitals, labor savings in the public sector, and green energy. Research in IT at the other Danish universities has also been strengthened in recent years. The IT University is happy to be in close collaboration with strong research groups at all the other Danish universities. At the same time competition from these must be expected (and welcomed) for the limited resources available for IT research. The IT University will continue its efforts to place IT research high on the Danish national research agenda and to increase the awareness of the importance of IT research for development and growth in almost all research fields, economic sectors and social life/culture.

2.1.2 EU

It is very likely that the European Union will take over some of the roles played by national research politics and the Danish research councils. The first steps in this direction have been taken with the "integrated platforms" introduced by the EU. There is a strong push from the commission to coordinate

the research in and amongst the member countries. Another important development at the EU level has been the creation of the European Research Council (ERC). The significance of funding from the EU will increase in the coming years.

2.1.3 International trends

The most significant international research trend is probably the *growing importance of IT* in all research fields (and in some fields complete dependency), economic sectors and social life/culture. The mapping of the human genome, study (and development of) of network culture, and economic modeling are examples of research areas that are not only deeply dependent on information technologies, but which also creates interesting challenges for IT research as such. This integration of IT into a wide variety of research domains, as well as broad aspects of modern society, is a tremendous source of inspiration and opportunity. Rather than relying on narrow, conservative formulations of IT, we increasingly see the necessity of an expansive formulation, one that involves a range of approaches, both disciplinary and methodological. Although there is a growing realization of the importance of IT, not just as a tool, but as a rich area of research itself; there is still a long way to go before the importance and indispensability of IT research is widely recognized among politicians, in the board rooms, within public administration, and even the university at large.

Scouting for trends and new breakthroughs is an integral part of doing. Hence, the research strategy stands on the foundation provided by the accumulated outlook of the entire organization. In addition the Research Board has studied a number of strategy and foresight reports both from Denmark and internationally (listed at the end of this section) to double check that important trends are not overlooked.

A significant international economic trend is globalisation. In addition to its economic impact it will also influence research itself. It is, therefore, an important challenge to universities in general and the IT University in particular. Globalisation has led to fundamental changes in production, services, transportation, and finance. Research (both funding and the way it is done) has until now not been affected very much. This will most likely change. The IT University has a globalisation strategy (alturl.com/zb5uj). Although many of the concrete steps in this strategy relate to education, the first sections cover research as well.

List of reports consulted by the Research Board in the work with the research strategy:

1. EU FP 8 (available at alturl.com/g8zd9)
2. Report to the President and Congress, *Designing a Digital Future*, 2010 (available at alturl.com/4d2a8)
3. Microsoft, *Towards 2020 Science* Research Report (available at alturl.com/4w7ki)
4. IBM Research, *Global Technology Outlook* (available at alturl.com/hkbo7)
5. Georgia Tech College of Computing, *Advancing the Field* (available at alturl.com/63b3u)
6. Oxford Research for Forskningsministeriet, Analyse af udviklingstendenser, Maj 2011, Oxford Research rapport.

7. Branchefælles investeringer i finans-it, DAMVAD analyse for CFIR 201, Maj 2011.

2.2 Internal Framework

In addition to considering various external factors, the research strategy is based on the internal framework of the IT University consisting of fundamental principles, key values, mission and vision of the institution. This section contains a short summary of these.

2.2.1 Mission and Vision

The mission and vision statements of the IT University are:

Mission

The mission of the IT University of Copenhagen is to deliver internationally leading teaching and research which enable Denmark to become exceptionally good at creating value with IT. Teaching and research in information technology include all academic activities which involve computers.

Vision

The IT University of Copenhagen is an outstanding example of how a small university by being innovative and globally interactive can achieve a ranking among the best in the world, both in terms of academic standards and in terms of creation of value.

2.2.2 Fundamental principles

IT research and education at the IT University are based on these three fundamental principles:

A unique view on IT: Information Technology is about handling mental constructions with digital technology wherever such mental constructions appear: in arts, in science or business. This very inclusive view on IT is often illustrated with the IT triangle. It is further illustrated in the short film:: http://www.itu.dk/en/Om-IT-Universitetet/Grundprincipper

Education: All educations at the IT University strive to meet all the following three criteria: attracting a large number of well-qualified students, world class academic contents, and giving students the competences needed for the future job market. This is further illustrated in the short film: http://www.itu.dk/en/Om-IT-Universitetet/Grundprincipper

Research: All research at the IT University is expected to be motivated by *both* the search for fundamental insight *and* consideration of use. This is further illustrated in the short film: http://www.itu.dk/en/Om-IT-Universitetet/Grundprincipper

2.2.3 Organisational values and personnel policy

The values and personnel policy defines the framework for the day to day collaboration at the IT University itself and with external partners/stakeholders. The values of the IT University are: accountable ("ansvarlig"), forthcoming ("imødekommende") and direction finding ("toneangivende"). This is further explained here: http://www.itu.dk/en/Om-IT-Universitetet/Organisation/Vaerdier

Finally, the personnel policy provides a framework for all employees. It also has specific sections related to research, e.g., handling of inventions: http://intranet.itu.dk/en/~/media/Personale/Politikker/Personalepolitik%20200611%20underskrevet%20engelsk%20pdf.ashx

2.2.4 Interdependence of education and research

There is a tight interdependence of education and research. In addition to the traditional relation between the two found at all universities worldwide, in Denmark there is an additional tight financial coupling between them. All tenured faculty have to split their time between teaching and research. However, education and research are financed very differently. Teaching is funded by an activity based scheme ("STÅ"), where income is closely tied to the number of students passing exams. Hence, an increase in teaching activity is (almost) automatically followed by an increase in funding. In contrast to this, research is funded by a combination of a fixed amount of base funding supplemented by project-based funding, which is variable. In a static situation where the amount of teaching is fixed and the corresponding research is covered by base funding and externally funded research projects, it is simple to manage. However, in any scenario with changes, whether it is growth, shift of academic areas or anything else, controlling the financing is a challenge, because the income from teaching and research are controlled by very different mechanisms.

The accreditation of Danish study programs require that the programs are "research based." In practice, this means that there has to be a certain (high) proportion of active researchers teaching the majority of courses in the program. Preparing for accreditation of future programs imposes additional constraints on the research strategy.

3. Strategic Goals

With these frameworks and context in mind, this section provides an overview of the strategic objectives of the IT University Research Strategy. These goals are to be reached by 2016. The individual goals are elaborated and discussed in more detail in the subsequent sections of the strategy.

1. Move up the reputation spiral.
2. Increase externally funded research and research collaboration.
3. Contribute through research in making Denmark exceptionally good at creating value with IT.
4. Identify and further develop a small number of strategic areas where education and research is particularly visible.
5. Stimulate growth and development of all faculty while encouraging a common culture of collaboration and innovation.
6. Adding a "3+5" scheme within the PhD program (as a supplement to the existing "5+3"), including raising the number of new PhD students admitted each year to an average of two PhD students per tenured faculty member.

Short motivation for each strategic goal:

1. *The reputation* of the people and their research at the IT University is the capital that, to a large extent, determines the chances of success in reaching the other objectives of the strategy. However, in order to accumulate this capital and gain recognition, the research must be supported and visible. Therefore, promoting and communicating about the research of the IT University is an indispensable part of being recognized and achieving/maintaining a reputation of excellence. This is discussed in further detail in the sections on visibility.

2. The IT University has already demonstrated a strong ability to attract *external funding* and establishing successful research collaborations that supplement base funding for research. The university should develop and draw on this ability in order to ensure further financial robustness - an increasingly important issue since the Danish state budget for the coming years may have a significant decrease in research funding (base funding and competitive sources such as the research councils alike). Secondly, striving for an increase of external research collaboration goes well with the ambitions of the university to be globally interactive, enabling Denmark to play a major part in development and deployment of IT. This is discussed in further detail in the sections on external framework and strategic areas.

3. In accordance with the mission of the IT University, the institution (in both teaching and research) should *contribute to making Denmark exceptionally good at creating value with IT*. The nature of research makes it impossible to promise results, in particular on a short time-scale. However, as a Danish university the IT University should take on some of the national challenges for Denmark, the Danish economy, and continued welfare for the Danish population. This is discussed in more detail in the sections on internal/external framework and on strategic areas.

4. During the strategy period, the IT University will initiate and carry through a transparent, bottom-up process aimed at identifying, and in some cases further developing, a small number of *strategic research areas* with impact beyond the traditional peer research community. Among other things, this will strengthen the ability of the university to demonstrate the long-term value creation possible through investments in IT research and provide the IT University with an excellent extra tool for communicating and promoting its research (a component of moving up the reputation spiral). Moreover, the development of a few strategic areas in which research from the IT University contributes significantly would likely be an important step in the accomplishment of the institution's mission. The strategy itself does *not* identify or define the strategic areas. It instead defines criteria for such areas, the motivation for having them, and a process for choosing and developing them. This is discussed in more detail in the section on strategic areas.

5. The IT University considers it crucial to *stimulate and facilitate faculty growth and development* in ways that are appropriate for the individual faculty member. This may, for example, happen through the allocation of seed funding to faculty to help them establish new research initiatives. It can also happen through employee development, the support of grant applications, by involving faculty in key

decisions at the university, and various other ways. Also, the IT University supports a professional culture in which collaboration is encouraged and facilitated, in which a multitude of perspectives are brought together and in which value may be created in many different ways. This is discussed in more detail in the sections on research culture.

6. Since the PhD school is a key element of the research at the IT University and the graduates are an important contribution to the value created by the institution, *continuous development of the PhD program* is important. During the strategy period, the PhD school will develop a "3+5" program[3] and will admit and support sufficient candidates to correspond to an average of two PhD students per tenured faculty member.

4. Reputation and Visibility

The research capital of a university is largely based in the cumulative insight, experience, and results of its researchers and staff. Labs, key processes, equipment, and software certainly play a role but the faculty is clearly the single most important element of the research capital. This value cannot be measured objectively. It is primarily assessed subjectively by other people, for example, research peers, partners in various sectors, students, government institutions, and international organisations. In the following, the term *reputation* will be used to shorthand this otherwise complex value.

4.1 Visibility to peers

For a university, a good reputation among peers is the prerequisite for almost any other activity related to research (or teaching for that matter). For example, finding new valuable partners, getting invitations to the best groups, meetings and workshops, recruitment, career advances and funding are all directly related to peer reputation. A good reputation is earned by doing good research. This is not the place for a discussion of what constitutes good research (there is substantial variation from field to field). But, *within any field recognition by other researchers (peers) is a prerequisite*. However, to be recognized the research must be visible and, therefore, communicating about one's research is an indispensable part of being recognized and achieving a good reputation. This communicative effort may take many forms: publication through the best channels is a must, but appearing in conferences, workshops, appearing in public media and on electronic platforms are all needed. In addition, the research must be communicated through people, for example via graduating students (who know the research), getting the research applied, collaborative projects etc. Ultimately achieving a good reputation requires both producing good research and disseminating it.

Reputation is not a static property, but a constantly changing position on a spiral where advances lead to further advances (and where, similarly, movement in the opposite direction is always a risk). Hence, *moving up the reputation spiral is an important strategic objective*. At the end of this section is a short discussion of some concrete suggestions for evaluating whether the IT University is moving up the reputation spiral (and at what speed). Let us first discuss a few alternative ways of moving.

[3]Currently, most PhD students are admitted after completing a MSc degree, this may be called a "5+3" program (3 years of PhD on top of a 5 year MSc program). The "3+5" program is a 5 year PhD program on top of a 3 year bachelor education

The current reputation of the IT University has been earned through a combination of top-quality research, innovative steps (compared to other universities), an open, friendly and collaborative environment, good use of resources and strong support from stakeholders. For example:

- an approach to IT as a multidisciplinary area reaching into almost all traditional academic disciplines (often illustrated with the IT triangle)
- careful use of resources and an agile organization

These points, and many others, have all contributed to earning the IT University a good reputation in a short time-span. Though as a small public institution the IT University faces special challenges in securing a spot amongst the most reputable international universities (as well as situating how we compare with other universities within Denmark), our ambition is to continue to build a high-quality internationally competitive institution.

Some universities have access to substantial resources by obtaining, for example, strong political backup for huge investments (several examples in Asia and Middle East), private donations (many examples in USA) or accumulating money over many years (a few examples in Great Britain). Regardless of how the resources have been obtained, these universities have the option of moving up the reputation spiral by giving lucrative offers to researchers with a strong reputation and by investing in the infrastructure and staff. Often this is self-perpetuating by attracting additional donations and investments.

Most countries (and states in large countries such as USA) have one (often old) favored university attracting a lot of local talent and resources. This is, for example, the case of at least one university in every European capital. These universities are often able to maintain or even advance their position in the reputation spiral despite financial limitations simply because they are the default choice by many talented people, donations and political initiatives.

4.1.A. Strategic direction

The IT University must make substantial advancements on the reputation spiral in the coming years. This is a prerequisite for being able to attract the right new faculty, students, and partners, as well as create value for our stakeholders. There will be competitors who will have much more abundant resources available to them; hence, it is of key importance to find those initiatives where our limited resources will maximize our advancement on the reputation spiral.

The IT University should continue developing new, ground-breaking ways of doing research and refine efficient key processes related to research like recruitment, funding, communication, operating equipment and project management. Although some competitors will have access to much larger resources, others will not. By showing innovative ways of doing research, the IT University will be

able to move up the reputation spiral by being an inspiration to the majority of universities who must survive by working smart.

4.1.B. Possible indicators

In order to decide whether the IT University is actually moving up the reputation spiral (and hence moving towards the strategic goal), we must identify a small number of indicators and commit to improving these substantially during the time span of the strategy (2012-2016). Below is the list of indicators to measure if we are moving up the reputation spiral:

- *Publications*: where the indicator should emphasize quality over quantity and be relevant for all research areas present at the IT University.
- *Invitations*: to program committees, research consortia, keynotes, and visiting professorships is an indicator of reputation.
- *Quantity/quality of job applicants*: receiving job applications from good researchers is an indicator of reputation.
- *Artifacts:* demonstrations, exhibits, software, prototypes, and the like that becomes reference points and are recognized as breaking new ground in showing how IT influences design practices, culture or social life.
- *Funding*: being able to convince third parties to invest money in research or research collaboration is a very objective measure of reputation. An indicator should preferably have a qualitative element.
- *PhD graduates first job*: a number of PhD graduates find their first job through the network of their advisor/university. Hence, the reputation of the organization hiring PhD graduates is an indicator of the reputation of the university from which they graduated.

4.2 Visibility to the general public

As discussed above, a significant portion of a university's capital resides in the work and reputation of its faculty. While much of this is built within the framework of academia (amongst professional peer networks, for example) how the university connects with, and is thought about, in the broader public holds real importance. Voters, aspiring students, parents, and other members of the public all come to understand the value of the university in part through its connections with faculty (either via education or research).

At the same time, the university in general and faculty in particular has an obligation to share and disseminate valuable knowledge to the general public - for example by taking on the role as public intellectuals and contributing to keeping current debates in society informed and qualified by updated, valid, research based knowledge. The value of visibility in this respect is symmetric, however. Often, researchers may acquire valuable input through participating in a close dialogue with the "real world" - in other words, the university has both an obligation to distribute knowledge to the broader public and to qualify ongoing debates as well as significant advantages to be gained from this sort of activity.

4.2.A. Strategic direction

The IT University supports faculty engagement with the public and this kind of work will be recognized and institutionally valued. Work with the public is seen as a valuable component of the university's capital and especially notable achievements in this domain will be recognized as such. The university will also facilitate these opportunities by providing an infrastructure that is well-suited for facilitating visibility to the public.

Far too often, university life is seen as disconnected from the everyday world. Yet at any given moment in the university there are a variety of ongoing projects that present real opportunities to bridge out to non-academic networks and demonstrate the value of research. Certainly some projects will more readily lend themselves to public interest and we might think of the university as having a variety of projects that lend themselves in diverse ways to a range of audiences. Some projects will be more relevant for industrial stakeholders and public organisations; others will form basic research that circulates primarily amongst academic communities. But those who do work that is *also* of particular popular public interest contribute an important component to the overall research capital of the institution.

4.2.B. Possible indicators

There is a number of ways faculty do important work bridging to the general public. Below is the list of indicators to measure if we are moving up the reputation spiral toward the general public:

- *Interviews:* in popular press articles, television programs, or documentaries where scientific findings are communicated or expert opinions are sought.
- *Talks and panel presentations:* in public venues such as trade union meetings, library lecture series, primary educations, non-academic conferences, or to non-profit organizations.
- *Blogging, podcasts*: or other new media activities that demonstrate ongoing engagement in broader public debates and discussions.
- *Research dissemination activities:* that fall outside traditional publishing and are intended for a broader audience (for example, short form video via YouTube or documentary film productions).

4.3 Visibility to political actors

Another important group of stakeholders for the IT University, beyond the peers and the general public as discussed above, are the Danish *political actors*, i.e. the politicians, the central administration, lobby organizations, research councils and the like. Many decisions taken by these stakeholders will to a varying extent influence the future of the IT University, so a good relation and visibility to these actors are of utmost importance.

An important challenge therefore is to relate the research carried out at the IT University to these stakeholders, to ensure they understand what is unique about the university and its interpretation of IT and IT research and to make them aware of how we create value for society and for the various organizations represented by the respective stakeholders.

4.3.A. Strategic direction

The IT University needs to continue explaining to political actors the special understanding of IT which underpins research (and teaching) carried out at the institution. This means that we must continue explaining what we internally call the "IT triangle" spanned by the corners technical and natural science, the arts, and business. In particular, we must emphasize to these actors that IT is much more than what the technical and natural sciences typically contribute with; for instance has the liberal arts nowadays a huge impact on the development and use of IT.

4.3.B. Possible indicators

The below are possible indicators for whether we are following our strategic direction for maintaining visibility to key political actors:

- *Committee membership*: tenured faculty and management should when possible be members of central or relevant committees which are agenda-setting or have influence with political actors.
- *Advocacy*: management and the board will be proactive in continuing to "translate out" to various actors and agencies the work undertaken at the institution and the value created.
- *Research initiatives*: in order to be visible to political actors we must have some clearly visible research initiatives, of a size comparable to basic research foundation centers, or bigger.
- *Being efficient*: being among the four best universities in terms of the key indicators used by the Danish Rektors Conference and the Danish government.

4.4 Visibility to collaborators

One of the fundamental principles of the IT University is to engage in collaboration with external partners. Such partners should, of course, be sought both in the public and the private sector, and a large number of them will most likely be international partners, due to the limited number of companies in Denmark that carry out research related directly to IT. The challenge here is to make sure that the IT University is visible to potential collaborators so that we will be an obvious or even preferred point of contact whenever they have a research problem to be dealt with, and symmetrically when we are in need for external partners to help carry out our research we need to be known for being worthwhile collaborating with.

4.4.A Strategic directions

A possible strategy going forward is to make sure that we maintain visibility not just to potential collaborators who carry out IT research but, even more importantly, that we also maintain visibility to collaborators who belong to the non-IT sectors that are ready for research collaboration. Strategically, we should decide on some sectors that we see the best opportunities collaborating with.

4.4.B Possible indicators

Indicators for improvement in regard to visibility to potential collaborators could be:

- *Strategic areas*: in order to be visible towards the potential collaborators we develop some clearly visible research initiatives, illustrating the multi-disciplinary and crosscutting recognition of what constitutes IT within certain non-IT sectors.
- *Funding*: the amount of money that external partners are prepared to invest in IT research at the IT University is a very tangible indicator of the visibility and reputation of our research
- *Communicative initiatives:* developing and measuring the visibility of communication efforts such as research newsletters, films, and websites.
- *Requests for collaboration:* perhaps the most direct indicator of visibility and important is the number of requests for collaboration and advice.

5. Research Culture

In this section we discuss possible ways of fostering a strong research culture within the institution. Around the world different models are used to organize researchers. One structure is that every faculty member runs his or her own research group consisting of temporary researchers (Postdocs and PhD students). Another is of independently run research groups where, in addition to Postdocs and PhD students, faculty themselves also work "under" a senior researcher. In some fields research groups are formed around core methodological and disciplinary similarities but individual member's research is carried out fairly independent of one another. In general, a variety of models are possible (often rooted in longstanding traditions and corresponding to methodological approaches) and group sizes typically vary from field to field (the general tendency perhaps being that experimental sciences have larger group sizes).

At the IT University of Copenhagen, we are not fixed on a particular model for all faculty, because we recognize that members can contribute to the goals of the University in many different ways and groups often develop their own best practices for their specific research conditions. A key focus of the strategy is, however, to help faculty grow, developing their research profiles, and overall career goals, thus contributing to the overall success of the university. We especially encourage and want to make it possible for faculty members to form projects and research teams, building productive collaborations together (and with those outside the university).

At the same time, as a publically funded entity the IT University is expected to deliver value back out to society within the areas of education, research, participation in the public debate on IT related matters, dissemination, and developing and maintaining an international network. Some of these are very tangible and have quantifiable measures: teaching (ECTS/STÅ), publications (bibliometric measures), and external collaboration (funding). Other equally important forms (network building, public service, etc.) are more difficult to measure quantitatively but play a crucial role in the life of the university. All employees (faculty, administrators, and management) together share the responsibility for the IT University delivering the expected values and results. As researchers, and indeed as an institution, there is thus always a balance between individual goals and broader commitments to the collective goals of the University.

As an institution we believe that for some areas more can be done in linking up individual research agendas and facilitating strong collaboration among faculty (both within and across disciplinary

backgrounds). The IT University thus wants to stimulate the formation of teams - rooted in the expertise and interests of faculty - to better collaborate in delivering teaching, research, outreach, and dissemination. This also includes close collaboration between administrative staff and faculty. How any given team or project is organized will vary, and there will likely be some amount of specialization or division of labor (e.g. some do more dissemination than others, teaching is not necessarily divided equally among all members of the team, etc.). Ultimately, however, the incentives to form and work in teams should be strong enough that a number of faculty will find potential advantages and exciting opportunities to do so. Depending on disciplinary norms, it may be that a "team orientation" is a organizational principle for an individual or one a faculty member "cycles through" at times over the course of their research life.

We finally want to note that some consideration should also be given to the relationship between the student population, faculty, and the overall research culture. Strong, ambitious faculty will want access to good students. While the PhD program is one branch of this, more can be done institutionally to establish formal mechanisms for ambitious bachelor's and master's students to work as research assistants and engage in early apprenticeships where appropriate. The overall research culture of a university is inextricably tied to its student culture. They cannot be separated. While there is much to be said for growing the student population and indeed as a public institution committed to broad educational initiatives we should focus on such development, the University needs to be cautious about overly diluting the quality of the student pool and the ramifications of such to faculty hiring and retention. There is a careful balancing act done in the relationship between these branches and it in part this speaks to making sure there is a strong connection between faculty and teaching initiatives (bottom up versus top down).

5.A Strategic direction

The IT University wants to strengthen the way it is being seen by current and future faculty and be known for its strong research culture. The IT University wants to stimulate and foster faculty development (recognizing that this will in some sense "look different" depending on the traditions the person is situated within). This can, for example, happen by allocating seed funding to faculty to help them establish their own project. It can also occur through employee development talks, by supporting grant applications, by involving faculty in key decisions at the university, and various other ways. Generally, the IT University will continually try to improve the working conditions and research infrastructure to stimulate research. It is understood that the needs of researchers may vary substantially, since our unique interpretation of IT requires a large variety of faculty from many different research disciplines and traditions. Hence, there will not always be a single solution fitting all faculty members.

5.B Possible indicators

The indicators are capturing the essence of the strategic direction discussed above encouraging a collaborative and multidisciplinary research culture that allows all faculty to develop both as educators and teachers.

- *Research collaboration:* growing number of cross-group projects

- *Efficiency:* develop processes that encourage collaboration between administrative staff and faculty to effectively use their distinct competencies
- *Infrastructure development*: making sure researchers have adequate tools and support to carry out top-quality work.
- *Career development:* set up processes, incentives, programs, tools and management to ensure that all faculty will develop their competences in both education and research throughout their employment at the IT University.

6. Strategic Areas[4]

This section describes how the IT University will develop a small number of strategic areas covering a significant part (but not all) of future education and research at the university. A process for developing such areas is described with the goal that a few (1-3) areas evolve during the strategy period.

This section describes:

- motivation for identifying strategic areas
- a number of criteria for being a strategic area
- incentives for developing such areas and
- indicators to evaluate progress towards establishing the areas

Please note that a strategic area encompasses both education and research. However, in this document (the research strategy) the focus is on the research aspects of the areas.

6.1 Motivation

The mission of the IT University is to contribute to making Denmark exceptionally good at creating value with IT. There are many indicators (demography, economy, lack of economic growth, stagnation) showing a need for significant changes in Denmark. IT is first and foremost a very powerful tool for making changes and is the only factor that has over the past many years consistently contributed to better utilization of resources, economic growth and innovation in general[5]. In addition, the past 5-10 years have also shown the power of IT in developing social life and relations. Hence, in line with its mission, the IT University has the possibility (and therefore the obligation) to engage itself in the significant changes needed in Denmark. This may be done by identifying a few strategic areas where the IT University contributes significantly to value creation in Denmark through research (and education). At its meeting in May 2010, the Foresight panel of the IT University expressed it in this way, "Identifying and developing a small number of strategic areas of strength will enable the IT University to 'demonstrate the long-term value create by the ITU investment'".

In recent years, for example, several teams of researchers at the IT University have gathered around important themes that cut across the traditional disciplinary boundaries, for example Global Interaction

[4] The term "Strategic Areas" (in Danish "Styrkepositioner") is used in this section; over time several others have been used such as strategic focus areas, strategic research areas etc. The term might change again before the strategy document is finalized.

[5] "Digitale veje til vækst", Forskningsministeriet, Juni 2010 (and many other similar reports)

Research Initiative, Algorithmic Intelligence, and Network Culture. Such projects provide some early examples of how cross-group collaborations can provide vibrant research collaborations and possibilities. Identifying and developing strategic areas has the additional benefit of helping the IT University to move up the reputation spiral in specific domains by offering opportunities to support focused communication about a handful of areas that develop strong recognizable profiles.

In order to grow and have an impact, initiatives need access to additional resources and support. Focusing resources on such collaborations means that these resources are not available for other purposes. Hence, development and allocation of resources for research themes such as the ones mentioned above, and many potential others, calls for the establishment of clear criteria for identifying and prioritizing and identifying potential initiatives. Identifying and developing a small number of strategic areas will enable the IT University to provide a degree of extra support. It is important to note that this will not be done at the expense of the broad and varying research programs all faculty at the university undertake. Not everyone will at all times operate within a strategic area and indeed much good and valuable research in the institution will certainly be done outside of them. This program will, however, provide some additional support for emergent collaborations championed by a number of faculty.

Please note that the strategy document (finalized during 2011) will *not* identify the strategic areas themselves but instead outline the criteria for such areas, the motivation for having them, and the process to develop them.

6.2 Process for developing strategic areas

The key idea in this section on the process for developing strategic areas is that it fosters bottom up initiatives and makes decisions transparent. This will be done by having clear goals and incentives for developing the areas, leaving key decisions mainly to the researchers themselves. This is intended to ensure engagement and that the areas truly reflect the strengths, visions, and interests of faculty. The process is well in line with the overall view on the research strategy that it should enable everybody in the organisation who works with research to align their daily decisions with the overall strategic directions of the IT University.

The resources available to the IT University will allow it to establish 1-3 strategic areas during the strategy period. A key element of the process is to establish a set of criteria characterizing a strategic area. These criteria are described in the next section. They have been discussed and developed as part of the strategy process to a point where there is widespread agreement on the criteria. They are formulated at a rather high-level where many details are left open. Some of these details will be worked out during the strategy period. However, it is important that the criteria do not become too rigid and narrowly defined, such that they would constrain the process of coming up with new and surprising areas.

Along with the criteria, various incentives are developed both for supporting a mature strategic area, as well as growing an emerging area that is on the path of developing towards meeting the criteria. A first version of such incentives is given in the section on incentives below. It is the intention of the proposed process to minimize the need for centralized planning and selection of the strategic areas. An ideal would be that the areas emerge from the engagement, initiative, incentives, and enthusiasm of faculty trying to develop areas that they consider challenging and important.

6.3 Strategic direction

This section defines a number of criteria for a strategic area. They encompass both education and research, because the areas will not be long-term sustainable unless they are strong in both dimensions. A strategic area may, however, start out as predominantly a research effort.

It is proposed (part of the board have reservations with respect to some of the criteria – see section in italics after the list) to use the following criteria for nominating strategic areas of strength:

1. Significant future value: the area must yield insight that is (or believed to become) very important for creating value[6] with IT in the future.
2. High international level: the researchers must be at a high international level judged by academic standards (peer recognition, papers, PhD candidates etc.).
3. Critical mass: the area must have (or be able to establish within a short time frame) a critical mass of researchers (mix of faculty, Postdoc's, PhD's, teaching a group of core courses, etc.). Furthermore, there must be a well-defined leadership taking the overall responsibility for developing the area and for the resources committed.
4. Large future funding potential: it must be possible to attract a large part of the funding needed for the research from external sources.
5. Mission critical for a Danish stakeholder: the area must be of key importance for at least one stakeholder with a large presence in Denmark (e.g. a large company, a group of related companies or a key part of the public sector).
6. Broad importance: the area must be of significant importance for more than one application area (the graduates find employment in several different sectors and the research is of interest in more than one domain).
7. Significant teaching: the area must be or develop into a significant part of a (or several) study program at the IT University.

One can envisage several strategic areas of strength to co-exist and develop in parallel. During the strategy period, a number of potential strategic areas will develop from their current position to meet all seven criteria. The next section outlines how this development may be supported.

The research board has discussed possible criteria that a strategic area should fulfill. The board is not in agreement about the importance of all the listed criteria. In particular, some board members

[6]Each strategic area will have, by virtue of wanting to retain diversity, its own value proposition. It will be incumbent upon them to provide the rationale for the kinds of value being created and how it is evaluated.

question item 4 (thinking that a requirement of large-scale external funding may needlessly limit otherwise strong projects), item 5 (thinking that the focus on the Danish context is too narrow), and item 7 (thinking that a strategic area could consist of a small group of permanent faculty together with externally funded PhDs and Postdoc's, as long as faculty are able to teach on the study lines of the IT University). One could, perhaps, think that this is unimportant, since it is arguably better for an area to satisfy more criteria. However, the group of board members who are concerned about this, believe that it is important because of the risk that this list of criteria will favor some areas over others, even though the group does not think that it will lead to more impact (i.e., favoring an area that scores well on the whole list of criteria in preference to an area that scores extremely well on some criteria).

6.4 Incentives for developing strategic areas

During the strategy period, the IT University will develop a small number of areas to become strategic areas. No a priori selection of areas is made. Currently, there is teaching and research meeting some of the criteria. Faculty members are encouraged to form teams within particular areas aiming at meeting all criteria. Significant resources will be made available to support and accelerate this development in the form of incentives. Any team of faculty may decide to collaborate on developing an area they believe has the potential to become a strategic area. They are eligible for part of the resources reserved in the budgets for developing strategic areas. Initially these teams must make an assessment of how they meet each of the seven criteria and make a plan for how to develop into meeting all seven. While a number of potential projects may be formed at the start, ultimately the development of 1-3 areas is the target for the strategy period from 2012- to 2016.

The detailed procedure for supporting areas under development is not part of this strategy document. It is envisioned that there will be attempts to develop strategic areas of strength that only manage to meet some of the criteria; this may be exactly right for that area. Management will decide on the amount of resources available for developing strategic areas in the yearly budgets.

This is a sketch of the process:

2011:	Establish criteria part of strategy document
	Incentive structure (first version)
2012-2016	Support initiatives that meet (some) of the criteria
	Development of supported initiatives
	Recognize initiatives that meet criteria

Below are two very preliminary lists of incentives to illustrate and exemplify, they need to be developed as the organization gets more experience with developing the strategic areas of research.

> *Examples of incentives for an area in the development phase where it only meets some of the criteria*: resources will be provided to develop and reach those criteria the area has yet to meet, support for developing leadership, additional personnel

including PhD students, post-docs, or faculty (as relevant), priority for support from funding team, resources for network building (internal and external), including conference travel, visitor funding, workshops, etc. and resources to build infrastructure (demo's, analyses, PR, etc.).

Examples of incentives for an area meeting all six criteria: self-governance of task allocation (teaching and research), space, part of the overhead, professorship in a topic of relevance for the area, participation in the Research Board and support for external visibility (PR/communication support).

It is important to stress that a significant part of education and research will continue to be in areas that are neither potential nor full-blown strategic areas. The main difference will be that a significant amount of resources will be made available for developing the strategic areas.

6.5 Possible indicators

The ultimate indication is, of course, whether the IT University has succeeded to establish several strategic areas by 2016. However, in addition to this final indicator some milestones are proposed to judge whether sufficient progress is made.

- by 2016 the IT University will have at least two strategic areas meeting all seven criteria.

To judge whether sufficient progress is made the following milestones are used:

- during 2012 at least two teams of researchers have established areas meeting some of the criteria and there are plans and resources for developing additional criteria
- by 2014 there is a least one area meeting five of the seven criteria and there are plans and resources for meeting all seven criteria by 2016
- at the start of every year there are resources and plans for developing at least two areas (new or continuing)

7. Relationship to Education

A key principle at the IT University is a tight coupling between research and education. The institution aims for a consistent relationship between the two in the sense that both the academic level and contents of its educations are tied to the IT University's areas of active research. A continued commitment to research-based education is necessary to maintain an academically and financially healthy environment. We additionally recognize the natural inclination (and indeed need) top faculty and top students will have to work with one another. There are thus two areas we identify for special attention in this document: initiatives for top BA & MA students and the growth of the PhD program.

7.1 Strategic objectives

7.1.1 Alignment between research and education

Ideally, the IT University offers well-aligned educations progressing from undergraduate to research level. A strategic objective is thus to better align some of the IT University's masters programs in areas where the IT University has a strong research. While this in principle would allow the institution to be self-sufficient within its areas of excellence, the IT University maintains a strong commitment to mobility and globalisation. Therefore, it encourages external applicants to all programs. These principles are aligned with the tradition that the IT University researchers are expected to participate in the educational programs and are discouraged from for using external funds to achieve significant reductions in teaching obligations.

7.1.2 Elite education

The IT University supports the development of advanced tracks on the bachelors and masters programs to further align education with the research level. This is expected to have a stimulating effect both on the level and contents of related undergraduate programs, improve the recruitment situation for research education, and provide a rich and vibrant environment at the IT University with a clear commitment to academic excellence.

7.1.3 PhD education

PhD education is a key element of the research at the IT University. Our graduates are an important contribution to the value created by the IT University, as well as an important indicator of the reputation of the university. Furthermore, during their PhD studies, students contribute significantly to the research of the university.

The IT University will increase its palette of PhD programs, including a 3+5 model in which candidates are selected after a bachelor's program to complete a 5-year PhD program. Such a program would strongly increase the academic level of related master's educations, and help bridging the gap between the IT University's undergraduate educations and the level of current research.

A large part of the IT University's PhD students are funded through external grants and tied to specific projects. In fact, it is likely that the composition of the financial resources available will change in the coming years with a reduction in unconstrained funding and an increase in external funding. The IT University reserves funds for fully funded applicants. A third funding model, for industrial PhDs, is the Danish "*erhvervs-ph.d.-ordning*" which allows PhDs to be developed in close collaboration with an industrial partner or project.

Despite the various funding models it is important that all PhD students are treated according to the same high academic standards and receive the same support. The PhD School is responsible for the recruitment of excellent candidates and relies on faculty to be invested in that task. Grant applicants and research administration are responsible for making well-motivated choices about using PhD students as project personnel.

7.1.5 Institutional commitment to PhD education

The IT University is aware of a joint responsibility for PhD education beyond individual supervisor obligations. This includes involvement in and administrative support for a solid offering of PhD courses, research seminars, reading groups, etc., that offer both breadth and depth. IT University

researchers are expected to be actively involved in administrative services, such as in the PhD School board and various committees, such as faculty assessment of potential candidates, hiring, evaluation, and graduation.

7.2 Possible indicators

- by 2016, a "3+5 model" for PhD education is in place
- by 2014, the incentive structure for graduate education is clarified
- there are two active PhD students per tenured faculty member
- a catalogue of PhD courses is advertised also to students in the greater Copenhagen area
- well-aligned courses on early graduate or master's level in strong research. An elite track or even a separate program allows the IT University students to qualify for graduate education.

8. Summary

The goal of the research strategy for the IT University is to provide a guide that helps shape the everyday working life of the organization, and the decisions it takes along the way, during the years 2012-2016. Ideally the research strategy will serve to foster individual faculty growth, research collaborations, and overall organizational development. The key part of the strategy is section 3 which describes the six overall goals for research in the years 2012 – 2016.

The first goal is that the IT University should *increase the reputation* of the people and their research at the IT University (move up the reputation spiral).

The second goal is to *increase externally funded research and research collaboration*. An increase of external funding will allow the IT University to do more research and hence increase its visibility and impact.

In line with the mission the third goal is contribute through research in *making Denmark exceptionally good at creating value with IT*.

The fourth goal is to identify and further develop *a small number of strategic areas* where education and research at the IT University are particularly visible.

The first four goals can only be achieved by having strong faculty and staff at the IT University. Therefore, the fifth goal is to *stimulate growth and development* of all faculty while encouraging a culture of collaboration and innovation.

The sixth goal is in *developing research focus and capacity within our educational programs* at the Bachelors, Masters, and PhD level.

While pursuing these six goals for research the IT University will continue to strengthen the relation between its education and research. In addition to the traditional relation between the two found at all universities worldwide, in Denmark there is an additional financial and regulatory interdependence between the two.