



The South African Institute for Computer Scientists and  
Information Technologists

**ANNUAL RESEARCH AND DEVELOPMENT  
SYMPOSIUM**

23-24 NOVEMBER 1998

CAPE TOWN

Van Riebeeck hotel in Gordons Bay

Hosted by the University of Cape Town in association with the CSSA,  
Potchefstroom University for CHE and  
The University of Natal

**PROCEEDINGS**

**EDITED BY**  
D. PETKOV AND L. VENTER

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**LOCAL ORGANISING CHAIR: PROF. P. LICKER, UCT - IS**

**PROCEEDINGS**

**EDITED BY  
D. PETKOV AND L. VENTER**

**SYMPOSIUM THEME:**

**Development of a quality academic CS/IS infrastructure in South Africa**

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Proceedings of the 1998 Annual Research Conference of the South African Institute for Computer Scientists and Information Technologists.

Edited by Prof. D. Petkov and Prof. L. Venter

Van Reebeck Hotel, Gordons Bay, 23-24 November 1998

**ISBN: 1-86840-303-3**

**Keywords: Computer Science, Information Systems, Software Engineering.**

The views expressed in this book are those of the individual authors and not of the South African Institute for Computer Scientists and Information Technologists.

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## FOREWORD

The South African Institute for Computer Scientists and Information Technologists (SAICSIT) promotes the cooperation of academics and industry in the area of research and development in Computer Science, Information Systems and Technology and Software Engineering. The culmination of its activities throughout the year is the annual research symposium. This book is a collection of papers presented at the 1998 such event taking place on the 23<sup>rd</sup> and 24<sup>th</sup> of November in Gordons Bay, Cape Town. The Conference is hosted by the Department of Information Systems, University of Cape Town in cooperation with the Department of Computer Science, Potchefstroom University for CHE and and Department of Computer Science and Information Systems of the University of Natal, Pietermaritzburg.

There are a total of 46 papers. The speakers represent practitioners and academics from all the major Universities and Technikons in the country. The number of industry based authors has increased compared to previous years.

We would like to express our gratitude to the referees and the paper contributors for their hard work on the papers included in this volume. The Organising and Programme Committees would like to thank the keynote speaker, Prof M.C.Jackson, Dean, University of Lincolnshire and Humberside, United Kingdom, President of the International Federation for Systems Research as well as the Computer Society of South Africa and The University of Cape Town for the cooperation as well as the management and staff of the Potchefstroom University for CHE and the University of Natal for their support and for making this event a success.

Giel Hattingh, Paul Licker, Lucas Venter and Don Petkov



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# **A Framework for Information Systems and National Development Research**

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## **ABSTRACT**

This paper develops a multidimensional framework to look at the role that information systems can play in the field of National Development. While there are already several frameworks, these are aimed at the employment of IS for specific goals (such as healthcare, education, job creation, administration, etc.) rather than to generate research questions. These frameworks are useful for generating policy, action, or products and generally work at a single level (usually macroeconomic).

The framework proposed here looks at how IS contributes to human activities at various levels, in various roles, and with certain expected results. For example, while GUI interfaces are popular in first-world societies, it is unknown precisely how to design information systems for illiterates, since there are few examples of systems deployed among illiterates. This paper develops a multidimensional framework useful for generating researchable questions that help create theory. A research project to examine the effects of literacy on errors in use of a GUI would be classified as user level(perceptual, learning), tool role, and long-term payoff of results. In many cases, we carry out atheoretic evaluation of schemes without considering that our logic may be flawed by hidden assumptions. The three dimensions are (1) level of activity (2) change agency and (3) results horizon.

A discussion of each of these three dimensions is offered. The dimensions can be used to frame (hence the term "framework") a set of theoretical questions. The framework is being applied to guide the design of a doctoral program in Information Systems and National Development to be offered starting in 1999 at the University of Cape Town.

## **1. Introduction**

This paper concerns research that delves into questions of the interaction between information systems (IS – the use of information in business) and technology (IS – the technologies enabling that use) on the one hand<sup>1</sup> and national development on the other. This is a rich, rather chaotic field of endeavour, one in which there is a lot of hope for positive results, but which is not considered "mainstream" by my colleagues in academic information systems. Among all the "ampersanded" subfields of IS (i.e., those named "Information Systems and something"), this one is least populated by IS researchers, least mentioned in IS textbooks, and least published in mainstream, high-prestige "research" journals.

The structure of the paper is as follows. The next section points out the importance of the topic of IS&ND and is followed by a section on the place of IS on the national development in South Africa. The third section spells out the importance of research frameworks. The next sections of the paper introduce the framework and then discuss each of the three dimensions separately. Information on the doctoral program based loosely on this framework is available from the author.

## **2. The Importance of the Topic**

First, a definition is in order. We need not define "information system", but the term "national development" is not transparently graspable. The word "national" is intentionally vague, because the

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<sup>1</sup> In this paper the terms "information systems" and "information technology" will be used synonymously to refer to the field of inquiry that focuses on the use of information in business and administration. While a "system" and a "technology" are manifestly different, the terms are used with a variety of meanings in a variety of contexts world wide and are probably almost synonymous now.

word "development" is a technical term in our field and, as well, defines another, important field generally equated in the non-profit sector with the term "fund raising". We might just as well use other terms that fit into the same place as "national", including "economic", "social", "political", "human" or even "cultural", although this last term has also been the subject of much spousal abuse from academics.

What "national development" entails, of course, is all those activities (including planning, dreaming, and arguing) related to making life better for people in third-world countries. Not to put too fine a point on it, we have a term like "national development" because some countries seem to be better places to live than others. While granting this is sometimes a personal choice (some people actually choose to live in most inhospitable places), there is ample evidence that while people vote with their feet and purses, but given "development", they would stay where they are. That's why the term "national" makes some sense, even though we rarely speak, except curiously in the case of South Africa, of nation building. Thus, for reasons, some obvious, others not, the subject is not of primary importance in most of the developed world, especially in the field of information systems. In fact, one would normally be surprised to find any interest at all in IS&ND given the high infrastructure (human and material) costs necessary to mount IS efforts and the relatively "developed" nature of the IS industry in the first world.

But while IS academics virtually ignore this topic, there is a great deal of work going on, anyway. For example, IFIP Working Group 9.4 is concerned with this topic and has sponsored a series of conferences on the topic<sup>2</sup>. The IDRC in Canada is a prime mover behind a growing corpus of work and the Canadian government a strong funder of applied research in this field. The IDRC web site (<http://www.idrc.ca>) is a rich resource. There are several journals now publishing research in IT&ND, including *The Journal of Global Information Technology Management* and *The Journal of Global Technology Management*.

The level of communication (mostly assisted by the very technologies under discussion) is phenomenal. The Global Knowledge Day 97 conference held in Toronto in June of 1997 spawned an incredible flurry of interest as well as a list server (now known merely as GK for Global Knowledge). GKD97 was hosted by the World Bank and the Government of Canada, sponsored by the governments of Switzerland and the US, UNESCO, Dell Computers and Unilever, among others, and cosponsored by governmental agencies, NGOs and private businesses around the world. This particular conference was important enough to be welcomed by the Prime Minister of Canada and the Secretary General of the UN. The World Bank is supporting several initiatives of a research nature as well as the InfoDev funding project and list serve. Interest in the concept of the "Information Society" has spurred a number of efforts including the African Information Society Initiative (UNECA) 1998, Partnership for Information and Communication Technologies in Africa (PICTA), among others.

Here in South Africa, we have the fine work of PRODDER and TAD among others, keeping the communication flowing. The Development Policy Research Unit of the University of Cape Town has published working papers (Kaplan (no date), and Hodge and Miller (no date)) and sponsored a recent paper on IS policy (Hodge and Miller (1997)). There is a small group of IS researchers working in this field, including several of my colleagues at the University of Pretoria. Much of the local publication is in the realm of policy analysis. Most of the remainder is reports of case studies, field trials, and grass-roots observations. There is no dearth of activity; in fact, it is a full-time activity merely to sift through the web sites, discussion groups and list servers on a daily basis. Thanks to the world-wide-web, there are no limits on the working day, first world or otherwise ☺!

From a research viewpoint, making sense of this overwhelming amount of material is daunting to say the least. There just does not seem to be a unifying framework for research. This is not to say that the research is not of high quality or value; far from it. But from the point of view of someone wanting to construct a home-grown doctoral program in IS&ND, the scarcity of useful frameworks for organising research is a barrier. Hence this paper attempts to build a three-dimensional framework for classifying (and generating) research questions in this general area.

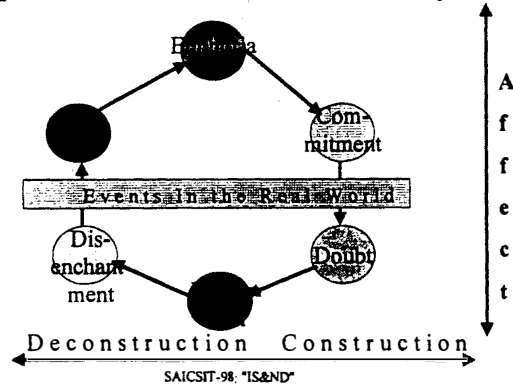
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<sup>2</sup> These conferences took place in Cairo in 1995 and in Bangkok in 1998. Papers from the Cairo conference (Odedra-Straub, 1996) are referenced here as examples.

### 3. IS on the Development Agenda

Clearly IS is on the development agenda. There is no need to reproduce here the avalanche of position papers, legislative drafts, press releases, and similar propaganda coming from our government (and others; we are not unique) concerning the promise of IS in the area of national redevelopment. Yet that promise is not unalloyed, nor is it static. Figure 1 illustrates what I call "The Cycle of Euphoria and Disillusion" that frequently

#### Euphoria-Disillusionment Cycle



accompanies the introduction of new concepts, technology, ideas, or projects.

Let's begin the cycle with **hope**. Hope is always in anticipation of something, a movement away from the present towards a better future. Hope represents a lack of involvement with a solution, but a turn-around in emotion towards positive feelings. Hope is met with the promise of improvement (generally from some sort of public agenda) and we move to a stage of **euphoria**, relative in any event to hope. Euphoria ("well being", literally "bearing up well") develops as it looks like the latest fix might be the one. Betting on the latest with resources, time, emotion brings us to the next stage, **commitment**. Commitment requires those resources, however, which means work, not so euphoric; our affect starts to move in a negative way. And since nothing's perfect, least of all information technology and the systems it supports, so sooner or later, total commitment changes into **doubt**, the opposite of hope. At this stage the involvement, which had been moving in a positive direction, stalls and starts to move in the opposite direction. Constructive activities, nurtured by the promise of success give way to deconstruction, de-coupling and dis-involvement, leading to **disillusion**. In this stage the figurative bloom is off the figurative rose; the state is exactly opposite to that of euphoria. No illusions are held, no news is good. Of course the illusion is that everything is awful, but that is enough to disengage and get less involved, risk less. That inability to risk any more brings about **disenchantment**. The former solution is no longer "enchanting", it no longer sings. Involvement and affect are at their lowest; this is the opposite of commitment. And this state continues until a new **hope** arises.

Is IS/IT a "promise" in the sense of a "hope" in the cycle of euphoria and Disillusion? What are the illusions? Why the euphoria?

The answers must lie in the illusions or expectations of these sorts of technology. One of the problems of IS is that it is, in a sense, illusory:

- 1) The technology itself is opaque, badly understood by most people
- 2) Our experience of the technology is not tempered through the heat of centuries of experience (even flying has been around twice as long as automatic computing) making evaluation of our experience difficult
- 3) Most of what we know about the technology and its use is gleaned from quick experience and rapid, incomplete learning, as applications obsolete rapidly, most having half-lives<sup>3</sup> of less than five years

<sup>3</sup> The *half-life* of an application is the amount of time from its installation until the time when it has half the original functionality. Functionality is relative: some functions "break" because of bugs, but

- 4) It is difficult to conduct experiments on social systems that are unstable and not at equilibrium.

The key to understanding, of course, is proper research. The beginning point for research is a framework.

#### 4. Why Have a Research Framework?

A research framework is useful for the following reasons:

- 1) It can **classify** situations, issues, and phenomena into mutually exclusive and exhaustive subsets
- 2) It can be used to **compare research** results that examine similar phenomena in similar contexts, thanks to the classification
- 3) It can **generate areas** for research by showing where knowledge is incomplete, unreliable, or imprecise;
- 4) It can be used to generate **questions** about phenomena by pointing out what is considered important about them
- 5) It makes a value statement about what makes a difference, what researchers (generally the framework designer) think is important about a field of knowledge.
- 6) Finally, it can be used to evaluate the need for and value of existing research in a particular area.

Consider just one example about why research frameworks are important. Without research frameworks, it is hard to classify situations under discussion, primarily because each situation must be approached on its own merits. For example, suppose someone working with a trader in the informal sector discovers that the trader avoids situations in which it is necessary to record information because she is illiterate. The trader therefore naturally seeks situations in which it is not necessary to record information (which might mean strongly habitual situations involving familiar people and events). Alternatively, the trader may try to memorise situations, mentally recording data that will have to be encoded into familiar patterns. The trader thus has less chance to learn new things and a bias towards the familiar. Now when it comes time to expand, the illiterate trader has no recorded information to take to a bank, but instead she must rely on informal means of finance, some of which might be shady or unreliable. But at least nothing has to be recorded. This finding is not easy to relate to other findings about illiteracy, business, the informal sector, and information systems because there is no way to relate it systematically to these other areas. There is a wealth of experience in information and informal commerce but little way to relate it all together and create coherent, testable theories in order to design, build and use **appropriate** technology.

There are a number of frameworks but none of them includes information systems as an explicit and necessary element. The reason for this is as much due to "islands of research" and disciplinary rivalry as anything else. There is little motivation to look at development as a profitable area to do information systems research. This is so because of the high technology bias in our field and the expense necessary to create and manage field trials (clearly there is not a lot of technology already available in "the field."). From the other side (i.e., development), there is a lot of thought. Consider the following set of topic areas that GKD-97 puts forward as its agenda:

1. Empowering the poor with information and knowledge
2. Policy and Regulatory Frameworks for the Information Economy
3. Harnessing Information and Knowledge: Infrastructure, capacity building and applications
4. Fostering science and technology in developing countries
5. Public information, civic dialogue and effective governance
6. Life-long learning and distance education

---

generally the original requirements change or the system becomes difficult to maintain because of an accumulation of fixes.



Broadly speaking, this is a framework, illustrating a set of possibly mutually exclusive and exhaustive topics, subject matter areas, and disciplines. However, as a guide to research, it falls far short. For example, one might mount an effort in life-long learning (of technology). This effort could simultaneously foster science and technology (by building an informed customer base) while helping to create civic dialogue and ultimately better governance if the life-long learners happen to be parliamentarians!

Palvia (1998) notes that while there are many potential frameworks for global information systems (a larger superset of what we are interested in this paper), most of the frameworks are neither validated nor comprehensive but are overly articulated. His complaint is that a pertinent set of independent and dependent variables have not been devised, and proposes the following concerns:

- 1) Most frameworks propose too few or too specific categories of dependent variable
- 2) Dependent variables may not be appropriate measures of performance of information systems and might be culturally biased
- 3) Dependent variables might be difficult to operationalise internationally (read here as “interculturally”).
- 4) Independent variables must be well thought out and not culturally limited
- 5) Concepts (such as country, for example) should not be loosely defined
- 6) Practitioners must not be forgotten: they turn research into action;

To this can be added the following important considerations for any framework:

- 1) Independent and dependent variables should be clearly distinguished
- 2) Categories of these variables should be mutually exclusive and exhaustive
- 3) Variables (situations) mentioned in the framework should be isolatable and describable in normal activity and discourse (i.e., not just abstract constructs and theoretical or possible events).

The framework proposed here probably suffers from many of these laments. It has only a few categories in each dimension and doesn't clearly distinguish independent and dependent variables. However, as will be discussed, the dimensions are important in almost every attempt to employ IS in the service of national development. The situations referred to are real and tangible. Any cultural biases extend only so far as the interpretation of the dimensions themselves by individual researchers.

## Dimensions of the Framework

### ① Level of Activity

- ✓ Societal, Corporate, Application, User, Technological

### ② Change Agency

- ✓ Change Initiator, Change agent, Tool of change, Agenda item, Change goal, Metaphor

### ③ Results Horizon

- ✓ Immediate, short-term, long-term, exploratory  
OR PROVOCATIVE SAICSTT-98 "IS&ND"

Also, the framework does not seek to include applied or pure research that while potentially useful IS&ND does not have ND as its application focus. For example, the work by Davison and Jordan (1998) explores cultural dimensions of GSS without explicit reference to national development. The work is useful, however, in raising awareness of the role of culture in any IS application that involves inter-group communication. Similarly, the original research by Couger and Zawacki (1980) on the motivating potential for IS jobs has spawned a number of “national” comparisons that will ultimately turn out to be useful to practitioners in the ND field, but the work itself is not so clearly IS&ND. This also points out that any nascent field will have boundary problems.

## 5. The Framework: Dimensions

The framework (Figure 2, below) classifies experience in IS&ND in three ways:

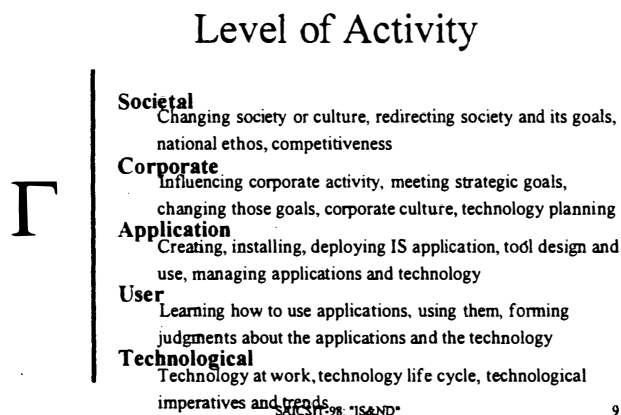
- 1) Level (or area) of impact (in human experience)
- 2) Change agency (i.e., the role of technology)
- 3) Results horizon

This is an elaborate way to answer the question: “How would we describe a project or task or plan to employ (change agency) information technology to some end (level of impact) at some time (results horizon)?” In effect, the framework proposes an implicit model of IS&ND as goal-oriented, task-implemented and tool-enabled. Stated even more simply, the framework categorises questions of the form “Who (change agency) does what to whom (level of impact) when (results horizon)?” As such it is a **descriptive** model rather than an explanatory, predictive or prescriptive one (Babbie, 1992), although the cultural bias should be apparent<sup>4</sup>. An explanatory model would attempt to show why particular projects, for example, in IS&ND would succeed or fail. A predictive model would be useful for predicting the results of particular campaigns or efforts. Finally, a prescriptive model would guide project managers and funders into appropriate activity. My feeling is that research in IS as well as in IS&ND has not reached a level of maturity yet to enable models of such sophistication.

Each of these dimensions is described independently below.

### 5.1 Dimension 1: Level

One of the important descriptors for any work in IS&ND is the “level” at which the work is being executed. Some research looks at whole societies (such as devising “national” IS policies) while other



research examines micro-behaviour (such as the hidden importance of reading even in supposedly graphic user interfaces). The fact that research in such a wide range can be accommodated in a new field shows how diverse the interests – and possibly how difficult the challenges and how high the hopes – are.

### 5.2 Dimension 2: Change Agency

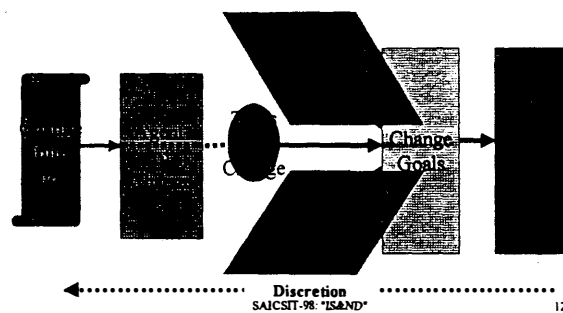
One of the major characteristics of a field like IS&ND is its applied nature and, more importantly, the goal-directedness of the efforts. Because ND has an end in mind (upliftment, improvement), the field

<sup>4</sup> If it is not, the reader should note the implicit actions, the emphasis on causality and results, and the strong temporal quality. This is a process-oriented model, leading from one state to another, with the emphasis on agency (and probably implicitly an emphasis on ownership and autonomy). There is little in the model that explicitly explores responsibility, shared goals, intention, and all the “whys” that make development projects so interesting. On the other hand, this is a research framework, a starting point, a spur to further thinking.

is inherently concerned with change. The role of IS in this change can be viewed as multiple ranging from a mere instrument of someone else's goals to an end in itself. Figure 4 illustrates the model of change agency employed here.

The model illustrates a conception of change<sup>5</sup>. Change generally begins with a **change initiator** who has an idea in mind. The change initiator could be a person, a working group or an organisation, even potentially an entire society. The change initiator selects actively or passively one or more **agents of change** who actually perform the work with appropriate permissions and skills. The change agent might be seen as a manager, along the lines of agency theory (Gibbins, 1995). Change agents employ **tools** and resources for change, directly or indirectly. These tools are brought to bear on specific **change goals** which are derived (probably at some previous time, but probably over some period of time – they might actually never be frozen) from a set of **change metaphors**. These are ideas or stories or representations of what is changeable, the role of change in society, how change should be

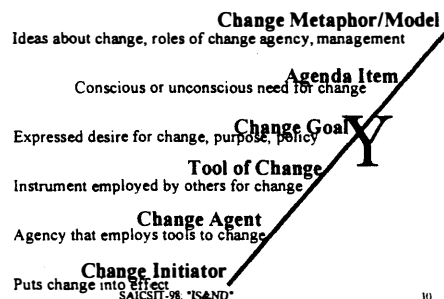
### Change Agency Model



managed). Goals also stem from a **change agenda** which could be public (national, cultural, social, mass mediated) or private (corporate, familial, personal). Change goals, being the loose desired ends are not always effected, so it is the actual end states that are documented in project reports.

Hence the role of IS in change (Figure 5) should be seen in relation to this model as having multiple facets. IS could be an initiator of change, for example, when IS managers attempt to “modernise” an organisation in a third-world country. IS is often thought of simply as a change agent, however. This is frequently confused with initiation or prime cause as when the popular press states that “IS has changed the way business operates.” A better example is research into outsourcing vs. insourcing (inland vs. external, too) in third-world countries. Also confused with change agent roles is the tool

### Change Agency



role. A manager might say “We’re so much better now that our NGO now uses information systems to keep track of our projects.” A better way to say this is to talk about the use of IS *by NGOs and their managers*, to keep better records and ensure continued economic viability of its projects.

<sup>5</sup> Although the model appears linear, the arrows may be read as “in conjunction with” or “with the help of” or “consistent with” or “contributes to”. The key notions are “alignment” and “orientation”.

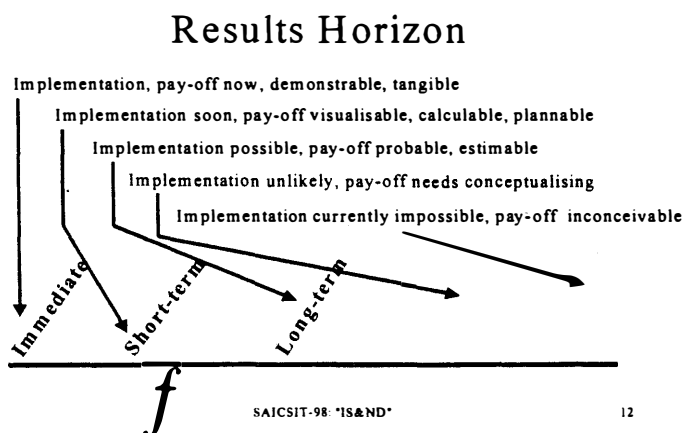
Frequently people will speak about a goal of “computerisation” or “going client-server” or “switching to a Windows NT-based environment, as though that were an end in itself. In fact, there might be such ends and one problem pointed out in recent research (Waema, 1996) is that the appearance of “modernity” might be an inappropriate goal in developing countries because of the high cost. However, it is possible that there might be specific goals for information technology in organisations and societies. More likely, though, is that IS makes an agenda, usually public, through the efforts of concerned individuals and business people who understand the benefits (although not always the costs) of computerisation and information systems. Many firms in OECD countries find themselves pulled along on a merry technology chase without firm benefit justification merely because an expensive buzzword, like “data mining” has made the corporate agenda. Finally, information systems has spawned a number of modes of thought that promise benefits merely through thinking! These metaphors (input-process-output is one example) provide “tools for thinking” about development efforts that are mechanistic, information-based, and potential models for how to create and manage (national) development projects. In fact, of course, working with people is hardly like working with machines.

Thus, IS can serve in a number of roles (and probably simultaneously, especially when perceptions of role-seers is taken into account<sup>6</sup>). That these roles can be vaguely defined and in conflict might serious spice up research and muddle field work.

### 5.3 Dimension 3: Results Horizon

We’ve covered the “who/what” and the “how”. The remaining important aspect of the framework is temporal, namely when results are expected. Bundled into this is the nature of the results. Are they tangible and actionable? Are they in the realm of plans that have some reality (we will be **trying** to get them done) and some unreality (they haven’t “occurred” yet, they refer to future events)? Are they in the realm of speculation, what might be, if only....

The *results horizon* speaks about the outcomes of IS-assisted ND efforts and their “reality.” At the



most **immediate** level, implementation (of the assist) brings about immediate, tangible results with demonstrable results. A study of the effects of literacy training on error rates of POS terminal operators would fall into this class. At the **short-term** level, implementation is some time off in the future, but payoffs are foreseeable; there is a way of calculating the payoffs so that it is possible to plan for them (and to see if implementation is really cost-effective). A project to examine the effects of exposure to information technology (say, through personal computers) on the attitudes of school children toward technology will have a short-term payoff in their motivation to learn more. **Long-**

<sup>6</sup> For example, a project manager might see IS as a means to an end (tool), while those implementing the applications might see themselves as change agents. Those who have to use the applications might see IS as a goal of management (as in a trade-off between “people” and “machines”). Certainly labour unions often (publically at least) take the position that “computerisation” is an end in itself and unnecessary.

**term** results horizons are characteristic of policy research, looking at the projections of employment in the IS field given certain options in tertiary education, for example. Other examples would be studies of the role of pre-competitive IS consortia, technology buying cartels, and industry-sponsored training institutes in developing countries. **Provocative** results horizons are built into position papers that ask questions about assumptions or question the status quo in some area. Consider a research project that asks whether or not the way GUI interfaces are designed might mirror American culture. It is not likely that anyone will seriously try to contend with Windows and redesign its interface, but it may be necessary to draw attention to the assumptions underlying that particular GUI. Finally, there are **speculative** results horizons that appear in research that questions whether or not we should be seeking answers to certain questions. Research that asks if IS can actually solve serious problems in ND, studies of future trends in technology and their effects on the developing world, and the creation of software development industries in rural areas might fall into this category.

The results horizon dimension provides us with a broad sweep of research goals, from immediate application through long-term policy making to speculation on the limits of technology, people, and development.

## 6. Conclusion

This paper has developed a three-dimensional framework for generation, classification, comparison, and evaluation of research activity in the field of information systems and national development. This more or less common-sense framework is a starting point for understanding how various research efforts fit together, contribute or conflict, and build theory.

The framework is being employed to design a doctoral program in information systems and national development at the University of Cape Town. This program will commence in January of 1999 and will bring together researchers and scholars in information systems and development studies. The goal of the program is to create a community of scholars here in the Western Cape that have as their primary interest the employment of information systems for the improvement of the country in social, economic, political, cultural and human resource terms. While this is a very broad topic and a relatively chaotic one at that, we feel the time is ripe for an emphasis on a home-grown, Southern Africa focus but internationally-scoped program. Cooperation among scholars is the important element of this program, which should be turning out the first doctorates in the earliest years of the next millennium.

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