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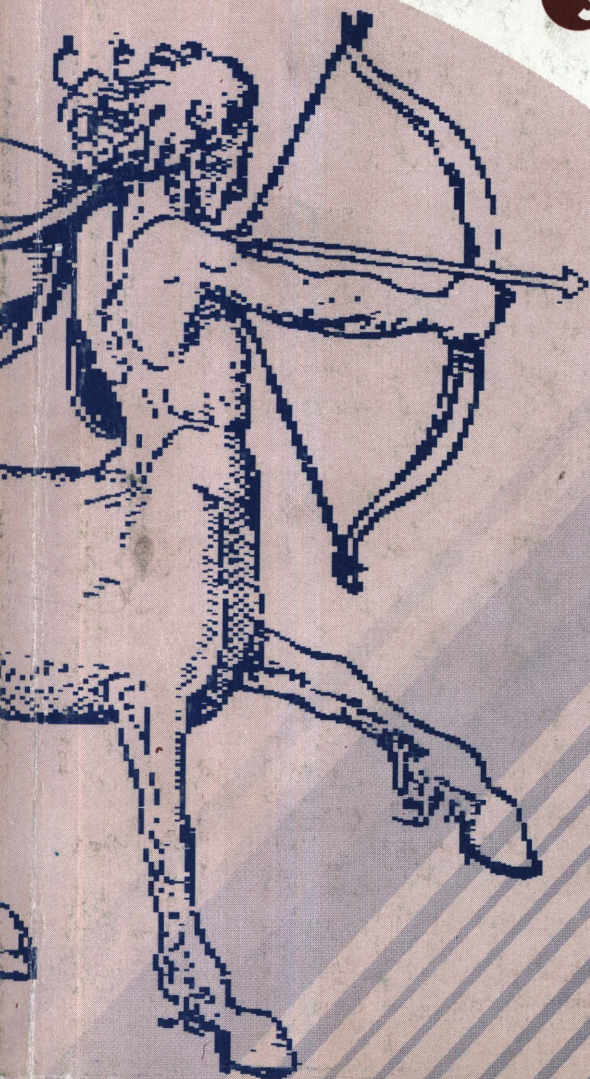
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25 & **26** MAY 1995

3 DISCIPLINES

- COMPUTER SCIENCE
- SOFTWARE ENGINEERING
- INFORMATION SYSTEMS

A. L. STEENKAMP (RED.)



Papers delivered at the
SAICSIT • 95
Research & Development Symposium

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- ◆ *South African Institute for Computer Scientists and Information Technologists* and endorsed by the
- ◆ *Computer Society of South Africa* and the
- ◆ *University of South Africa*

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PREFACE

On the occasion of the first symposium of the *South African Institute for Computer Scientists and Information Technologists* I wish to welcome everyone to this forum for the exchange of ideas and results on research and development in the disciplines of Computer Science, Software Engineering and Information Systems. The growing demand for information and computer systems of ever-increasing size, scope and complexity has emphasized the need for approaches which acknowledge the interrelationships between the various technology strands in the field of information technology. The three disciplines of this symposium reflect the broader interests of the membership of our restructured institute. It has been a pleasure to participate in the organisation of this event that has attracted such a number of fine contributions. I wish to acknowledge and thank all the members of the organising and programme committees who contributed their efforts to make the symposium the success that we aimed for. A special word of thanks to *Persetel* and *Siemens* for providing financial support, to the *University of South Africa* for making its services and venues available, and to the administration of the *Computer Society of South Africa* for their assistance. We are also indebted to the *Department of Computer Science and Information Systems* of *UNISA* who made the resources and infrastructure of the *Centre for Software Engineering* available to organise the symposium. Special mention is due to our efficient secretary El-marié Botha who devoted so much effort to the administration of the symposium and preparation of the proceedings.

Prof A L Steenkamp
President: SAICSIT

WELCOMING MESSAGE

It is a pleasure to welcome the participants of the first symposium of the *South African Institute for Computer Scientists and Information Technologists* at the University of South Africa.

Recent developments in computers and information technology have opened new and exciting possibilities for mankind. These developments have irrevocably turned *concepts* which we thought that we understand into *problems*, for instance:

- the concept *Wealth of Nations* does not depend anymore on visible products produced in visible factories, but on the invisible flow of information and services along invisible lines of communication which are managed by virtually invisible machines, using invisible software;
- the concept of the *mega-organisation*, (like mega states, mega-churches, mega-universities, mega-businesses) with its central control and mega-burocracy, is being replaced by the concept of *small-is-also-powerful* - "organisations" run by individuals all around the globe linked up in virtual structures and are eliminating the powers of states, councils and boards; and
- some of our concepts about *education and training* of two millenia, are suddenly being replaced by new ones depending upon telematics and information technology, which leaves the traditional educationalist in a state of bewilderment and indecision.

These are important problem areas to be studied - and UNISA has an interest in the solutions to all of them - especially in the problem area of education-over-a-distance, since we are moving towards the implementation of the new technologies to serve our students better.

I am pleased to see that some of the speakers of the symposium are addressing these and other areas of interest, and I express the hope that your deliberations will contribute to their solution.

Prof C J H Schutte
Chief Executive Director:
Science, Technology & Informatics, UNISA

OPENING MESSAGE

Information Technology and the undergirding *computer sciences* will have a profound impact on the reconstruction and development of South Africa. This is however not simply a national or regional concern. In order to become a competitive economy the deployment of a national information technology infrastructure and the effective and judicious use of these resources will be critical.

Trained human resources will be required. There is, more importantly, a need to develop an understanding of how information technology can redress and overcome the educational and development deficits which result from our past.

Research in this critical field cannot therefore take place in a vacuum without being informed of our context. I have initiated a process to develop a *Science and Technology White Paper* which will, among other things, address information technology and its impact on the endeavours of science and technology and, more pervasively, on the competitiveness and development needs of the nation.

The *SAICSIT* will I hope, with other specialist institutes and role players, contribute to the direction setting envisaged in the *White Paper* and develop a rich texture of responses that will enhance our national information technology endeavours. I wish you well for this important symposium.

Dr B Ngubane
Minister of Arts, Culture, Science and Technology

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SYMPOSIUM PROCEEDINGS

Copies of the proceedings will be handed out at the symposium. Delegates who attend the symposium will receive a copy of the proceedings free of charge. Additional copies will be sold at R100.00 each. An order form for the symposium proceedings is in the folder handed to you at registration.

Tabular Notations

PROF JEFFERY ZUCKER

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Abstract: Tabular notations were developed by D L Parnas and his co-workers for the formal documentation, inspection and validation of large software systems. Such notations provide a formalism which combines mathematical precision with ease of use. This formalism has, on the one hand, important practical applications in software engineering. On the other hand, investigation of it leads to interesting problems in theoretical computer science.

RESEARCH IN INFORMATION TECHNOLOGY AT SOUTH AFRICAN TECHNIKONS

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Abstract: Traditionally, Technikon training was focused on career-oriented education and training. This has changed over the last few years and research has started to play a major role in Technikon education. This additional objective caught many technikons unprepared and research expertise, infrastructure and a research climate is lacking in many cases. To enable all Technikons to conduct effective research, these shortcomings need to be addressed quickly and effectively.

Keywords: Technikon research, Information technology

1. Introduction

The mission of Technikons, and earlier the Colleges for Advanced Technical Education (CATE), has always been to provide career-oriented education and training to industry. Technikons have done this with a great deal of success over the past years. Recently the task of research has also been given to Technikons, especially now that degrees, up to doctoral level, may be issued at technikons. Some of the disciplines at Technikons do not lend themselves to research and will thus not issue M and D degrees, but most do. The possibility of issuing M and D degrees has put the spotlight solidly on research at technikons.

2. Applied Research

The first question that comes to mind is, what is the difference between Technikon research and University research? According to the Department of National Education, universities should do basic research and technikons applied research. This differentiation does not apply anymore, or has never really applied, because the funds that can be generated through basic research might not always compare favourably with funds generated doing applied research. Applied research, done with industry, can generate lots of money and all educational institutions need funds to survive nowadays and will have to generate money doing research with industry.

Further, research funding institutions, like the FRD, have changed their research priorities recently. The new policy document of the FRD, called 'Facing the Challenge' has indicated clearly that every research project funded by the FRD must include some element of basic research, research involving industry and research involving the community. Thus, the basic / applied difference between University and Technikon research does not hold anymore.

3. Computer Education at Technikons

The Information Technology departments of South African technikons operate mostly in the Information Systems and Software Engineering subdisciplines. Until recently, the National Diploma in Information Technology was the only pure computer-oriented course offered at Technikon. This course leans heavily towards the Business disciplines. If a comparison can be made, this course is closer to the B.Comm Information Systems degree found at many universities than a B.Sc Computer Science degree. Recently, another computer course was established, i.e. the National Diploma in Computer Systems. This qualification involves more technical and low level computer education as well as some electronics and is perhaps closer to the Computer Science degree at Universities. Both these diplomas lead to a B.Tech degree following a fourth year of study.

All Information Technology and Computer Systems departments have strong links with industry. Many Technikons make use of cooperative education where students spend up to a year in industry to ensure that the theory taught at the Technikon is put into practice.

4. The Research climate at Technikons Today

No emphasis was placed on research traditionally as it was not part of the Technikon mission. For this reason, very few departments have gained the experience and developed the expertise to do effective research.

Another drawback for Technikon research is the heavy contact hours for lecturers at Technikons, up to 25 hours per week is nothing extraordinary. Most research at this point in time is done by the lecturers themselves to improve their qualifications and most of this is done at Universities. Very little coordinated research was therefore conducted at Technikons until recently.

Very few large research projects with a number of smaller research projects where students are also involved are currently undertaken at IT departments. Only two Technikons have ever issued a Masters diploma, i.e. Cape Technikon - 2 and P.E. Technikon - 5. So, according to statistics, very little research has been done by senior students at Technikons.

Cape Technikon, P.E. Technikon and M.L. Sultan Technikon have enrolled M Tech students for 1995 and even D Tech students might be enrolled by some technikons in the near future. No department may enrol students for a M or D Tech degree if there is no expertise in the department and if they have not been given the right by SERTEC. Even though some expertise must be present in the department, external help is still needed in most cases. I do not think any D Tech can be enrolled without an external co-promoter at any Technikon at this stage. The FRD even forces us to name either an external promoter or external consultant for every M.Tech student that applies for a FRD study grant. The bulk of this experienced external help resides within the University community. Technikons will thus have to work together with Universities, at least for the next few years to come. Amongst all of the Information Technology lecturers at South African Technikons, only two have a FRD rating as researchers. This will obviously also restrict research funding from the FRD from 1996.

5. Research at Technikons

Joint research projects should be encouraged, for the reasons mentioned above, but certainly also for many other reasons. The FRD promotes joint projects between Technikons and Universities and funding will thus be a motivation. RAU and P.E. Technikon have a very successful joint project running under the Communications Program of the FRD. A number of international papers have flowed from this joint project. Both institutions have therefore gained from this agreement and some much needed research experience has been gained by P.E. Technikon personnel. Much of the theoretical work done at RAU has been implemented at P.E. Technikon. Similar agreements also exist between other Technikons and Universities.

Hopefully, the FRD Technikon Program will carry on for another few years to help Technikon researchers

improve their research qualifications and get the much needed experience in conducting effective research. Further, many technikon departments will seek some form of collaboration with university departments which can be beneficial for both departments.

6. Conclusion

In summary, we at the Technikons are new in the research game and need help to better our qualifications and to get the required experience. Technikons have been involved with industry for many years and this experience many definitely come in handy seeing that Industry has become one of the focus points of research today. The Universities can also gain through their involvement with Technikons. Towards the end of the year the FRD will call for proposals for research projects in their new Open as well as Directed categories. This is the ideal chance for Universities and Technikons to join forces on the research battle ground.

