HARDWARE, SOFTWARE AND PEOPLEWARE

SAICSIT 2001

Edited by Karen Renaud
Paula Kotzé
Andries Barnard
HARDWARE, SOFTWARE AND PEOPLEWARE

South African Institute of Computer Scientists and Information Technologists
Annual Conference
25 – 28 September 2001
Pretoria, South Africa

SAICSIT 2001

Edited by Karen Renaud, Paula Kotzé & Andries Barnard
University of South Africa, Pretoria
Table of Contents

Message from the SAICSIT President ........................................................ iv
Message from the Chairs ........................................................................ vi
Conference Organisation ....................................................................... vii
Referees ................................................................................................. viii

Keynote Speakers

Cyber-economies and the Real World ...................................................... xi
  Alan Dix
Computer-aided Instruction with Emphasis on Language Learning ..........., xiv
  Lut Baten
Internet and Security Trends .................................................................... xv
  Arthur Goldstuck
The Future of Data Compression in E-technology ..................................... xvi
  Nigel Horspool
Strategic Planning for E-Commerce Systems: Towards an Inspirational Focus .... xvii
  Raymond Hackney

Research Papers

Human-Computer Interaction / Virtual Reality
The Development of a User Classification Model for a Multi-cultural Society ... 1
  M Streicher, J Wesson & A Calitz
Real-Time Facial Animation for Virtual Characters ................................... 11
  D Burford & E Blake
The Effects of Avatars on Co-presence in a Collaborative Virtual Environment ... 19
  J Casanueva & E Blake

Education
Structured Mapping of Digital Learning Systems .................................... 29
  E Cloete & L Miller

Formal Methods
The specification of a multi-level marketing business .............................. 35
  A van der Poll & P Kotzé
Finite state computational morphology - the case of the Zulu noun ........... 45
  L Pretorius & S Bosch
Combining context provisions with graph grammar rewriting rules: the three-dimensional case ........................................... 54
  A Barnard & E Ehlers

Human-Computer Interaction / Web Usability
Web Site Readability and Navigation Techniques: An Empirical Study .......... 64
  P Licker, R Anderson, C Macintosh & A van Kets
Jiminy: Helping Users to Remember Their Passwords ............................ 73
  K Renaud & E Smith

Information Security
Computer Security: Hacking Tendencies, Criteria and Solutions .............. 81
  M Botha & R von Solms
An access control architecture for XML documents in workflow environments .... 88
  R Botha & J Eloff
# Graphics and Ethics

**Model-based Segmentation of CT Images** ......................................................... 96  
  O Marte & P Marais

**Towards Teaching Computer Ethics** ................................................................. 102  
  C de Ridder, L Pretorius & A Barnard

# Human-Computer Interaction / Mobile Devices

**Ubiquitous Computing and Cellular Handset Interfaces – are menus the best way forward?** ........................................................................................................... 111  
  G Marsden & M Jones

**A Comparison of the Interface Effect on the Use of Mobile Devices** ............... 120  
  J Franken, A Stander, Z Booley, Z Isaacs & R Rose

**The Effect of Colour, Luminance, Contrast, Icons, Forgiveness and Closure on ATM Interface Efficiency** ............................................................... 129  
  A Stander, P van der Zee, & Y Wang

# Object Orientation

**JavaCloak - Considering the Limitations of Proxies for Facilitating Java Runtime Specialisation** ....................................................................................... 139  
  K Renaud

# Hardware

**Hierarchical Level of Detail Optimization for Constant Frame Rate Rendering** ...... 147  
  S Nirenstein, E-Blake, S Windberg & A Mason

**A Proposal for Dynamic Access Lists for TCP/IP Packet Filtering** ................. 156  
  S Hazelhurst

# Information Systems

**The Use of Technology to Support Group Decision-Making in South Africa** ....... 165  
  J Nash, D Gwilt, A Ludwig & K Shaw

**Creating high Performance I.S. Teams** .............................................................. 172  
  D C Smith, M Becker, J Burns-Howell & J Kyriakides

**Issues Affecting the Adoption of Data Mining in South Africa** ......................... 182  
  M Hart, E Barker-Goldie, K Davies & A Theron

# Information Systems / Management

**Knowledge management: do we do what we preach?** ........................................ 191  
  M Handzic, C Van Toorn, & P Parkin

**Information Systems Strategic Planning and IS Function Performance: An Empirical Study** ......................................................................................... 197  
  J Cohen

# Formal Methods

**Implication in three-valued logics of partial information** .................................... 207  
  A Britz

**Optimal Multi-splitting of Numeric value ranges for Decision Tree Induction** .... 212  
  P Lutu
Abstracts of Electronic Papers

Lessons learnt from an action research project running groupwork activities on the Internet: Lecturers' experiences ................................................................. 221
  T Thomas & S Brown

A conceptual model for tracking a learners' progress in an outcomes-based environment .............................................................. 221
  R Harmse & T Thomas

Introductory IT at a Tertiary Level – Is ICDL the Answer? ........................................ 222
  C Dixie & J Wesson

Formal usability testing – Informing design ............................................................. 222
  D van Greunen & J Wesson

Effectively Exploiting Server Log Information for Large Scale Web Sites .............. 223
  B Wong & G Marsden

  E von Solms & J Eloff

A Pattern Architecture, Using patterns to define an overall systems architecture ................................................................................................................. 224
  J van Zyl & A Walker

Real-time performance of OPC ............................................................................. 224
  S Kew, & B Dwolatzky

The Case for a Multiprocessor on a Die: MoaD .................................................... 225
  P Machanick

Further Cache and TLB Investigation of the RAM-page Memory Hierarchy ............ 225
  P Machanick & Z Patel

The Influence of Facilitation in a Group Decision Support Systems Environment ...... 226
  T Nepal & D Petkov

Managing the operational implications of Information Systems ................................ 226
  B Potgieter

Finding Adjacencies in Non-Overlapping Polygons ................................................. 226
  J Adler, GD Christelis, JA Denyes, GD Konidaris, G Lewis, AG Lipson, RL Phillips,
  DK Scott-Dawkins, DA Shell, BV Strydom, WM Trakman & LD Van Gool
Message from the SAICSIT President

The South African Institute of Computer Scientists and Information Technologists (SAICSIT) was formed in 1982 and focuses on research and development in all fields of computing and information technology in South Africa. Now in the 20th year of its existence, SAICSIT has come of age, and through its flagship series of annual conferences provides a showcase of not only the best research from the Southern-African region, but also of international research, attracting contributions from far afield. SAICSIT does, however, not exist or operate in isolation.

More than 50 years have passed since the first electronic computer appeared in our society. In the intervening years technological development has been exponential. Over the last 20 years there has been a vast growth and pervasiveness of computing and information technology throughout the world. This has led into the expansion and consolidation of research into a diversity of new technologies and applications in diverse cultural environments. During this period huge strides have also been made in the development of computing devices. The processing speed of computers has increased thousand-fold and memory capacity from megabytes to gigabytes in the last decade alone. The Southern African region did not miss out on these developments.

It is hardly possible for such quantitative expansion not to bring a change in quality. Initially computers had been developed mainly for purposes such as automation for the improvement of processing, labour-reduction in production and automation control of machinery, with artificial intelligence, which made great strides in the 1980s, seen as the ultimate field to which computers could be applied. As we moved into the 1990s it was recognized that such an automation route was not the only direction in the improvement of computers. The expansion of processing power has enabled image data to be incorporated into computer systems, mainly for the purpose of improving human utilisation. For most computer technologies of the 1990s, including the Internet and virtual reality, automation was not the ultimate purpose. Humans were increasingly actively involved in the information-processing loop. This involvement has gradually increased as we move into the 21st century. Development of computer technology based not on automation, but on interaction, is now fully established.

The method of interaction has significantly changed as well. The expansion of computer ability means that the same function can be performed far more cheaply and on smaller computers than ever before. The advent of portable and mobile computers and pervasive computing devices is ample evidence of this. The need for users to be at the same location as a computer in order to reap the benefits of software installed on that computer is becoming an obsolete notion. Time and space are no longer constraints. One of the most discussed impacts of computing and information technology is communication and the easy accessibility of information. This changes the emphasis for research and development – issues such as cultural, political, and economic differences must, for example, be accommodated in ways that researchers have not previously considered. Our goal should be to enable users to benefit from technological advances, hence matching the skills, needs, and expectations of users of available technologies to their immense possibilities.
The conference theme for the SAICSIT 2001 Conference – *Hardware, Software and Peopleware: The Reality in the Real Millennium* – aims to reflect technological developments in all aspects related to computerised systems or computing devices, and especially reflect the fact that each influences the others.

Not only has SAICSIT come of age in the 21st century, but so has the research and development community in Southern Africa. The outstanding quality of papers submitted to SAICSIT 2001, of which only a small selection is published in this collection, illustrates both the exciting and developing nature of the field in our region. I hope that you will enjoy SAICSIT 2001 and that it will provide opportunities to cultivate and grow the seeds of discussion on innovative and new developments in computing and information technology.

Paula Kotzé
SAICSIT President
Running this conference has been rewarding, exciting and exhausting. The response to the call for papers we sent out in March was overwhelming. We received 64 paper submissions for our main conference and twelve for the postgraduate symposium. We had a panel of internationally recognized reviewers, both local and international. The response from the reviewers was impressive – accepting a variety of papers and mostly returning the reviews long before the due date. We were struck, once again, by the sheer magnanimity of academia – as busy as we all are, we still manage to contribute fully to a conference such as SAICSIT.

After an exhaustive review process, where each paper was reviewed by at least three reviewers, the program committee accepted 26 full research papers and 14 electronic papers. Five papers were referred to the postgraduate symposium, since they represented work in progress – not yet ready for presentation to a full conference but which nevertheless represented sound and relevant research. The papers published in this volume therefore represent research of an internationally high standard and we are proud to publish it. Full electronic papers will be available on the conference web site (http://www.cs.unisa.ac.za/saicsit2001/).

Computer Science and Information Systems academics in South Africa labour under difficult circumstances. The popularity of IT courses stems from the fact that IT qualifications are in high demand in industry, which leads in turn to a shortage of IT academic staff to teach the courses, even when posts are available. The net result is that fewer people teach more courses to more students. IT departments thus rake in ever-increasing amounts of state subsidy for their universities. These profits, euphemistically labelled “contribution to overhead costs”, are deployed in various ways: cross-subsidization of non-profitable departments; maintenance of general facilities; salaries for administrative personnel, etc. Sweeteners of generous physical resources for the IT departments may be provided. We have yet to hear of a University in South Africa where significant concessions have been made in terms of industry-related remuneration. At best, small subventions are provided. As a result, shortages of quality staff remain acute in most IT departments – especially at senior teaching levels. What is even worse is that academics in these departments have to motivate the value of their conference contributions and other IT outputs to selection committees, often dominated by sceptical academic power-brokers from the more traditional departments whose continued survival is underwritten by IT’s contribution to overhead costs.

The papers published in this volume are conclusive evidence of the indefatigability and pertinacity of Computer Science and Information Systems academics and technologists in South Africa. We are proud to be part of such a prestigious and innovative group of people.

In conclusion, we would like to thank the conference chair, Prof Paula Kotzé, for her support. We also specially thank Prof Derrick Kourie for his substantial contribution. Finally, to all of you, contributors, presenters, reviewers and organisers – a big thank you – without you this conference could not be successful.

Enjoy the Conference!
Karen Renaud & Andries Barnard

---

1 This taken almost verbatim from Professor Derrick Kourie’s SACLA 2001 paper titled: “The Benefits of Bad Teaching”. 
Conference Organisation

General Chair
Paula Kotze

Sponsor Liaison
Paula Kotze, Chris Bornman

Programme Chairs
Karen Renaud
Andries Barnard

Secretarial & Finances
Christa Prinsloo, Elmarie Havenga

Organising Committee
Chairs
Lucas Venter, Alta van der Merwe

Marketing & Public Relations
Klarissa Engelbrecht, Elmarie van Solms, Adriaan Pottas, Mac van der Merwe

Art and Design
Tersia Parsons

Audio Visual
Tobie van Dyk, Andre van der Poll, Mac van der Merwe

Program Committee

Bob Baber – McMaster University, Canada
Andries Barnard – University of South Africa
Judy Bishop – University of Pretoria
Andy Bytheway – University of the Western Cape
Andre Calitz – University of Port Elizabeth
Elsabe Cloete – University of South Africa
Carina de Villiers – University of Pretoria
Alan Dix – Lancaster University, United Kingdom
Jan Eloff – Rand Afrikaans University
Andries Engelbrecht – University of Pretoria
Chris Johnson – University of Glasgow, United Kingdom
Paul Licker – University of Cape Town
Paula Kotze – University of South Africa
Derrick Kourie – University of Pretoria
Philip Machanick – University of the Witwatersrand
Gary Marsden – University of Cape Town
Don Petkov – University of Natal in Pietermaritzburg
Karen Renaud – University of South Africa
Ian Sanders – University of the Witwatersrand
Derrick Smith – University of Cape Town
Harold Thimbleby – Middlesex University, United Kingdom
Theda Thomas – Port Elizabeth Technikon
Herna Viktor – University of Pretoria, South Africa
Bruce Watson – Universities of Pretoria and Eindhoven
Janet Wesson – University of Port Elizabeth
Referees

Molla Alemayehu
Trish Alexander
Adi Attar
Bob Baber
Andries Barnard
John Barrow
Judy Bishop
Gordon Blair
Arina Britz
Andy Bytheway
André Calitz
Charmain Cilliers
Elsabe Cloete
Gordon Cooper
Richard Cooper
Annemieke Craig
Thad Crews
Quintin Cutts
Michael Dales
Carina de Villiers
Alan Dix
Dunlop Mark
Elize Ehlers
Jan Eloff
Andries Engelbrecht
Klarissa Engelbrecht
David Forsyth
John Galletly
Vashti Galpin
Wayne Goddard
Alexandre Hardy
Scott Hazelhurst
Johannes Heidema
Tersia Hörne
Chris Johnson
Bob Jolliffe
Paula Kotzé
Derrick Kourie
Les Labuschagne
Paul Licker
Philip Machanick
Anthony Maeder
David Manlove
Gary Marsden
Thomas Meyer
Elsa Naudé
Martin Olivier
Don Petkov
Pekka Pihlajasaari
Nelisha Pillay
Laurette Pretorius
Karen Renaud
Ingrid Rewitzky
Sheila Rock
Markus Roggenbach
Ian Sanders
Justin Schoeman
Martie Schoeman
Eljse Scott
Derek Smith
Elmë Smith
Adrie Stander
Harold Thimbleby
Theda Thomas
Judy Van Biljon
Alta Van der Merwe
André van der Poll
Tobias Van Dyk
Lynette van Zijl
Lucas Venter
Herna Viktor
Bruce Watson
Janet Wesson

Conference
Sponsors

UNISA
ABSA Group
Microsoft
NRF

viii
Keynote Abstracts
Information Systems Strategic Planning and IS Function Performance: An Empirical Study

J.F. Cohen
School of Economic and Business Sciences, University of the Witwatersrand, jasonc@isys.wits.ac.za

Abstract: The validity of managerial activities such as strategic planning have come under increasing scrutiny in recent years. In particular, the validity of information systems strategic planning (ISSP) within South African organisations remains to be demonstrated by empirically confirming its link to IS performance measures. This paper presents findings from an empirical study of ISSP involving responses from 100 listed public companies. Results indicate that emphasis placed on ISSP activities, planning commitment and integration mechanisms are significantly related to IS function performance. More successful IS functions were found to place more emphasis on ISSP activities, to commit greater resources to ISSP and to attribute greater importance to the integration of ISSP and business strategic planning processes, than poor performing IS functions. Planning experience was not found to moderate the relationships.

Keywords: Information systems strategic planning, IS function performance
Computing Review Categories: K6.1, K6.2

1. Introduction

Multiple terms have been used to describe strategic planning for information systems. Common descriptors include information systems strategic planning or ISSP (e.g. [7, 16, 22]), strategic information systems planning or SISP (e.g. [35, 45]), and strategic information planning or SIP (e.g. [28]). One of the earliest definition of strategic planning for information systems was proposed by McLean and Soden [30]. They described it as "the process of deciding on objectives for the MIS organisation; on changes in these objectives; on the resources used to obtain these objectives; and on the policies that are to govern the acquisition, use and disposition of the resources. Strategic MIS planning can occur at infrequent intervals and is often triggered by the need for an enterprise to resolve a particular substantive issue or issues that involves the MIS entity" (page 23).

Other definitions have been proposed numerous times in the literature (see for example [1, 4, 10, 29, 37, 45, 54]). Despite the numerous and often inconsistent definitions, the literature does agree that a formal information systems strategic planning (ISSP) approach is necessary because ad-hoc, incremental and disconnected [54], approaches to IS strategy formulation are simply not good enough given the opportunities that IT can afford an organisation. Formal planning, carefully considered implementation and meticulous monitoring are required to ensure that the strategic advantages from information systems are achieved [25].

This is confirmed by Bryson and Currie [6] who found that most firms prefer to view IS strategy formulation as a formal rational process. Organisations need to rationally plan for their IS activities due to the numerous diverse opportunities for the development and use of information systems [39]. The need to avoid bad IT investments is by far the most popular stimuli for undertaking ISSP discussed in the literature. This is historically due to the numerous missed opportunities and wasted resources that result from the lack of sufficient attention to IS strategy [14] and the potential waste of money by organisations who are unaware of the pitfalls in today's technology [18]. Those organisations that fail to "effectively execute" ISSP [27] can thus expect lost opportunities and wasted IS resources in investments that fail to suit business objectives or information goals [23] and in the development of systems that prove to be a source for great managerial concern and frequent frustration [9].

Recently, however, scholars have recognised that the reality of generally accepted IS management practices such as ISSP should be examined [13], particularly in light of IS/ITs growing importance and the inability of many organisations to reap the rewards they were expecting [46]. IS researchers now find themselves faced with answering the same questions plaguing strategic management scholars: is planning worthwhile and if well installed and used does it produce any improvements in performance [2]? For example King [21] exclaimed:

"However much these SPIS processes display face validity, intuitive appeal and operational acceptance, their ef-
Fitzgerald [16] also suggested that both managers and researchers should no longer be prepared to accept ISSP at “face value”.

The aim of this paper, and others like it, is to determine empirically whether strategic planning for information systems produces positive IS performance. More specifically, this paper operationalizes the concept of IS function performance as the dependent variable. Often referred to as the IS activity, IT activity, IS effort or IS service, Feeny and Willcocks [15] define the information systems function as “the set of activities, personnel and IT assets set up to define and ensure delivery of the information systems requirements of the business” (page 356). The IS function thus not only includes all IS groups and departments within the organisation [48], but due to the proliferation of the outsourcing concept the definition is extended to incorporate outsourced IS activity.

This study proposes that the emphasis placed by IS planners on the components or activities of the ISSP process effects IS function performance. In addition the paper examines the concept of integration, which it has been suggested, is an important part of a highly evolved planning system [52]. Specifically the effect of various mechanisms through which integration is achieved is examined. These integration mechanisms include “facilitation mechanisms” defined by Premkumar and King [36], further include elements of “participation” [50], and have to do with the manner in which the relationships or ties between the ISSP and BSP processes and between ISSP planners and BSP planners are structured [22], all of which are important determinants of social alignment [43]. Finally, the paper also examines the effects of managerial commitment to the ISSP process, an important planning dimension pertaining to the organisational context within which planning occurs [40].

The next section of this paper provides the theoretical framework necessary for stating the study’s hypotheses by briefly reviewing some recent literature on the ISSP process. The subsequent sections describe and present results of a recent study of ISSP in 100 listed public companies. Finally, the paper concludes with some suggestions for practitioners.

2. Hypotheses

2.1 Information Systems Strategic Planning

The IS literature has been trying to confirm the validity of ISSP as a managerial activity for the past 15 years. Over that period numerous empirical attempts have been made to relate IS planning processes to user satisfaction [38]; perceptual measures of IS contribution to organisational performance [32, 52]; ISSP problems [52]; competitive advantage [19]; ISSP effectiveness [50]; ISSP success [11] and IS success [47]. In addition, theoretical arguments have been made for linking ISSP concepts to alignment [26, 42]. While, many of the studies have been successful in suggesting that ISSP does have performance implications, the need to link ISSP activities and process characteristics to organisational performance remains high on the IS research agenda. In particular, the relationship between ISSP and the performance of organisational subsystems, such as the information systems function, remains absent in prior studies.

Despite the fact that the earliest ISSP literature recognised the role that ISSP plays both in defining the mission of the IS function within the organisation and in ensuring its overall success [20, 30], the latest IS literature describes evidence linking IS function performance to planning as insufficient and has called for greater rigour to be afforded the relationship [3].

ISSP has been recognised for the role it plays in helping firms to visualize the potential contribution of IT by identifying broad initiatives, specific applications and critical technologies to help the organisation carry out its business strategy more effectively [24]. It has also been identified as intending to aid IS planners in analysing internal processes and patterns of data dispersion throughout the organisation [49], integrating the activities of the IS function with those of the business [33] and in aligning IS strategies with those of the organisation [26]. Lederer and Sethi [29] have also concerned themselves with a specification of ISSP objectives and have included the following:

- aligning IT with the business
- gaining competitive advantage from IT
- identifying new and higher payback applications
- identifying strategic applications
- increasing top management commitment
ISSP process and intangible resources such as commitment to the ISSP process. Considering that commitment to the ISSP process is likely to be associated with improved IS function performance, it follows that:

Hypothesis 2: Commitment to ISSP will be positively related to IS Function performance improvement

Hypothesis 3: Commitment to ISSP moderates the relationship between emphasis placed on ISSP activities and IS Function performance improvement

2.3 Integration

Conrath et al. [9] found that, in general, IS planning is still undertaken from an IS rather than a corporate perspective. It is not surprising, therefore, to find the literature urging that information systems strategies be developed within the context of the wider business strategic planning processes. By ensuring that information systems strategic planning is conducted within the context of business strategic planning, organisations will be ensuring that their investments in information systems are directed toward the achievement of their business objectives and goals [54].

Earl [12], King [22], Teo and King [53], and Remenyi [45] and have all described this concept as planning integration and have described fully integrated or indistinguishable business strategic planning (BSP) and ISSP processes as the theoretical ideal. Since it may not be pragmatic nor appropriate for a single integrated BSP-ISSP process to be introduced, it is suggested that various integration mechanisms be used to facilitate the process. Integration mechanisms include top management involvement in ISSP, IS management involvement in SP, and the use of steering committees where IS, users and management are represented. Moreover, it is suggested that integration is achieved by ensuring that the activities of ISSP dovetail in with BSP approaches and time tables [53] and that IS planning is conducted within the context of business planning [9]. Premkumar and King [34] indicate that
these integration mechanisms help to broaden the business perspective of the IS manager and create an awareness among business users and senior management of the "strategic potential" of information systems. Ward and Griffiths [54] indicate that it is only through such "two-way awareness" that IS can take its place as a contributor to creating and supporting business strategy. Thus integration, co-operation and the close interaction of business and IS executives serves to foster a learning environment, where business and IS re-orientate themselves to treating information and information systems as core organisational resources. Through integration mechanisms the ISSP process can be used to extract senior management's objectives, convince senior management of the potential strategic impact of information and information systems and thereby increase the chance that the IS strategy will agree with the final conclusions of the business planning study [24]. It follows that:

Hypothesis 4: Importance attributed to integration mechanisms will be positively related to IS Function performance improvement

Given the value inherent in ISSP activities and commitment together with integration mechanisms, it is further hypothesized that:

Hypothesis 5: High performing IS Functions will display significantly greater levels of ISSP emphasis, integration mechanisms and commitment to ISSP than low performing IS Functions

3. Research Methodology

3.1 Sample and Data Collection

A questionnaire was mailed to over 450 listed public companies in South Africa in late 2000. Data collection took place over a 3 month period, into early 2001, and formed part of the refinement of measures and constructs for a larger doctoral study. 100 completed questionnaires were received, for a 22% response rate. All respondents were directly involved in their organisation's ISSP process. Tables 1 and 2 provide general characteristics of respondents.

Table 1: Respondents by Industry Type

<table>
<thead>
<tr>
<th>Industry Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing and Wholesale</td>
<td>23</td>
</tr>
<tr>
<td>Healthcare, Service, Hotels and Leisure</td>
<td>17</td>
</tr>
<tr>
<td>Transport</td>
<td>16</td>
</tr>
<tr>
<td>Financial services, Banking, Insurance</td>
<td>16</td>
</tr>
<tr>
<td>and Assurance</td>
<td></td>
</tr>
<tr>
<td>Telecommunications, IT, Media</td>
<td>16</td>
</tr>
<tr>
<td>Retail</td>
<td>14</td>
</tr>
<tr>
<td>Non-mining, Chemicals, Oils and</td>
<td>6</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Respondents by Job Title

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Manager: IT / IT Manager</td>
<td>39</td>
</tr>
<tr>
<td>Group IT Director</td>
<td>24</td>
</tr>
<tr>
<td>Chief Information Officer</td>
<td>9</td>
</tr>
<tr>
<td>Chief Operating Officer / Director of Operations</td>
<td>9</td>
</tr>
<tr>
<td>Other*</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

* Those respondents classified as other, included directors of strategic planning, directors of finance, managing directors and chief executive officers. All respondents indicated that they were directly involved in their organisation's ISSP process.

3.2 Measurement of the Study's Variables

On a five-point scale (varying from 1 = very low emphasis to 5 = very high emphasis) respondents were asked to indicate the relative emphasis placed on 11 distinct ISSP activities over the last 2 years. In addition respondents were asked to indicate extent of importance (ranging from 1 = not at all important to 5 = very important) that had been attributed to 5 ISSP integration mechanisms and 4 ISSP commitment measures. Finally, respondents were asked to indicate their perception of how IS function performance had improved over the last two years with respect to 5 measures of IS function performance rated on a five point scale (1 = major deterioration to 5 = major improvement). Table 3 lists the study's constructs and measures. Face or content validity of the instrument was established through an initial pilot study involving 2 senior IT executives, 2 chief executive officers, 2 strategy consultants and 5 academics.
Table 3: List of Constructs and Measures

<table>
<thead>
<tr>
<th>Emphasis placed on ISSP activities (ISSP Emphasis)</th>
<th>Establishing IS mission and objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assessing the impact of future technologies on the organization</td>
</tr>
<tr>
<td></td>
<td>Exploring opportunities for the competitive use of IT</td>
</tr>
<tr>
<td></td>
<td>Analysis of the current IT environment within the organization</td>
</tr>
<tr>
<td></td>
<td>Analysis of the external business environment and competitive trends relevant to IS</td>
</tr>
<tr>
<td></td>
<td>Analysis of the organisation’s business strategy and the identification of opportunities for the use of IS to support that strategy</td>
</tr>
<tr>
<td></td>
<td>Analysis of business processes that would benefit from IS</td>
</tr>
<tr>
<td></td>
<td>Developing a set of programs and plans for managing the IS function</td>
</tr>
<tr>
<td></td>
<td>Identifying and prioritizing projects</td>
</tr>
<tr>
<td></td>
<td>Establishing policies and plans for IS development and/or procurement related to those projects</td>
</tr>
<tr>
<td></td>
<td>Establishing policies and plans for infrastructure development</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integration Mechanisms (Integration)</th>
<th>Use of a steering committee consisting of IS, user and senior management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top management involvement in strategic IS planning</td>
</tr>
<tr>
<td></td>
<td>Participation of IS manager(s) in strategic business planning</td>
</tr>
<tr>
<td></td>
<td>Interaction between business and IS planners</td>
</tr>
<tr>
<td></td>
<td>IS planning linked to the approach, timetable and outcomes of strategic business planning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Commitment to ISSP (Commitment)</th>
<th>Inclusion of a proportionally high number of IS staff in the IS strategic planning team</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use of IS planning methodologies</td>
</tr>
<tr>
<td></td>
<td>Use of skilled IS planners</td>
</tr>
<tr>
<td></td>
<td>Large commitment of time and money to IS strategic planning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IS Function Performance (Performance)</th>
<th>Ability of the IS function to meet its organisational commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ability of the IS function to meet its goals</td>
</tr>
<tr>
<td></td>
<td>Ability of the IS function to react quickly to organisational needs</td>
</tr>
<tr>
<td></td>
<td>Quality of the IS function’s work product</td>
</tr>
<tr>
<td></td>
<td>Contribution of the IS function to overall business success</td>
</tr>
</tbody>
</table>

Table 4: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>No. of Items</th>
<th>Cronbach Alpha</th>
<th>Eigenvalue</th>
<th>Min. Factor Loading</th>
<th>Variance Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSP Emphasis</td>
<td>3.7071</td>
<td>.7633</td>
<td>11</td>
<td>0.93</td>
<td>6.595</td>
<td>.708</td>
<td>59.95%</td>
</tr>
<tr>
<td>Integration</td>
<td>3.8424</td>
<td>.8959</td>
<td>5</td>
<td>0.88</td>
<td>3.47</td>
<td>.817</td>
<td>69.44%</td>
</tr>
<tr>
<td>Commitment</td>
<td>2.9798</td>
<td>.9792</td>
<td>4</td>
<td>0.89</td>
<td>3.069</td>
<td>.789</td>
<td>76.73%</td>
</tr>
<tr>
<td>Performance</td>
<td>3.8480</td>
<td>.4842</td>
<td>5</td>
<td>0.79</td>
<td>2.773</td>
<td>.581</td>
<td>55.46%</td>
</tr>
</tbody>
</table>

4. Empirical Results

Descriptive statistics and Cronbach alphas are provided in Table 4. All alpha values are above 0.7 [17] and are considered acceptable for demonstrating scale reliability. In addition, factor analysis extracted single factors for ISSP emphasis, integration mechanisms and commitment, thus confirming construct validity (Table 4).

Table 5 shows the relative emphasis placed on the various strategic planning activities. Those activities receiving the most emphasis namely, “analysis of business processes that would benefit from IS”, and “analysis of the current IT environment within the organisation” point to the largely internally oriented nature of ISSP in South Africa. Externally focused activities such as “analysis of the external business environment and competitive trends relevant to IS” received limited emphasis. Similar to the discovery by Cohen [8] with regard to corporate mission, determining the mission and vision of IS was identified as the least emphasized activity in the ISSP process.

The mean emphasis of all 11 planning items was calculated for each case in order to provide an index of overall emphasis placed on ISSP activities (ISSP Emphasis). Similarly, the mean values of the 5 integration mechanisms (Integration), 4 commitment items (Commitment), and 5 IS function performance measures (Performance) were calculated. These mean values were then used in subsequent analyses. Missing values were replaced with a zero when calculating the means.

4.1 Hypotheses 1, 2, 4

Table 6 shows the results of a correlation analysis. Hypotheses 1, 2 and 4 are supported as the emphasis placed on ISSP activities was positively and significantly related to IS function performance improvement (P < 0.01) as was the relationship between integration mechanisms and IS function performance (p < 0.05) and commitment to ISSP and performance (p < 0.01). Thus additional empirical support has been provided for the argument that attention to planning produces positive improvements in performance. As should be expected ISSP emphasis had the strongest relationship with performance, thus the greater the emphasis placed on various ISSP activities the greater the likelihood for performance improvements. Use of steering committees, participation and interaction are also associated with performance improvements and are thus important mechanisms that IS planners should not ignore. Those firms that commit resources, personnel and rely on methodologies in order to ensure a more comprehensive and effective planning process should expect a return on such an investment through improved IS function performance.

Just over 1/3 of respondent organisations indicated that they had been conducting ISSP for less that 2 years. Thus the sample was subsequently split into those who have been conducting ISSP for 2 or more years (experienced planners) and those that have been conducting ISSP for less than 2 years (inexperienced planners). Although the literature suggests that planning experience and capability is important [50] no theoretical justification could be found for hypothesizing that experience moderated the relationships between the three planning dimensions and performance. However, it was still decided to test whether planning experience might moderate any of the relationships. Planning experience, however, was not found to moderate the relationships as z values were found not to be significant (Table 7) i.e. the correlations between ISSP emphasis, commitment, integration and performance are not significantly different for experienced and inexperienced planners. Performance improvements thus appear to accrue to all firms regardless of experience. Although not significant, it should be noted that, relationships were slightly higher for ISSP emphasis and commitment in the experienced group, but interestingly the integration-performance relationship was higher for the inexperienced group suggesting that planning inexperience demands higher levels of integration mechanisms.

4.2 Hypothesis 3

Following the recommendations of Hair et. al. [17], moderated regression analysis was used to examine the moderating effect of commitment on the ISSP emphasis – performance relationship.

Table 5: Relative Emphasis Placed on ISSP Activities

<table>
<thead>
<tr>
<th>Business Processes</th>
<th>Mean*</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.02</td>
<td></td>
</tr>
<tr>
<td>Current IT Environment</td>
<td>4.00</td>
</tr>
<tr>
<td>Projects</td>
<td>3.94</td>
</tr>
<tr>
<td>Business Strategy</td>
<td>3.90</td>
</tr>
<tr>
<td>Opportunity</td>
<td>3.82</td>
</tr>
<tr>
<td>Future IT Impact</td>
<td>3.70</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>3.61</td>
</tr>
<tr>
<td>Development/Procurement</td>
<td>3.53</td>
</tr>
<tr>
<td>External Business</td>
<td>3.47</td>
</tr>
<tr>
<td>Managing IS Function</td>
<td>3.46</td>
</tr>
<tr>
<td>Mission</td>
<td>3.37</td>
</tr>
</tbody>
</table>

* Missing values deleted listwise

Table 6: Relationship Between IS Function Performance and Planning Emphasis, Integration and Commitment

<table>
<thead>
<tr>
<th>IS Function Performance</th>
<th>ISSP Emphasis</th>
<th>Integration</th>
<th>Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>.451*</td>
<td>.230**</td>
<td>.397*</td>
<td></td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.01 level
** Correlation is significant at the 0.05 level

Table 7: Experience as a moderator

<table>
<thead>
<tr>
<th>Experience</th>
<th>Experienced* n=65</th>
<th>Inexperienced* n=35</th>
<th>Z value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSP Emphasis-Performance</td>
<td>.495</td>
<td>.351</td>
<td>0.82</td>
</tr>
<tr>
<td>Integration-Performance</td>
<td>.174</td>
<td>.227</td>
<td>0.24</td>
</tr>
<tr>
<td>Commitment-Performance</td>
<td>.435</td>
<td>.250</td>
<td>0.97</td>
</tr>
</tbody>
</table>

* Pearson correlation coefficient
Moderated regression requires the calculation of an interaction term that is then inserted into the regression equation as a predictor variable. The interaction term is calculated as the moderator multiplied by the predictor it is moderating. Results revealed that the interaction term between ISSP and commitment was not significant, thus hypothesis 3 was rejected. Multiple regression revealed, however, that commitment together with ISSP emphasis and integration is an independent predictor of performance (see Table 8).

Table 8: Multiple Regression of ISSP emphasis, integration and commitment on IS function performance

<table>
<thead>
<tr>
<th></th>
<th>Beta</th>
<th>T value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSP Emphasis</td>
<td>.427</td>
<td>3.200</td>
<td>.002</td>
</tr>
<tr>
<td>Integration</td>
<td>-.279</td>
<td>-2.016</td>
<td>.047</td>
</tr>
<tr>
<td>Commitment</td>
<td>.299</td>
<td>2.067</td>
<td>.042</td>
</tr>
</tbody>
</table>

Adj. $R^2 = 0.224$

4.3 Hypothesis 5

Figure 1 shows IS Function Performance per industry group. Interestingly, the lowest performance improvement exists in the construction, chemicals and non-mining industries which traditionally have never been information intensive industries and where the role of IS has been relatively less strategic [4]. The “other” category consisting predominantly of venture and development capital companies experienced the largest performance improvements. This is consistent with the need for these companies to grow and improve all organisational subsystems. In addition, all performance improvement mean values lie between the “no change” and “improvement” points on the scale, with no industry experiencing major improvements. This could point to maturation or leveling off of IT function performance improvements, with improvement becoming incremental rather than exponential in nature.

In order to test hypothesis 5, organisations were classified as high or low performers based on whether their mean value fell above or below the total mean performance improvement across all respondents (3.84). 47% of the organisations were classified as low performers with 53% classified as high performers.

Results of ANOVA testing for differences in planning emphasis, importance of integration mechanisms and commitment factors among high and low performers suggest that differences among high and low performers with respect to the three factors is significant (Table 9).

Figure 1: IS Function Performance per industry group
Key: 1=financial services, banking, insurance and assurance; 2=non-mining, chemicals, oils and construction; 3=healthcare, service, hotels and leisure, transport; 4=telecommunications, IT, media; 5=manufacturing and wholesale; 6=retail; 7=others

Table 9: ANOVA testing of differences between high and low performers

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df *</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSP Emphasis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>10.244</td>
<td>1</td>
<td>10.244</td>
<td>21.299</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>45.689</td>
<td>95</td>
<td>.481</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>55.932</td>
<td>96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>3.254</td>
<td>1</td>
<td>3.254</td>
<td>4.186</td>
<td>.043</td>
</tr>
<tr>
<td>Within Groups</td>
<td>75.408</td>
<td>97</td>
<td>.777</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>78.662</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commitment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between Groups</td>
<td>8.621</td>
<td>1</td>
<td>8.621</td>
<td>9.799</td>
<td>.002</td>
</tr>
<tr>
<td>Within Groups</td>
<td>85.338</td>
<td>97</td>
<td>.880</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>93.960</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* missing values deleted analysis by analysis
An analysis of means (Table 10) indicates that ISSP emphasis, integration and commitment are highest in the high performing group. Thus hypothesis 5 was supported.

Table 10: Mean values for High and Low Performers

<table>
<thead>
<tr>
<th>Group*</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSP Emphasis</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>3.3505</td>
</tr>
<tr>
<td>1</td>
<td>4.0032</td>
</tr>
<tr>
<td>Integration</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>3.6478</td>
</tr>
<tr>
<td>1</td>
<td>4.0113</td>
</tr>
<tr>
<td>Commitment</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2.6630</td>
</tr>
<tr>
<td>1</td>
<td>3.2547</td>
</tr>
</tbody>
</table>

* 0 = low performers and 1 = high performers

5. Conclusion

The information systems literature has been trying for a number of years to empirically demonstrate the validity of ISSP as a managerial activity. This is an increasingly important issue as organisations can ill afford to pursue activities that cannot be shown to improve organisational performance. A study of ISSP and IS Function performance in 100 listed public companies revealed that hypotheses relating emphasis placed on ISSP activities, planning commitment and integration mechanisms to IS function performance were supported.

In addition, it was found that those IS function's emphasizing the activities of strategic planning for information systems, that commit organisational resources in terms of time, money and personnel, and that work towards fostering the integration of the ISSP and BSP processes, significantly outperform those IS functions that do not. In addition, the study has added weight to the argument that experience in strategic planning is not needed before it can begin to yield results. Those firms who have only recently begun to undertake ISSP (less than 2 years) are experiencing performance improvements. Interestingly, integration mechanisms appear to be of slightly more importance to inexperienced planners, and it is suggested that inexperienced IS planners actively seek to encourage interaction between and reciprocal participation of business and IS planners in their respective planning activities.

The finding that commitment is an independent predictor of performance rather than a moderator suggests that, by relying on a methodology, by committing skilled planners to the process and investing resources in it, the process may gain more credibility, its output become more relevant, readily accepted and more amenable to effective implementation.

6. References


