Development Contract for the IT University of Copenhagen, 2004-2006 DRAFT*

IT University of Copenhagen

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Contents

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1 Introduction

This document forms the basis for a new Development Contract between the ITU and the Ministry of Science, Technology and Innovation (MVTU).

The document is also a first step towards defining a strategy for the ITU for the coming years. However, it is only a first step which can be used for strategic discussions in the Board, the management and among the employees at ITU.

In Section 2 we describe the background to this document, namely the results of the external evaluation and the fulfillment of goals set in the previous Development Contract. We also re-iterate the twelve point vision of the ITU and assess where the ITU is relative to the vision.

In Section 3 we perform a SWOT-analysis of the ITU, based on the points made in Section 2.

In Section 4 we describe the strategic focus areas for the contract period, based on the analysis in Section 3. In Section 5 we present result goals which define the success criteria for the strategic focus areas. The result goals are stratified into two layers. The "Base elements" describe goals which the ITU intends to achieve given the funding currently projected. The "Add-on elements" describe extra goals which the ITU is prepared to commit to, *provided* that the specified additional funding can be obtained.

2 Background and Status

In this section we summarise the state of the ITU, drawing upon three sources: (a) The external evaluation which the Ministry of Science, Technology and Innovation commissioned in 2002; (b) A comparison of the goals of the Development Contract for the years 2001-2003 with the achievements during the same period; and (c) A discussion of the visions of the ITU and of the degree to which we have made progress towards the visions.

2.1 External Evaluation

The Ministry of Science, Technology and Innovation (MVTU) commissioned an external evaluation of the IT University in 2002. The evaluation was conducted during summer 2002 and the evaluation report [1] was published in November 2002.

We quote from the summary of the report [1, pp. 7-8]:

> "**The IT University of Copenhagen (IT-C)**
> The panel finds that IT-C has substantially met the expectations and objectives set three years ago. In particular, the key objective of increasing the number of graduates with IT qualifications has been achieved, and the current enrolment promises that this will continue. The one area in which expectations have not been fully met is in the area of Diploma programmes.

Taking advantage of being a new institution, the IT-C management has succeeded with creating an innovative management system and culture, which appears to be achieving a high degree of motivation and commitment among the students and employees. The management system represents an innovative development in the context of higher education and research institutions in Denmark. In particular, the panel commends IT-C for creating a system of metrics and quality feedback which are used to drive continuing progress."

[...]

"IT-C has built up a strong research environment. At present, the activity level of teaching is relatively higher than the level of research. The panel finds this acceptable in the view of IT-C's limited time of existence. But at a longer term, in order to ensure the continuous high quality of the educational activities, the activity balance between teaching and research should be at a comparable level with other Danish universities, and the IT-C should continuously aim at a leading international research position in line with the Government's national strategy for IT research.

IT-C has succeeded with building up a dynamic collaboration with industry and a sound level of research collaboration with other universities in Denmark. However, as regards educational collaboration with other universities, this appears to need to be further developed.

The panel believes strongly that increasing the level of visibility and publicity of IT-C's success can further enhance the value of IT-C to society. The visibility of IT-C may, among others, be strengthened by ensuring its Danish name reflects that IT-C graduates Masters of Science and Masters."

The evaluation panel also pointed out that the then governance structure of the IT-C, with four university representatives and five outside members, had been a good way to start up the IT-C but held a built-in potential for conflict of interest which might in the long term become an obstacle to IT-C's future development.

The issue concerning the governance structure of the IT-C and the issue concerning the Danish name ("IT-højskolen") were resolved with the introduction of the new University Bill, which took effect on July 1, 2003. The bill changed the Danish name of the IT-C to "IT-Universitetet i København" (the IT University of Copenhagen, abbreviated ITU) and gave it status as an independent university, the 12th university in Denmark.

The new University Bill has thus addressed two of the key points made by the external evaluation panel. The ITU accepts the points made by the evaluation panel concerning Diploma programmes; the balance between teaching and research; and increasing the visibility and publicity of IT-C's success. These points are reflected in

the plans for the coming contract period, see Sections 4 and 5.

The evaluation panel further made the following assessment of the professional and organisational strengths and weaknesses of IT-C [1, pp. 31-32]:

> "The panel appreciates IT-C's elaboration of SWOT analyses, both on the level of IT-C as a whole and on the level of each individual department. The SWOT analyses contribute to IT-C's continuous development of its strategy and plans for improvements. Actual metrics for measuring progress seem to have been defined and implemented to some extent.
>
> Among the more significant strengths, weaknesses, opportunities, and threats for IT-C, the panel sees the following:
>
> Strengths: A very successful start-up, delivering to the expectations of the ministry; innovative culture and management system; openness to graduates from a variety of fields; offers diverse and rich study programmes, anchored in a strong research environment.
>
> Weaknesses: No major ones at present (see threats).
>
> Opportunities: Institutionalise the innovative systems in place; expand visibility and collaboration [in] educational activities; create a better balance between research and educational activities; create international exchange programmes; increase regional co-operation.
>
> Threats: Management is thin and heavily loaded; tough competition with industry and universities on hiring qualified staff; high teaching load; too few Ph.D. students; the structure of IT-C's research funding."

The issue of the "thin and heavily loaded" management is expanded on page 25 in the report:

> "IT-C is on a steep growth curve and has reached a stage where further scaling up and development of the faculties constitute a major challenge for the management. The innovative culture needs to be institutionalised. The ongoing work on the value delivered to society, and the values by which the institution lives, will help in this institutionalisation process. We believe that it is key that the human resources functions should be strengthened, and that additional resources should be allocated to the central management. In the view of the panel, the current level of success is highly dependent on a small number cadre of people, in particular the managing director. This dependence constitutes a risk which must be both recognized and managed."

The ITU accepts the points made by the external evaluation panel. This development

contract specifies how the MVTU and ITU intend to collaborate on addressing those points.

2.2   Achievement of Goals set in Previous Development Contract

The Development Contract for 2001-2003 [2] specified a (fairly detailed) list of measurable goals. A status report which indicates, for each goal, the degree to which the goal has been achieved, is found in [3]. The status report describes most of the goals as fully achieved. In particular, the number of *cand. it.* graduates, which is currently 400[1] is, we believe, a great success.

The main short-comings are:

Number of STÅ and "årselever"   The growth in STÅ[2] and "årselever" has been rapid: 121 STÅ and "årselever" from 2001 to 2002 and 78 STÅ and "årselever" from 2002 to 2003, reaching 627 STÅ and "årselever" in 2003. The goal set in 2001 for 2003 was even higher, however, namely 792 STÅ and "årselever". See Appendix A for further details.

Number of Ph.D. students   The growth in scientific staff at assistant professor and associate professor level has been almost exactly as planned in 2001, which we consider a great success. The growth in Ph.D. students has been significant, but falls short of the 2001 plans by 5 full-time employees (FTE). For details about the development in the number of scientific staff, see Appendix B.

Goals in administrative departments   Whereas all the research departments have formulated goals and use them systematically in the running of the departments, the same is not true of all administrative departments.

Evaluation of project supervision   The ITU has a comprehensive, net-based course evaluation system which is used with great success. However, evaluation of projects and theses have not yet been systematically introduced uniformly across the university.

Systematic feedback from employers on the curriculum   The ITU has a teaching advisory board ("aftagerpanel") which comments on the curriculum. Also, the ITU has conducted two separate surveys of employers' requests for qualifications and employers' view on the qualifications of ITU graduates they have employed. However, the ITU needs to conduct these surveys in a more structured manner and the feedback from the surveys to the curriculum development process could be improved.

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[1] Numbers current at Dec. 31, 2003

[2] A STÅ ("studenterårsværk", Eng.: "student year equivalent") is a unit of documented student progress: 1 STÅ corresponds to the number of credits which a full-time student is supposed to earn during 1 year of study.

Completion times The median completion time for the 2-year *cand. it.* programme has gradually risen and currently stands at 29 months (Dec. 2003). The ITU is concerned that the median should not rise further and has taken unusual steps to avoid a further increase. (One such unusual step has been the Vice Chancellor writing personally to each individual student about his or her progress.)

LinuxLab The "LinuxLab" opened in 2001. LinuxLab was made possible through a donation of equipment by IBM. The ITU staffs LinuxLab with one full-time employee. LinuxLab has helped promote the use of Linux in courses at the ITU and LinuxLab has obtained some visibility outside the ITU. However, in other ways, LinuxLab has not progressed as intended in 2001.

2.3   Visions and Current State

The IT University has formulated its vision in twelve statements. These *vision statements* describe an ideal that the IT University is striving for. Below, we discuss each vision statement and how far ITU has progressed towards it. The statements are grouped into three groups corresponding to the headlines of the major strategic areas where we propose to focus the development in the coming contract period.

2.3.1   Research - Excellence and Impact

Vision 1: The IT University is counted among one of the leading forces within the development of IT.

Vision 3: The IT University conducts research which creates value for society.

ITU is not content with being a popular, well-reputed teaching university; ITU wants its researchers to be among those who define what the field of IT is. In order to do that, the IT University must make research contributions at the highest international level. Furthermore, ITU must be an enabler for a regional development, primarily through teaching, entrepreneurship and co-operation with private companies and public institutions in Denmark and the Øresund region.

The IT University has formulated a research strategy with three research themes to stimulate interaction and collaboration both with external partners and within the university. The research themes are: *computer games*; *context-dependent mobile communication*; and *software production*. Computer games is a new academic discipline; in fact the first academic conference on Computer Games in the world was held at the ITU in 2001. The group has already established itself internationally as pivotal in the development of Computer Games as an academic discipline.

In the area of mobile computing and computation the IT University has been instrumental in forming a partnership with other institutions located in Ørestad together

with a number of private companies. The vision is to make Ørestad a large living research laboratory for context-dependent mobile communication.

The value of the research to society comes in different forms. A strong research environment is a prerequisite for sustaining high standards in teaching. ITU researchers teach not for their own sake, but for the sake of the students and for the sake of society. Within these boundaries, the researchers conscientiously make sure that the relevant knowledge from the research communities is made available to the students.

Some of the research seeks to create new technology and see it put into use through start-up companies or licensing. So far, one successful spin-off has been created and one patent has been filed (based on ITU research). The ITU has created a strongly innovative culture among its students and staff; in 2003, the ITU became the first of Denmark's twelve universities to receive the MVTU "Annual Entrepreneur University" price. The price was awarded based on a survey among Danish university students. A next step would be to create teaching, training and mentoring activities for these entrepreneurial students to maximize the number of viable businesses resulting from these efforts.

A strategic partnership with a major IT company would be a strong indication that the ITU creates value for society. Such a contract should benefit both the company and the IT University. It could be based on research, teaching, staff development or a combination of these. It could, for example, ensure a steady supply of candidates (M.Sc. and/or Ph.D.) within a particular area of IT or a long-term research cooperation.

A methodological difficulty with the vision of being counted as one of the leading forces within the development of IT is the absence of easy-to-employ measures of the degree to which one as a university creates value for society (the point being that obtaining a reputation as a leading force in the development of IT is closely linked to being good at creating value for society). We emphasize that value need not only be economical value, although it certainly is an important aspect.

The absence of such a measure does not mean that we refrain from making a concerted effort to produce value for society, however. We propose four strategic focus areas which we trust will increase the value of ITU to society:

- Improve research collaboration and external communication of research.

- Strengthen appreciation of the qualifications of ITU graduates in the Danish IT labour market.

- Increase the share of ITU graduates among employed IT graduates in IT jobs in Denmark.

- Contribute to making Ørestad a world-leading competence center for media, culture and communication technology.

Those four strategic focus areas are explained further in Section 4.

The ITU research strategy defines two important concepts: *competence groups* and *research themes* (for further description of those, see [4]). The strategy outlines a plan

for how the competence groups (there are twelve of them) can grow to attain some modest level of critical mass, while at the same time using three research themes as vehicles of stimulating interaction and collaboration between researchers.

External funding has been obtained for projects in all three themes, and they have, with varying levels of success, already served as useful vehicles of collaboration. During the coming contract period, we wish to achieve solid critical mass in competence groups and strengthen the research themes, not least with Ph.D. students and post-docs.

> **Vision 2: The IT University conducts research at the highest international level, measured by the standards of the international peer communities.**

The goal of contributing to research at the highest international level is traditionally measured in terms of publications, citations and peer recognition. Although these measures are not infallible, deviating from these standards is not an option for a new academic institution as ITU which has to earn the respect of the international research community. The ITU is now well represented at the best conferences and journals within its established areas of research. It has been the goal that the ratio between the number of refereed research publications and the number of full-time faculty must be at least one per year. In both 2001 and 2002 this ratio averaged more than 1.5. We believe that the quality of the publications is what really matters and would therefore like to revise this goal to encourage a steady stream of contributions in the most prestigious and influential journals, conferences and books. A revised goal should also reflect that *all* researchers must publish; a respectable average is not sufficient.

> **Vision 6: The Ph.D. programme at the IT University results in a marked increase in the volume of first-rate IT research in Denmark.**

The ITU has started building a substantial Ph.D. programme (see Appendix B). We are still in the process of filling the pipeline, but expect to reach a production around 10 Ph.D.s per year from 2004. In the fall of 2003, an internal evaluation of the Ph.D. education was done; among many others steps all students were asked to complete a questionnaire. It revealed a need for better mentoring of the Ph.D. students' communication efforts (including their teaching), focus on completion times and internationalisation of our Ph.D. programme. The evaluation resulted in a number of initiatives in the ITU research strategy for 2004.

We would like to give very high priority to research education and are, therefore, concerned that during the period 1999 to 2003, our emphasis on teaching at the masters level has resulted in using less resources than planned on Ph.D. funding.

There are many indicators showing a growing demand for Ph.D.s in Denmark, e.g.

- The report [5] states a need for an additional 1500 Ph.D.s in IT before year 2010.

- Currently, 0.32 % of the IT workforce holds a Ph.D. In the biomedical area this number is 2.5 %.
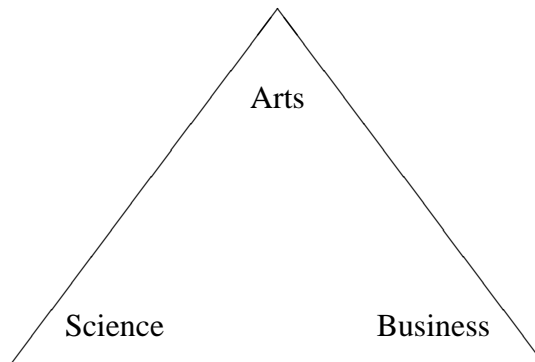
Figure 1: The ITU triangle.

- In IT more than 20 % of the M.Sc. candidates should continue as Ph.D. students. This number is more than 30 % in the medical area and more than 25 % in the technical sciences, according to a report from the MVTU ministry [5].

Such numbers are by nature rather inaccurate, but they indicate that an additional 2-300 IT Ph.D.s should be produced per year in Denmark. Currently, the total IT Ph.D. production in Denmark is 30-40 per year.

2.3.2 Teaching - Quality and Impact

The triangle shown in Figure 1 underlies the view of IT at the IT University. The field of IT is made up of science, business and arts. Our graduates have some knowledge in all three areas and in-depth knowledge in at least one. The courses offered cover the entire triangle.

> **Vision 4: The IT University provides research-based graduate IT programmes which attract and excite excellent bachelors from within the ITU triangle (see Figure 1).**

The educational programmes do give a good coverage of the ITU triangle, and they do attract and excite excellent bachelors from all corners of the triangle. This statement is based on the strength of some of the applications and the scores which students give to the courses, teachers and to the ITU in general in the course evaluation system.

After starting its educational programmes, the ITU has created four strong research departments. An opportunity for the coming period is therefore to increase the ties between teaching and research. Furthermore, the ITU educational programme has not undergone any major changes since it was made in 1999. The time has come to reconsider the programmes based on investigations of the IT labour market and recent developments in the IT field.

	1999	**2000**	**2001**	**2002**	**2003**
Candidate	73 %	58 %	61 %	67 %	44 %
Master	70 %	60 %	62 %	77 %	74 %
Diploma	-	80 %	69 %	55 %	73 %

Table 1: The ratio between applications and offers of admissions

Grads. 2000-05-04 to	*cand. it.*	**SWU**	**INT**	**DKM**	**MMT**	**EBUSS**	**TIT**
2003-12-31	400	115	24	109	19	95	38
2003-06-30	327	92	16	95	15	79	30
2002-12-31	193	53	11	54	5	58	12
2002-06-30	113	36	4	39	5	25	4
2001-12-31	48	15	-	17	-	14	2
2001-06-30	26	8	-	16	-	2	-
2000-12-31	1	1	-	-	-	-	-
2000-06-30	1	1	-	-	-	-	-

Table 2: Production of *cand. it.* graduates (accumulated numbers for different programmes and total)

In its first years of existence, the ITU had almost exclusively Danish applicants. More recently, the ITU has received a substantial number of applications from foreign students, especially from India and Pakistan. The number of applicants, the ratio between admissions and applications and the distribution between Danish and foreign applicants vary greatly between the different programmes. Internationalisation is an important way for the ITU to create a world-leading center for IT education and IT research. However, internationalisation poses a number of tough challenges which the ITU is only now beginning to learn to tackle.

The ITU would like to see increased numbers of applicants from other European countries.

While the ITU does admit many excellent students, there is a need for obtaining a higher degree of precision in the admission procedures, given that the ITU admits graduate students from more than 100 bachelor degrees. Table 1 shows the ratio between the number of students applying and obtaining admission for years 1999-2003.

> **Vision 5: There is a large number of graduates from the IT University and their qualifications are highly attractive to employers.**

The number of *cand. it.* graduates is very satisfactory, see Table 2. This is not the case for the number of graduates from the Diploma and Master programmes.

The ITU strives to give its students knowledge and professional computer skills which will make them valuable assets for their future employers. However, it is equally

	E99	F00	E00	F01	E01	F02	E02	F03	E03
No. of courses	20	43	65	66	79	85	90	86	80
No. of O.U. courses	-	-	-	3	9	13	20	18	15

Table 3: Number of courses offered 1999-2003

important that employers hold the degrees of the ITU in high esteem and that the graduates they employ live up to the expectations of the employers. We have obtained preliminary and positive feedback on this from both graduates and their employers. During the coming contract period, we will try to establish more systematic measurements. We believe that a good indicator of the employers appreciation of the ITU education is the market share of our candidates, see also Section 4.3. Currently, 1.3 % of the people employed in an IT job having an IT education have an ITU degree.

> **Vision 7: The IT University offers life-long learning programmes emphasising practically oriented, yet durable, knowledge at Diploma and Master levels.**

The ITU has established four Master programmes and a Diploma programme for part-time students. Special resources have been devoted to the area of Open University. After an initial, very slow start, the Open University gained momentum as more courses were offered outside normal working hours and via the internet.

The Open University activities are now of a substantial size, namely around 100 "årselever" a year. However, the production seems to have stabilised at that level.

Life-long education is particularly important in IT for at least two reasons. Firstly, although IT is a knowledge-intensive area, only 14 % of the people employed in an IT job have a graduate level education. This is very low compared both to other countries and sectors. In one of the highly successful Danish IT companies, this number is 69 %! Secondly, the IT field itself develops constantly so all graduates can expect that they need to educate themselves further throughout their professional career. Hence, there is a considerable unexploited potential for developing the Open University further.

2.3.3 High Standards of University Governance

> **Vision 8: The IT University uses the best professional practices within all of its activities, including research, teaching, administration and management.**

Using the best professional practices within teaching and research is necessary in order to achieve high academic standards. To ensure that the entire organisation is highly productive, ITU must identify and use the best professional practices within management and administration as well. This includes means for attracting and keeping excellent students and staff.

At the ITU, everybody with personnel responsibility is either hired to manage or appointed by people who are hired to manage. Everybody with personnel responsibility takes management courses and is regularly assessed by his immediate superior, his peers and his staff.

In 2003, the ITU initiated systematic, organisation-wide evaluations of itself from a Human Resource management point of view. In October 2003, we conducted the first "work satisfaction survey" among all employees and a 360-degree evaluation of all managers. The results have been thoroughly analysed and form the basis for further development of both the ITU organisation and the individual managers. Among the findings are that we need to strengthen the internal communication and that we need to focus more on every individual, realizing their full potential.

The initial years of the ITU were characterized by highly successful, but somewhat disorganised, start-up enthusiasm. In this process the governance structure with a board and an appointed director was quite effective. It has, for example, been possible to attract very good staff to build up both the administrative and academic departments. However, the increasing size, new status as an independent university and relocation to a new building bring new challenges to the organization and top management. Challenges that cannot be met by enthusiasm alone. During the coming years, the ITU must develop a mature organization, strengthen top management, increase its focus on attracting and developing human resources, and at the same time increase productivity.

All departments are supposed to define goals and metrics; the research departments have done so, but some of the administrative departments have not. As a consequence, there are detailed models and procedures in place for measuring the performance of faculty, but there are no similar models or procedures for measuring the performance in the administration. This is not a tenable situation, so part of the development contract is to develop measurable goals of performance for administrative work processes and use them for improving efficiency.

Vision 9: The IT University always strives towards the best possible balance between quality and cost.

A very important mechanism is the use of output-focused measures of productivity in teaching where each faculty member can see his own contribution to the earnings of the university.

During the last couple of years, the ITU has developed a process of budget negotiations for achieving a good balance between quality and cost. Every department has to make a budget proposal and negotiate the budget with the management. The results in terms of wishes granted and denied are made known to all departments at the end of the process. This open process helps to create a joint responsibility for using resources effectively.

The research strategy attempts to deliver the best results possible with the funding available. Similarly, all faculty members are encouraged to contribute to teaching productivity.

As mentioned previously, a task for the coming contract period will be to develop and use such output-oriented measures of productivity in the administration as well.

> **Vision 10: The IT University formulates its visions in a dialogue with its constituents and chooses whichever organisation best matches the visions.**

The visions of the ITU have been formed over a period of several years of close interaction with our constituents in a number of different fora. The Board is composed to further dialogue between the university and its constituents. In addition, the ITU has two advisory boards: an advisory board on teaching and a Foresight Panel, which gives advice on research. The ITU has already gone through one major reorganisation and is in the middle of a second one, involving primarily the management and the administration, to be completed in 2004. A reorganisation of the research departments is scheduled for 2005.

A theme for the upcoming contract period is to keep alive the ability to change the organisation according to what is required to move towards the vision and to make sure that those changes are successful.

> **Vision 11: Everybody who works or studies at the ITU is highly qualified, highly competent and is dedicated to pursuing the goals and visions of the organisation.**

This vision stresses the importance of staff and student development. During the coming contract period, we want to increase our focus on the classical recruitment and development aspects of Human Resource management. We want to do this not just for staff, but also for students, following the ITU motto: "students are regarded as employees".

An essential prerequisite for organisation-wide backing of goals of visions is internal communication. While there is generally a good sense of common direction, the measurement of work satisfaction has revealed that there is room for improvement, in particular with respect to internal communication. During the coming contract period, the ITU intends to strengthen its internal communication in general and its internal communication about goals and visions in particular.

> **Vision 12: The IT University is both internally and externally regarded as forthcoming and courteous. Both students and external observers regard the IT University as a professional and efficient organisation.**

During the past nearly two years, the ITU has undertaken a culture study in order to formulate core values of the organisation. This has resulted in three cultural core values: forthcoming, direction-finding and accountable. These are published on the ITU web-site together with an explanatory document.

The core values are gradually finding their way into the daily decision making and reasoning within the ITU. However, we still have some way to go to integrate them into everyday conduct and in evaluating to what extent this happens.

3   Analysis

Based on the observations in Section 2, we sum up the strengths, weaknesses, opportunities and threats in the sections below. This analysis forms the basis of the goals for the next contract period, which are formulated in Section 4.

3.1   Strengths

- Strong board and commitment to management development.

- Openness to graduates from a variety of fields.

- Diverse and rich study programmes, which are liked by the students.

- Large number of good applicants for the *cand. it.* programmes.

- Large number of *cand. it.* students and *cand. it.* graduates.

- Respectable completion times and employment rates.

- Productive research environment.

- An organisation which measures itself and changes according to the results.

- Innovative culture.

3.2   Weaknesses

- Lacks strategic collaborations with large industrial partners.

- Open University is small in volume seen in proportion to its potential.

- Little collaboration on teaching with universities outside Denmark.

- Too little focus on internal and external communication.

- Lacks mechanisms for continuous self-improvement of efficiency in the administration.

- Not a part of a benchmarking community.

- Lacks measure of value delivered to society.

- Some of the competence groups are below critical mass.

- Some of the educational programmes are small.

- ITU is not a well-established brand.

- Teaching programmes have not been revised recently.

3.3 Opportunities

- Realize full potential of staff.

- Forge revenue-generating, strategic collaborations with large industrial partners.

- Exploit the innovative culture to ensure that a large number of viable start-up companies are created.

- The new building in Ørestad, including use of the fifth floor for IT innovation and entrepreneurial activities.

- Institutionalize culture of university-wide self-assessment and self-improvement.

- Exploit full potential of the research strategy.

- Strengthen international exchange programmes with non-Danish universities.

- Increase Ph.D. production.

- Become a preferred place to study for the very best international students.

- Increase regional collaboration on research and teaching.

- Contribute to the creation of an exciting, new district in Ørestad.

- Become the de-facto preferred supplier in Denmark of university-level life-long education within IT.

- Improve admission process.

- Strengthen ties between teaching and research.

3.4 Threats

- Top management is thin and heavily loaded.

- Lacking visibility.

- Bottlenecks in the organization.

- The structure and level of ITU's research funding, which makes it difficult to increase the number of research staff further and so poses a danger to the further growth of high-level research and teaching at the ITU.

- Tough competition with industry and universities on hiring qualified staff.

- Decreasing employment rates.

- Increasing completion times.

- Loosing contact with alumni.

- To grow out of the new building in Ørestad before 2008.

4   Strategic Focus Areas

In this section, we present the overall strategic focus areas for the IT University in the period of the coming development contract, based on the analysis in Section 3.

The goals are listed in Figure 2. Let us consider them one by one.

4.1   Growth

In 2004, ITU will move into its new building in Ørestad. This new building represents a very significant public investment in IT research and IT education. However, the ITU building in Ørestad is also part of a larger national strategy of creating a strong competence center for media, culture and communication technology in Ørestad. The ITU is committed to and excited about this strategy, cf. G1. Therefore, we propose a number of result goals which are intended to support the overall Ørestad project.

As for the ITU itself, ITU must increase its output of candidates, Ph.D.s and collaboration with external partners. For this to happen, the ITU itself must grow, while maintaining high standards, cf. G2.

4.2   Research - Excellence and Impact

The analysis showed that ITU must increase its production of Ph.D.s significantly to meet the rapidly growing demand for IT Ph.D.s from society, cf. R1. This must be

Growth	
G1	Contribute to making Ørestad a world-leading competence center for media, culture and communication technology.
G2	Grow in size, without lowering standards.

Research - Excellence and Impact	
R1	Increase Ph.D. production.
R2	Nourish quality in research.
R3	Improve research collaboration and external communication of research.

Teaching - Quality and Impact	
T1	Maintain high quality in teaching and strengthen ties between teaching and research.
T2	Strengthen appreciation of the qualifications of ITU graduates in the Danish IT labour market.
T3	Increase the share of ITU graduates among employed IT graduates in IT jobs in Denmark.

High Standards in University Governance	
O1	Develop human resources.
O2	Increase robustness in ITU top management.
O3	Improve productivity, without lowering standards.

Figure 2: Strategic Focus Areas

done without compromising the quality of the research at ITU in general or of the Ph.D. candidates.

Increasing the Ph.D. production is an important way — although not the only way — of nourishing quality in research, which is a strategic focus area in its own right, cf. R2. Nourishing research also involves developing the research themes and competence groups in accordance with the ITU research strategy and furthering that every researcher makes the strongest possible research contribution.

To improve the visibility and value to society of ITU, we must improve the research collaboration with external partners and also improve external communication of research, cf. R3.

4.3   Teaching - Quality and Impact

Ensuring high quality in teaching will remain a high priority for ITU, cf. T1. At the same time, we must ensure that the ITU candidates are appreciated and their qualifications fit the Danish IT labour market, cf. T2. This entails improving communication to employers about the qualifications of ITU graduates. But it also entails deepening our understanding of the relationship between what programmes we do (or could) offer and what best serves the labour market and adjusting our programmes accordingly.

ITU wants to increase the share of ITU graduates among employed IT graduates in IT jobs in Denmark, cf. T3. This focus area is chosen because a large share of ITU graduates among employed IT graduates in IT jobs in Denmark is, we believe, a good indicator of the value of IT graduates to the Danish society. It is also an indicator which is more robust to short-term fluctuations in the market than, for example, employment rates of ITU graduates.

Finally, the reason we are interested in the share of ITU graduates among employed IT graduates in IT jobs in Denmark, rather than simply the share of ITU graduates among IT employees in Denmark, is that we do not want fluctuations in employment of IT employees who do not hold a degree in IT to impact our measure of success. Nor are those ITU graduates who end up in non-IT jobs a key measure of success.

4.4   High Standards of University Governance

It is important to develop to its fullest potential the human resources at ITU, cf. O1. Also, we must ensure robustness in the top management of the ITU, cf. O2. Finally, ITU must also improve its productivity and do so without compromising quality or wearing out the staff, cf. O3. We believe that it is possible to produce more as well as better research and teaching with less effort by improving the ITU organisation.

5 Result Goals

In this section we state so-called result goals derived from the strategic focus areas (Section 4). A result goal is a goal which has the property that one can decide whether it is reached or not. It may or may not be numerical, but it must be decidable.

The plans and measurable goals have been divided in two parts; the first part, called the *base elements*, the ITU commit to with funding at the current level. The second, called *add-on elements*, will be possible only if the ITU obtains additional funding.

5.1 Ørestad - Base Elements

The ITU is committed to and excited about the prospect of turning Ørestad North into a world-leading center for media, culture and communication technology. Indeed, ITU is one of the founding members of the association "Crossroads Copenhagen", which is a partnership of private companies and public institutions who all share this vision.

> **Result Goal 1: Together with its future neighbours in Ørestad, ITU contributes to a list of public events (e.g., exhibitions, talks, conferences) in Ørestad, on topics ranging from advanced research in media, culture and communication technology to practical demonstrations of what life in the Network Society will be like.**

The fifth floor in ITU's building in Ørestad is not at this stage allocated to the ITU, although ITU has an option to rent it. That floor represents an opportunity for strengthening the way ITU supports its exceptionally innovative students and their creation of new businesses. We return to this opportunity as an add-on element in Section 5.5.

5.2 Research - Base Elements

One way to measure research quality is how much external funding that can be obtained in competition with other universities. In 2003 the goal of the IT University was that 10 % of the budget came from external sources.

> **Result Goal 2: To increase external funding by 1 percentage-point per year, reaching 13 % by 2006. The share of the external funding which comes from private companies grows to 25 %.**

A large part of the external funding is intended for Ph.D. scholarships.

> **Result Goal 3: The number of Ph.D. students is at least 40, of which at least 40 % are externally funded.**

The current level of externally funded Ph.D.s is 15 (37 %).

> **Result Goal 4: At the end of the contract period, an external evaluation of ITU research, which will include an assessment of every researcher at the ITU, finds that at least three research activities at ITU are world-class and that every researcher is productive within his or her area.**

The ITU research strategy aims at increasing collaboration between researchers at the ITU, in order to maximize productivity and avoid fragmentation of efforts. The strategy also emphasises collaboration with other universities and with private companies who can benefit from the results of research.

The results from formulating a small number of research themes are beginning to show, but there is still a large unexploited potential.

> **Result Goal 5: The goals and motivation for strategic research themes and all research projects are continuously communicated to the general public and within the organisation.**

5.3   Teaching - Base Elements

A number of steps are planned to increase teaching productivity, without compromising quality. We want to develop the existing course evaluation to cover all teaching activities and we want to maintain the average scores at the current levels:

> **Result Goal 6: The average score of the course, project and thesis evaluation on the question "Overall conclusion, this is a study activity I am happy with" must be at least 4.75 (on a scale from 1 to 6). Moreover, the ITU must twice a year account for what changes it has made as a consequence of evaluation results.**

All courses at ITU must contribute to giving students an understanding of the relationship between research and state of the art in IT.

> **Result Goal 7: Every course given at the ITU must include at least one research publication in the assessed part of its curriculum.**

This goal applies also to introductory courses. The research paper may be a seminal paper central to the area covered by the course. The impact of the research paper on the field is more important than its age. Recognising that the goal is not very refined, the ITU hopes to find more refined goals during the contract period.

The ITU believes that a modest increase in volume of Open University can be achieved by making contents already taught at ITU more readily available to part-time students.

Result Goal 8: Increase the yearly number of "årselever" in the Open University programme from 100 to 130.

We plan to make a strategic assessment of curriculum and study programmes based on a better understanding of the IT labour market and of the demand for education among potential students.

Result Goal 9: Reconsider the study programmes based on investigations of the IT labour market and change them accordingly.

We want to combine this with improved communication to the general public about the successes of the ITU educational programmes and to increase collaboration between students and future employers (through student projects, case-studies, internships etc.).

Result Goal 10: Increase the share of ITU graduates among employed IT graduates with an IT job in Denmark from 1.3 % to 4 %.

This corresponds to graduating around 275 students in 2006, compared to 220 in 2003.

5.4   Organisation - Base Elements

When working at ITU, one must develop both individually and as part of the organisation. ITU must strengthen its culture of self-assessment and change in response to the results, when necessary. In addition to the indicators given in the sections on research and education, it is necessary to have indicators that measure improvements in administrative work processes.

Result Goal 11: Productivity goals are set up, measured and achieved for key administrative work processes.

Measures and measuring processes should not be set up indiscriminately. One good reason for setting up measures is that one wants to measure how well some administrative work process supports our key "business areas", teaching and research. Another good reason for setting up measures is that one wants to improve the efficiency of some administrative work process which is necessary, although it does not directly contribute to teaching or research (e.g., payment of bills).

Result Goal 12: M.Sc. students graduate in less than 30 months (median).

Since 2001, when the first graduates completed their degrees in 22 months, the median completion time has increased gradually to reach 29 at the end of 2003. Thus the goal is to bring this increase in the completion times to a halt.

Result Goal 13: The cost of producing one STÅ is at most 50.000 DKK.

The initial success of the candidate production must be maintained, but with improved productivity.

Result Goal 14: The ITU conducts systematic surveys internally and externally to assess to what extent we live up to our cultural core values and makes a concerted effort to live up to the core values.

ITU must create a management structure which makes top management more robust and more strategically oriented.

Result Goal 15: The top management of ITU is strengthened.

5.5   Add-on Elements

This section describes initiatives that the ITU would like to undertake, provided additional funding can be procured. We do not go into details about the costs or who should pay, but clearly have multiple sources in mind, including private and public research funding as well as income from teaching. Permanent faculty both teach and do research, therefore, there is a coupling between the different elements. For example, additional faculty for advising Ph.D.s also teach and thereby enable some of the add-on teaching activities.

> **Result Goal 16: The ITU uses the fifth floor of its building for a school of entrepreneurship, for housing start-up companies started by ITU staff and students, for housing Crossroads Copenhagen and for other external collaboration ("samspilsaktiviteter").**

The ITU wants to live up to the special responsibility that comes with ITU having received the "Annual Entrepreneur University" award, by creating a "school of entrepreneurship" for its exceptionally innovative students. The ITU school of entrepreneurship will teach students what they need to know in order to turn ideas into viable businesses. We envisage drawing on expertise from the ITU itself, who has an entire research department, the Department of Innovation, which is specifically concerned with innovative technologies and their use in commercial businesses. However, we also want to draw on expertise from other universities, research parks and from business people in the region, for example Copenhagen Business School and University of Copenhagen. The school of entrepreneurship will reside on the fifth floor in the Ørestad building, which will also house start-up companies.

In addition, ITU wishes to offer Crossroads Copenhagen office space on the fifth floor. In that way, the whole floor would be reserved for activities which are concerned with collaboration with other neighbours in Ørestad and with external collaboration ("samspilsaktiviteter") more generally.

> **Result Goal 17: The ITU enters into at least one large, strategic, mutually committing, partnership with a private company. By "large" we mean that the company commits to at least 5 Mkr. a year for the duration of the agreement.**

The nature of such partnerships can vary greatly, from partnerships motivated purely by teaching, e.g., as part of a life-long education effort, to pure research co-operations. To be an attractive partner for strategic partnerships, ITU must be able to commit resources to the collaboration, e.g., by matching the funding obtained from external partners by funding from public sources.

One of the goals in the base model is to maintain the Ph.D. production at the current level. However, the ITU is interested in meeting the increased demand discussed in the analysis.

> **Result Goal 18: To increase the number of Ph.D. students to 100 in 2006.**

This is a significant increase which requires an increase in the number of faculty for supervising the many new students. We propose that some of the Ph.D.s be funded purely by an increase in the basic research funding of the ITU, while other Ph.D.s be funded through private funding. In both cases, however, an increase in the basic

Strategic Focus Area	Label	Result Goal
Contribute to making Ørestad a world-leading competence center for media, culture and communication technology.	G1	1 and 16
Grow in size, without lowering standards.	G2	2, 8, 10, 15, 17, 18, 19 and 20
Increase Ph.D. production.	R1	17 and 18
Nourish quality in research.	R2	2, 4, 5, 14, 17 and 18
Improve research collaboration and external communication of research.	R3	2, 5, 15, 17 and 18
Maintain high quality in teaching and strengthen ties between teaching and research.	T1	5, 6, 7, 9, 14 and 15
Strengthen appreciation of the qualifications of ITU graduates in the Danish IT labour market.	T2	5, 9, 10, 12, 15 and 19
Increase the share of ITU graduates among employed IT graduates in IT jobs in Denmark.	T3	5, 9, 10, 18, 19 and 20
Develop human resources.	O1	4, 5, 11, 12 and 14
Increase robustness in ITU top management.	O2	15
Improve productivity, without lowering standards.	O3	8, 11, 13 and 15

Table 4: Relationship between strategic focus areas and measurable goals

research funding of the ITU is required in order to fund the research of the additional faculty required for the supervision of the Ph.D. students.

A growth of the research staff automatically enables ITU to do more teaching. We plan to split the additional resources between a strengthening of the Open University programme and an increase in the number of full-time students.

> **Result Goal 19: Increase the number of "årselever" in the Open University programme from 130 to 200.**

We propose to do this incrementally reaching 200 in 2006.

> **Result Goal 20: Increase the yearly STÅ production from 530 to 650.**

As explained in the analysis, the study programmes at ITU have not undergone any major revisions since the start of ITU in 1999. A new study programme would allow ITU to offer students a new programme based on recent developments in the IT field. This could possibly be based on the well-established entrepreneurial culture of our students to create a forum of learning around innovation, giving all students access to essential knowledge about what it takes to create a successful business.

5.6   Summary

Table 4 shows the relationship between the 20 measurable result goals and the strategic focus areas presented in Section 4. Note that for every strategic focus area there is at least one associated result goal.

6   Finansing the Development of the IT University

This section gives estimates of the costs for realising the add-on elements outlined above. The underlying principle is that the base elements of the plan can be done within the existing budget. Even at this level, it is possible to take a number of significant steps, e.g. adjusting study programmes, strengthening of the organisation, and increasing the cooperation with external partners. This can be achieved by increasing the productivity of all parts of the ITU organisation. The report [6] allowed for rapid growth in the funding of the ITU during the period 1999 to 2003. The budgets for the coming years show a slightly decreasing level for the public funding of the ITU, see Table 5. As a consequence, the hiring of researchers has been brought to near a standstill.

However, the IT University would like to participate in developing Danish IT by taking on some or all of the challenges set up as add-on elements in the plans outlined in Section 5:

- cooperation in Ørestad and entrepreneurial activities,

- increased Ph.D. production (up to 100 Ph.D. students),

- strategic partnership with private IT companies,

- strengthening of life-long education (additional 70 "årselever"), and

- increase the STÅ production (new study programme).

Each of these are major tasks that require a strengthening (growth) of the ITU in the coming contract period and a dialog with external partners both to set precise targets and to ensure the necessary funding.

We see the financing of the growth as a mixture coming from several sources, both public and private. For example, a strategic partnership means a mutually committing collaboration where the private company commits to at least 5 Mkr. a year for the duration of the agreement. Similarly, the teaching elements will generate additional income from the STÅ production. However, none of the five elements can be realized with the existing staff, which is already committed to sustain the current (rather high) production of research, candidates and Ph.D.s (as explained in the analysis in Section 3). Hence, it is not realistic to produce more Ph.D.s (or any of the other add-on elements) without additional faculty.

	2004	**2005**	**2006**
Teaching (STÅ production etc.)	41.6	41.8	42.9
Research	54.9	53.7	51.1
Other funding (public)	18.2	13.8	13.3
Total (Mkr.)	114.7	109.3	107.3

Table 5: Current plans for ITU public funding (based on "Forslag til Finanslov for 2004")

The add-on elements are not independent, for example, additional faculty to guide Ph.D. students automatically makes it possible to increase the teaching. This coupling makes it difficult to estimate the total costs of the add-on elements individually. Furthermore, the total costs are covered by several sources including external funding (both private and public), teaching (STÅ production) and additional research funding. The additional research costs are needed to cover the research part of new faculty positions (typically half of their salary). Table 6 shows estimates of the additional research funding needed to realize the different add-on elements.

The costs given in table 6 are based on these assumptions:

- The overall goal is to have 100 Ph.D. students by 2006, by reaching 60 in 2004 and 80 in 2005. The growth is divided evenly between Ph.D.s associated with the ITU research strategy and Ph.D.s where the scholarship is paid by external funds such as industrial Ph.D.s and research grants. For the latter only the costs for additional faculty to advise the Ph.D.s are included. For the Ph.D.s associated with the research strategy both the costs of the scholarships and the advisors are given in the table.

- Increased cooperation with partners in Ørestad (rent) and elsewhere in the region, and forming an entrepreneurial environment requires additional space in

	2004	**2005**	**2006**
Ph.D. production (research strategy)	7.3	14.6	22
Ph.D. production (external scholarships)	2.2	4.4	6.6
Increased cooperation in Ørestad	4.5	9.0	9.0
School of entrepreneurship	2.2	2.2	2.2
Strategic partnership	5.0	5.0	5.0
Strengthening life-long education	0.9	1.5	2.2
New study programme	2.3	3.3	4.4

Table 6: Additional public funding to cover research costs for add-on elements (in Mkr.), all numbers are increments on the 2003-level.

the ITU building (rent of the fifth floor).

- Establishing a school of entrepreneurship is estimated to additional 5 faculty members.

- Matching funding to give external partners added value from a collaboration.

- It is estimated that an additional 10 faculty members are needed to sustain a new study programme. The costs in the table are the research parts of a gradual increase towards 10 new faculty.

- It is estimated that an additional 5 faculty members are needed to sustain the increased number of "årselever". The costs in the table are the research parts of a gradual increase towards 5 new faculty.

6.1 Summary

It is important to stress that the research is an indispensable and integral part of what an university can offer whether it is education, collaboration, innovation or involvement. There are a number of mechanisms for funding activities based on short-term measurements of output; the ITU STÅ model for teaching is a good example. However, the long-term sustainability of a university is dependent on research funding. In this section, we have estimated a number of investments that will enable ITU to participate in solving a number of critical tasks, such as increasing the Danish production of IT Ph.D.s.

A Number of STÅ and "årselever"

The following table shows the number of STÅ and Open University "årselever" for the period 2001 to 2003. The "Target" numbers in the table are quoted from [7, Appendix K], which formed the basis of the 2001 Development Contract with the Ministry [2]. Both the target numbers and the actual numbers include EBUSS and TIT.

	2001		2002		2003	
	Target	Actual	Target	Actual	Target	Actual
STÅ, *cand. it.*	379	368	537	455	651	526
Open University, "årselever"	58	60	103	94	141	101
Total	437	428	640	549	792	627

There is a growth in the actual sum of STÅ and "årselever" from 2001 to 2002 of $549 - 428 = 121$ and a growth of $627 - 549 = 78$ from 2002 to 2003, both very significant increases. However, the target increases were even higher.

The discrepancy between target STÅ and actual STÅ for the *cand. it.* programme is primarily due to students' decreasing rate of progress through the programme in all

six study programmes. The number of applicants is not a problem, apart from EBUSS and TIT, who have not had the planned intake of students.

Concerning Open University, the discrepancy between the target and actual number of "årselver" is due to a combination of slow rate of progress through the programmes and a slower-than-expected increase in the number of applicants. In fact, it appears that the number of årselever has come to a stand-still between 2002 and 2003 (compare 94 "årselever" in 2002 with 101 "årselever" in 2003).

B   Number of Staff

The 2001 Development contract contained the following goals [2, Sec. 3.3]:

> Full-time employees with teaching obligations, including resources required of the teaching and research staff for management and administration:

	2001	**2002**	**2003**
Associate and Full Professors	14	19	23
Assistant professors	4	7	9
Amanuenses	3	4	6
Ph.D. students	16	30	44
Total (FTE)	37	60	82

In the table below, we compare the numbers from the 2001 Development Contract (Target), with the actual numbers (although for 2003, the "actual numbers" are of course projections).

	2001		2002		2003	
	Target	Actual	Target	Actual	Target	Proj.
Assoc. and Full Prof. (FTE)	14	13	19	18	23	20
Assistant Prof. (FTE)	4	6	7	8	9	12
Amanuenses (FTE)	3	2	4	1	6	1
Ph.D students (FTE)	16	15	30	28	44	39
Total	37	36	60	65	82	72

On the whole, the development of staff has corresponded to the targets set in 2001. Notice, however, the number of Ph.D. students which is going to be (around) 5 FTE below target in 2003. It was necessary to not admit qualified applicants, due to limitations in the ITU research funding.

Concerning part-time employees with teaching obligations, the 2001 Development Contract set the following targets (head-count):

	2001	**2002**	**2003**
External lecturers	12	21	27
Instructors	19	30	39
Part-time employees in total	31	51	66

We can convert this head-count to full-time equivalents (FTE) using the following assumptions from the STÅ-model:

- Instructors are paid for 360 hours of work a year, respectively.

- External lecturers are paid for 450 hours of work a year.

- There are $226 * 7 = 1582$ working hours a year.

After the conversion of the target numbers to FTE, we get the following comparison between target and actual numbers:

	2001		2002		2003	
	Target	Actual	Target	Actual	Target	Budget
External Lecturers (FTE)	3	9	6	21	8	7*
Instructors (FTE)	4	10	7	9	9	9*
Part-time teachers in total (FTE)	7	19	13	30	17	16*

*: The budget for 2003 will be exceeded.

The conclusion is that we have employed significantly more part-time teaching staff than anticipated in 2001, and attempts to reduce numbers in 2003 will not succeed completely.

If we partition the number of actual employees (FTE) categorised in the manner prescribed by the Danish State, we get:

	1999	2000	2001	2002	2003
VIP (FTE)	7	24	33	40	52
Ph.D. (FTE)	2	11	20	30	39
Admin (FTE)	8	27	50	56	63
Total	17	68	103	126	153

where VIP consists of full professors, associate professors, assistant professors and post docs. and Admin covers administration, external lecturers and teaching assistants.

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