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## Guest Contribution

# A Pragmatic Approach to Development Information to Provide Service on a Wide Scale

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## 1 Introduction

The rapid technological growth in our time has produced an explosion of information. This, in turn, has spawned information systems based on the use of computers and automated systems. These mechanised devices with their seemingly infinite capacity to store and retrieve knowledge on command have myriad applications. But the use of computer and automated information devices pose serious problems to individuals, groups and societies on an international scale in disseminating the available information. This is even more true in information flow between regions with high information capabilities than in those that have little or none. The information flow between these regions has been varied and frequently haphazard whenever it has existed.

In this context the philosophy for development information speaks to interdependence and humanitarian concern in information flow to various regions of the earth. Information must be perceived as a universal entity. The initial failure of one region and the ability of another to acquire information should not dictate a permanent global demarcation into 'developed and less developed' categories.

## 2 Objectives

The objective of development information is for it to function as an interlinking mechanism between a complex industry of information resources and the users of information. In addition, development information should be a catalytic agent that aims at providing objective clarification in information needs between regions with high information capabilities and those with little.

## 3 Mission

The mission is to strive for a move in all regional, national and international agencies and organisations concerned with information to give full co-operation and assistance in setting criteria and standards, formulating policy, and assessing the information needs of a given region of the world. Development information is capable of realistically assessing information related to socio-economic development in the light of the unique requirements of world regions in need of information and information technology.

## 4 The Dynamics of Information Processing

The proliferation of information technology production has resulted in the growth and development of an ever expanding information packaging industry. This area has become so large in size and scope that it is necessary to discuss some of the important developments that are taking place in the area.

The newest phrases now being used in information packaging range from electronic archives, compact discs (CDs), computer tapes, microfiche, teletexts, video discs, magnetic tapes and interactive imaging systems (optical systems) to word processing and the use of laser technology. Developing countries will not escape this new wave of information packaging. It soon will be bombarded with vendors of these products, to a point where some adaptation will be inevitable.

Assuring the quality of technical processes and the accuracy of packaging information is becoming an increasingly difficult task. Rapid increases in the volume of information, the sophistication of information uses, and the complexity of material flows and processes are characteristic of most modern technical environments. As complexity increases, the risk of introducing significant errors into material processes increases. The very complexity of such systems makes the detection of error itself a complex task. With increasing frequency, public and private organisations are seeking help from corporations with experience in quality control and information validation to ensure that technical process and information packaging meet performance and accuracy standards. The problems association with quality control and validation can be minimised by following these guidelines:

- Establishing ways of aiding in planning, organisation and control of software purchasing and development

through
  - creating a directory of software suppliers
  - evaluating the quality of software supplied
  - keeping abreast of the state-of-the-art in software production
- Providing leadership in the innovative use of software materials and the utilisation of extensive market research on software before making a major purchase
- Establishing cost-efficient ways of packaging and designing your own software by learning how to design and evaluate software for your own use

Preparation for these new technologies for packaging information ought to be made in institutions of higher learning. Perhaps it would be timely to introduce some of these concepts in technical institutes in order that future demands imposed by the new information technology may be met.

The successful growth of developing countries information technology will ultimately depend upon the commitment of substantial resources, especially financial resources. The successful application of this information technology will require more than the mere receiving and storing of it. In addition to the tasks of acquiring and organising informational materials, channels must be established to analyse incoming information. Too much of the information technology that does get transferred out of the industrialised nations is never utilised because it is unsuited for the consumption of users in developing countries. A great deal more effort must be made to analyse, package and disseminate materials on existing and forthcoming information in all vital areas of work and study so that these technologies will be accessible to the developing countries' information-user communities.

## 5 The Need to Establish a Consortium

Information technology specialists need to establish a consortium of regional, national and international information networks and associations. The consortium could be an open structure inviting any institutions, organisations and agencies existing for the purpose of forming a network or documentation clearinghouse and of providing information technology not as an end-product but as a means for human change.

The element common to all membership is an interest in and dedication to providing useful and accurate information that can bring about humanistic change. Equally important is a commitment to the development of relevant information resources to meet the needs of regions with low information capacity.

The philosophical outlook of the consortium would therefore be to crystalise and emphasise broad knowledge, deep understanding, and imaginative efforts, including a dedication to great ideas in providing accurate solutions to the information needs of various regions on an international scale.

## 6 The Organisation of Services for Members

The ideas constituting a conceptual framework for a service-oriented consortium are as multitudinous as the Kalahari sands but in this instance the consortium could function to:

- support creative change within its membership
- facilitate and support new educational enterprises and programs addressed to meet the needs of previously disenfranchised persons
- develop and implement co-operative programs and projects among it members
- provide a meeting ground for a diversity of persons, institutions, and agencies with common values and purposes
- provide a forum for the exchange of ideas among its member associates
- encourage methods of solving social problems
- influence public policy to be consistent with its mission and purpose.

## 7 An Appraisal of Internet

While casual observers have the leisure to observe unobtrusively the growth and development in Internet to be a world-wide phenomenon in information sharing, they do so at no cost. On the other hand, information specialists have to judge and weigh the work of an ongoing Internet program and estimate its usefulness as a network or networks to their daily operations. Information specialists are, therefore, still more sceptical about the scope and magnitude of the Internet. They alone are facing challenges of adding another performance task of being evaluation researchers of Internet in order to provide objective clarification of incorporating Internet as an integral component of their information system. This can be a tedious undertaking because it entails not only knowing how to navigate the Internet network but also cognisance of the following key factors:

- how appropriate the Internet is to your information environments
- to what extent the databanks provided through Internet are relevant to the mission and objective of your environment
- what the relationship is between costs and benefits of having Internet at your disposal

All these factors need to be addressed to determine the effectiveness of Internet in any given information environment, be it in a government setting or in other work environments.

## 8 Training in Information Networks

A seminar for the network should be designed to launch the co-operative exchange of knowledge and experience with

information accessibility and utility of the participant's respective information holdings. To succeed in this effort, the organisers will marshal appropriate interdisciplinary experts and technical resources from within the regions involved. The content of the seminar will consist of information related to formalising and establishing a plan for information networking. It is important that information ministries achieve a high level of knowledge and sensitivity to the information needs of their individual country, region, and ultimately the world, in order to assess, prescribe, design, manage and evaluate the most appropriate uses of information technology for enhancing the advancement of their world countries.

Although the organisers will determine who will be invited to participate in this seminar, special effort will be made to ensure that representatives come from a diversity of backgrounds, and have some knowledge or experience relating to information systems. Additionally, consideration will be given to the level of information technology which is currently utilised by the representative's country.

The content of the seminar will be tailored to meet the specific needs and issues designated by the participants through a pre-seminar survey and needs assessment, which will be administered by the organisers.

## 9 Summary

The above aims at presenting some possible scenario and does not pretend to be exhaustive. The issues, however vital to development information, are given cursory treatment here. It remains important for the luminaries in this area to expand on some of the thoughts contained above.

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# The new IS'95 Curriculum

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## Abstract

*The recent acceptance of South Africa as a world player and the government's reconstruction and development programme (RDP) have created new challenges and opportunities for business and universities. The Information Systems (IS) environment continues to change rapidly and degree curricula must be carefully planned to cater for current and future business requirements. This article reports on the ongoing efforts of a major IS academic task force to model an undergraduate degree curriculum in information systems. Recommendations are made regarding the potential of adopting such a curriculum in South Africa to increase the synergy within and between IS departments and to allow orderly progress towards professional accreditation and increased professionalism in the IS industry.*
**Keywords:** *IS Education, Course Accreditation, IS Professionalism*
**Computing Review Categories:** *K.3.2*

## 1 Introduction

The Information Systems (IS) environment world-wide is experiencing continual and rapid change. According to Aggarwal et al [1], these changes are putting pressure on universities to revise their curricula to meet market demands. In South Africa, the Information Systems industry faces these pressures as well as the far-reaching implications of a totally new political, social and educational dispensation. Whilst industry continues to demand increasing numbers of IS graduates with relevant skills and knowledge, academics must also be sensitive to new government and professional initiatives and develop new curricula that match the needs of the various stakeholders.

A new IS curriculum has evolved from a task group representing the major American computer organisations of the ACM, AIS, DPMA and the IAIM [12]. These proposals identify a convergence of thinking towards a common IS curriculum providing considerable benefits. For example, it could increase the possibilities of staff exchange and assistance as well as act as an enabler towards professional examinations and course accreditation.

## 2 Background

Of the 21 universities in South Africa offering computer-related degrees, only 12 offer Information Systems programs. Of these, more than half (55%) have departments that combine Computer Science and IS, 18% are part of Departments of Accounting and 27% are separate IS departments in Faculties of Commerce [16]. In 1992, almost 12,000 students were enrolled in IS courses, although 42% of these were registered with the national, distance-learning university (UNISA). Petkov et al [16] identified only 1200 IS students enrolled at 3rd year undergraduate level and 208 at post-graduate level. To support the various IS programs offered, there are 35 academics some of whom also teach Computer Science subjects. The qualifications of these academics is poorer than their United States counterparts. For example, there are only 6 PhDs in this number. Overall qualifications of employees in the IS industry compare poorly with other countries. For example, Couger and Smith [8] found that almost 75% of IS professionals in South Africa do not have a tertiary qualification.

As a consequence of apartheid policies and poor teaching facilities, the education of the black population has been sadly neglected. The number of blacks in the IS industry is low. Smith & Moller [17] calculated that fewer than 100 black systems analysts were employed in 1985 in South Africa. Although some progress may have been made in recent years, the government's affirmative action initiatives are likely to reduce this disparity in an accelerated fashion in the short term.

IS academics in South Africa find themselves in a unique situation. Whilst efforts are currently being made by the Computer Society of South Africa to encourage professional examinations, IS departments at universities still have very diverse current and planned curricula. [19]

## 3 IS Curricula Research

Given the small number of IS departments, faculty and graduates, it is important that there is collaboration on curriculum issues in academia, business and government. This

**Table 1. Decomposition of the key knowledge areas**

| 1.0 INFORMATION TECHNOLOGY | 2.0 ORGANISATIONAL & MANAGEMENT CONCEPTS | 3.0 THEORY & DEVELOPMENT OF SYSTEMS |
|---|---|---|
| 1.1 Computer Architectures | 2.1 Organisation Theory | 3.1 Systems & Information Concepts |
| 1.2 Algorithms | 2.2 IS Management | 3.2 Approaches to Systems Development |
| 1.3 Programming Languages | 2.3 Decision Theory | 3.3 SD Concepts & Methodologies |
| 1.4 Operating systems | 2.4 Org Behaviour | 3.4 SD Tools and Techniques |
| 1.5 Telecommunications | 2.7 Managing the change Process | 3.5 Application Planning |
| 1.6 Database | 2.8 Legal and Ethical Issues | 3.6 Risk Management |
| 1.7 Artificial Intelligence | 2.9 Professionalism | 3.7 Project Management |
| | 2.10 Interpersonal Skills | 3.8 Information & Business Analysis |
| | | 3.9 IS Design |
| | | 3.10 Implementation and Testing |
| | | 3.11 Operation & Maintenance |
| | | 3.12 SD for Specific information systems |

has been sadly lacking. A local research project last year investigating IS curricula attempted to identify the skills needs of the IS industry in the near future and to map this onto the IS curricula offered at universities [19]. This research proposed a 4-year business degree with an IS major that could be suitable for adoption by new or established IS departments.

The ACM'82 IS curriculum has been extensively used [15] as has the slightly different DPMA'90 curriculum [11] In early 1994, these major associations agreed to form a task group of all interested parties to collaborate and recommend a new model curriculum. After considerable effort, a draft report was presented to key IS academic bodies for comment at the end of 1994. Newsletters and journals were identified as communication vehicles initially, followed by a strong presence on the World Wide Web under the ISWorld Home Page address.

The curriculum has been developed from a body of knowledge based on the key areas of Information Technology, Organisation & Management Concepts and the Theory & Development of Systems. These three areas were decomposed into detailed levels as shown in Table 1.

These areas were further decomposed into more detailed elements. For example, under 1.1 (Computer Architecture), there is 1.1.1 (Fundamental Data Representation) and under this there is 1.1.1.1 (Basic Machine Representation of Numerical Data).

Having defined the IS body-of-knowledge, a 5 level depth-of-knowledge strategy was used based on Bloom's work. [13] The levels include *Awareness* at the lowest level through *Literacy, Concept/Use, Detailed Understanding/ Application* through to *Skilled Use*. This strategy is used in curriculum design to develop students from entry level knowledge in junior courses through to high-level skills in the relevant areas in senior courses.

Each body of knowledge element was then mapped to the 5 depth-of-knowledge levels and a learning unit number allocated. For example, the element 1.1.1 (Fundamental Data Representation) has learning units allocated at different knowledge levels:

Level 1 3
Level 2 42
Level 3 43
Level 4 44

These learning unit numbers can be used for detailed curriculum design.

To map the body of knowledge into a suitable curriculum, five areas were defined including *Fundamentals of Information Systems, IS Theory and Practice, Information Technology, Systems development* and *IS Deployment and Management*. These were further detailed as follows:

P PREREQUISITES
- Matriculation
- Maths and English

A. FUNDAMENTALS OF INFORMATION SYSTEMS
- A.1 IS Literacy
- A.2 End-User Computing

B. IS THEORY AND PRACTICE
- B.1 Systems and Quality
- B.2 Decision Making
- B.3 IS Planning
- B.4 IT and Organisational Systems

C. INFORMATION TECHNOLOGY
- C.1 Computer Hardware
- C.2 System Software
- C.3 Telecommunications
- C.4 Programming
- C.5 Algorithmic Design

D. SYSTEMS DEVELOPMENT
- D.1 Software Development
- D.2 Database
- D.3 Systems Analysis and Design
- D.4 Teams and Interpersonal Relations
- D.5 Project Management

E. IS DEPLOYMENT AND MANAGEMENT
- E.1 Systems Integration
- E.2 Management of the IS Function
- E.3 Information Resource Management

These curriculum areas (A to E) were then mapped onto sample courses for a typical IS'95 curriculum as follows:

A. Fundamentals of IS

IS'95.P0 Knowledge Work Software Toolkit (prerequisite)
IS'95.1 Fundamentals of IS
IS'95.2 Personal Productivity with IS Technology

B. IS Theory and Practice
IS'95.3 IS Theory and Practice

C. Information Technology
IS'95.4 Telecommunications
IS'95.5 Programming, Data and Object Structures
IS'95.6 IT Hardware and Software

D. Systems Development
IS'95.7 Analysis and Logical Design
IS'95.8 Physical Design and Implementation with DBMS
IS'95.9 Physical Design and Implementation with programming environment

E. IS Deployment and Management
IS'95.10 Project Management and Practice

Based on this high-level curriculum, specific learning units derived from the body of knowledge can now be utilised to build specific courses for an IS department. For example, under the IS'95.10 - Project Management and Practice (which may be run as a 3rd year course), the model curriculum already specifies a scope, background and topics along with the specific learning units, learning unit goals, learning unit objectives and relevant body of knowledge.

The learning unit concept is defined as the component of the curriculum designed to impart knowledge to a willing learner. It can be combined with other units to form parts of the curriculum in any way suited to the designer. Each learning unit has a goal, objectives and body of knowledge elements plus a knowledge level of understanding. This comprehensive set of information provides the support to build a sample course for a degree. A typical example of a four-year degree is:

| | |
|---|---|
| **Year1** | |
| IS-P0 | Toolkit |
| IS1 | Fundamentals of IS |
| **Year2** | |
| IS2 | Personal Productivity |
| IS3 | IS Theory and Practice |
| IS4 | Telecommunications |
| **Year3** | |
| IS5 | Programming |
| IS6 | IT Hardware and Software |
| IS7 | Analysis and Design |
| IS8 | Prog. with DBMS |
| **Year4** | |
| IS8 | Physical Design & Implementation |
| IS10 | Project Management and Practice |

These 10 courses could make up, say, 25% of the degree. Other subjects to be covered in the degree could include communications subjects (speaking, writing and listening skills), problem solving subjects (statistics, OR, modelling) and business/organisation subjects (Accounting, Auditing, Management, Operations Mgt, Economics, Finance, Marketing and Law).

## 4 Relevance of Curriculum'95 to South Africa

Although the full details are not finalised, the comprehensive development of the curriculum provides IS academics with considerable information to develop IS course and overall degree structures. Given the fact that the current IS courses offered in this country are very different and that there are currently relatively few universities offering IS as a major degree subject, it seems sensible to try and get considerable "buy-in" from all existing departments in terms of building future IS courses and curricula. The benefits are clear. IS academics should find it easier to move between universities, locally and world- wide, and to establish new IS courses at universities not currently offering them. Academics will also be more productive during sabbaticals when teaching at other universities.

The benefit to the IS industry in South Africa are potentially high. Given that IS is becoming a recognised discipline, the IS industry is moving towards more professionalism. Providing similar degree courses would assist employers of IS graduates to understand what is offered and to move towards some quality standards and control using accreditation procedures already in place in countries like Australia.

## 5 Conclusions

The "new" South Africa has created considerable opportunities for business and academia. The universities are under pressure to maintain exit standards whilst trying to cater for increasing numbers of disadvantaged students. Organisations are now back in the global arena and are looking to technology to assist them. The South African business environment is likely to develop in a similar way to first-world countries. To handle this rapidly changing environment, universities need to produce graduates who have appropriate IS skills.

The IS curricula used by universities in South Africa vary considerably at the moment showing a clear lack of cohesion.

Plans for the IS'95 Curriculum, a joint venture by the ACM , the DPMA and other associations, are both comprehensive and versatile. The present status is a discussion document that will be finalised in late 1995. This document presents the *modus operandi* of the committee in progressing from an updated body of knowledge, through to a specific curriculum and to detailed teaching units.

Adoption of the principles of the document can provide major advantages to both IS academics and the broader IS profession in South Africa.

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  - author's initials and surname;
  - author's affiliation and address;
  - an abstract of less than 200 words;
  - an appropriate keyword list;
  - a list of relevant Computing Review Categories.
- Tables and figures should be numbered and titled.
- References should be listed at the end of the text in alphabetic order of the (first) author's surname, and should be cited in the text in square brackets [1–3]. References should take the form shown at the end of these notes.

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