3 An overview of Executive Information Systems research in South Africa

3.1 Introduction

Executive Information Systems (EIS) are designed to serve the needs of executive users in strategic planning and decision-making. Sometimes the terms "Executive Information Systems" and "Executive Support Systems" are used interchangeably (Turban *et al*., 1999). Definitions of EIS are varied but all identify the need for information that support decisions about the organisation (Papageorgiou and de Bruyn, 2011: 2). EIS can be defined as "a computerized system that provides executives with easy access to internal and external information that is relevant to their critical success factors" (Watson *et al*., 1997). As information technology (IT) and the global environment change, the variety of information to choose from by users for strategic planning and decision-making purposes, results in a major change for EIS implementation.

This chapter is organised as follows: The background to EIS implementation is given. EIS research studies undertaken in South Africa are then described. Some future EIS trends are then suggested.

3.2 Background to EIS implementation

A number of possible indicators for a successful information system (IS) have been suggested in various implementation studies – see, for example, Laudon and Laudon (1998). The definition of implementation includes the concept of success or failure. Implementation is a vital step in ensuring the success of new ISs.

The EIS implementation process is defined as the process used to construct an EIS in an effective manner (Srivihok, 1998). Different factors have been suggested by various researchers as influencing successful EIS implementation – see, for example, Rainer and Watson (1995). However, there is no agreement on which factors play key roles in EIS implementation. A large number of success factors have been repeatedly suggested by practitioners and researchers, even though empirical studies on the success factors are rare. There thus exists "a need… to document successful EIS development" and implementation (Papageorgiou and de Bruyn, 2011: 9).

EIS are high-risk application systems that are expensive to build and maintain (Strydwom, 1994). For example, in October 1997 the largest water utility in South Africa, Rand Water, took a decision to build an EIS (based on Oracle® products) and invested ZAR4,5m in revamping its IT infrastructure to support that deployment. In the case of Rand Water, the organisation's EIS eventually played a major role in providing its executives with benchmarking information helping them track Rand Water's overall performance against a set of objective criteria. In organisations such as Rand Water, an EIS can therefore assist "in the decision-making process" and be of "added value to their business" (Papageorgiou and de Bruyn, 2011: 9).

EIS are found in many organisations in South Africa. For example, in the recent survey by Papageorgiou and de Bruyn (2011: 7), these researchers report the existence of EIS in 25 listed Johannesburg Stock Exchange (JSE) organisations and the existence of 13 listed JSE organisations which plan to implement EIS.

3.3 EIS research undertaken in South Africa

A review of previously conducted EIS research at universities in South Africa is undertaken. From this collection, the nature of EIS research for each study is discussed. South African databases were searched for research literature (in the form of essays, technical reports, thesis, dissertations) with the keywords 'Executive Information Systems' in the research title. Ten successful 'hits' were found. Those research articles are reflected in chronological publication sequence in Table 1. The existence of a recent journal article (Papageorgiou and de Bruyn, 2011) dealing with EIS in listed JSE organisations is acknowledged but for the sake of selection consistency, this journal article does not satisfy the author's chosen report type classification.

No	Researcher(s)	Publication Date	Research title	Report Type	Qualification and Institution
1	DeWitt, P.	May 1992	Design and Implementation of Executive Information Systems (EISs)	Technical Report	B Com (Honours) – University of Cape Town
2	Twemlow, S., Hoffmann, U. and Erlank, S.	October 1992	An Assessment of the Penetration of Executive Information Systems in South Africa	Technical Report	B Com (Honours) – University of Cape Town
3	Strydom, I.	April 1994	Executive Information Systems: A Fundamental Approach	Thesis	Doctor Commercii (Informatics) – University of Pretoria
4	Steer, I.J.	January 1995	The Critical Success Factors for the Implementation of Executive Information Systems in the South African environment	Dissertation	M Com – University of Witwatersrand
5	Faure, S.	June 1995	The Impact of Executive Information Systems on the User	Essay	B Com (Honours) – University of Cape Town
6	Chilwane, L.	November 1995	Critical Success Factors for the Management of Executive Information Systems in Manufacturing	Research report	M Com – University of Witwatersrand
7	Khan, S.J.	February 1996	The Benefits and Capabilities of Executive Information Systems	Research report	MBA – University of Witwatersrand
8	Baillache, S.	April 1997	The Experiences Gained by Users of Executive Information Systems	Dissertation	MBA – University of Witwatersrand
9	Averweg, U.R.F.	December 2002	Executive Information Systems Usage: The Impact of Web-based Technologies	Dissertation	M Science – University of Natal
10	Ako-Nai, S.A.M.	July 2005	Executive Information Systems: An identification of factors likely to affect user acceptance, usage and adoption of the Unilever EIS	Dissertation	MBA – University of KwaZulu-Natal

Table 1: Research literature (essays, technical reports, thesis or dissertations) with the keywords 'Executive Information Systems'

The nature of each of the above ten EIS studies in South Africa is now briefly discussed.

- **Researcher No 1: Design and Implementation of Executive Information System (EISs)**
  DeWitt (1992) discusses critical success factors (CSFs) for E IS implementation IS development and states that the type of EIS for an organisation will depend on the information requirements of the organisation. It should be driven by the CSFs that are unique to a particular business. From previous studies, DeWitt (1992) identifies nine CSFs for an EIS (see Table 2) and notes that there "are differences of opinion in the literature regarding the selection of the right technology" as a CSF.

A committed and informed executive sponsor
An EIS driver
A clear link to business objectives
Carefully defined system requirements
Ensure feasibility of data availability
An active team approach to ensure spread to additional users
An evolutionary development approach
Quick response and user friendliness
Managing organisational resistance

Table 2: DeWitt's (1992) nine CSFs for an EIS

This study was undertaken with sixteen large Cape Town companies from various industry sectors. The findings from Watson's international survey (Watson *et al.*, 1991) were compared against the local (South Africa) survey findings. The findings indicate (1) congruences between the literature search and survey findings; (2) major conflicting results between the local survey, the international survey and literature search; and (3) major problems encountered in developing EIS.

- **Researchers No 2: An Assessment of the Penetration of Executive Information Systems**
  Twemlow *et al.* (1992) carried out an exploratory study that showed the extent of EIS penetration in South Africa. The sample (61 companies) was selected from the 1992 Financial Mail survey (a reputable weekly financial publication) of "top" companies in South Africa. The research instrument was designed to evaluate EIS as a significant business trend, the extent of penetration of this trend in the organisation and perceived impact on the business. From these researchers' findings, the problems experienced by companies during the implementation and use of their EIS is reflected in Table 3.

Complex information needs of EIS users
Changing needs of EIS users
Insufficient management support
Lack of clarity of EIS purpose
Data availability
Failure to incorporate EIS into management processes
Hardware compatibility
Software compatibility
Unexpected increase in costs
Failure to meet the user's expectations

Table 3: Problems with Implementation and Use of EIS
(Source: Adapted from Twemlow *et al.*, 1992)

Twemlow *et al.* (1992) suggest that even though studies have been performed to determine the nature of executive work and their information requirements, there is still uncertainty in this area. Twemlow *et al.* (1992) note that "it is IS usage not surprising" that the first two out of the top four problems associated with EIS implementation were concerned with the complex and changing executive information needs.

- **Researcher No 3: Executive Information Systems: A Fundamental Approach**

  Strydom's (1994) research investigated the problems concerning EIS "from a fundamental research perspective". Based on the results of the research an augmented EIS was proposed and referred to as a Computer Supported Executive System (CSES). Strydom (1994) discussed the role of training in successful implementation of IS and focuses on computer supported learning for EIS.

- **Researcher No 4: Critical Success Factors for Executive Information Systems Implementation**

  Steer's (1995) study used the findings of research undertaken by Harris (1993) and others. The basis of Steer's research "was to identify the critical success factors for the successful implementation of an Executive Information System…where an EIS had been implemented". Seventeen well-established organisations in Gauteng (a province in South Africa) that have EIS experience were targeted and surveyed. The analysis of Steer's findings indicate twenty one major concepts that were raised by interviewed respondents in relation to the CSFs for implementing EIS. The top ten CSFs (in descending order) that were identified in this study for the successful implementation of EIS are reflected in Table 4.

Concept
An EIS needs a project champion
An EIS must support the cross-functional integration of information
An EIS has to link to the organisation's business strategy
An EIS should be implemented using a phased approach
An EIS project champion should be a steering committee rather than one person
Resistance from the information users must be managed
An EIS must have the capability to access external information
Resistance from the information providers must be managed
The project champion should change during the project
An EIS must support "drill down" facilities

Table 4: The Top ten CSFs for the Successful Implementation of EIS
(Source: Adapted from Steer, 1995)

Steer indicates that although "the remaining 11 concepts of the 21 discussed during the research are not the most important critical success factors of implementing an EIS, they are still important, and should therefore be considered when implementing an EIS". Steer (1995) labels these CSFs as 'secondary' CSFs for the successful implementation of EIS. These secondary CSFs are reflected in Table 5.

Concept
An EIS should be made available to everyone
An EIS must have "what if" and simulation facilities
Resistance from IT people must be managed
An EIS must support trend analysis
The user must be able to interact with and manipulate the information
An EIS must support exception reporting
It must be possible to track actuals against plans
An organisation must develop a formalised business strategy before it embarks on an EIS project
An EIS must have a good graphical user interface
An EIS should be for executives only
An EIS must be able to access financial information

Table 5: Secondary CSFs for the Successful Implementation of EIS
(Source: Adapted from Steer, 1995)

- **Researcher No 5: The Impact of Executive Information System on the User**
  The focus of Faure's (1995) research was to highlight "the key features of an EIS, the benefits that can be achieved from implementing an EIS and the development methodologies that can be adopted to achieve success in the implementation of an EIS".

- **Researcher No 6: Critical Success Factors for the Management of Executive Information Systems in Manufacturing**
  The aim of Chilwane's (1995) research was "to identify those critical issues, which when managed properly, will ensure that the system remains providing and meeting the needs of the executives. Ten interviews were conducted from business organisations in order (*sic*) identify these factors". Table 6 reflects the CSFs for managing an operating EIS "as seen by respondents who organisations have implemented EIS" (Chilwane, 1995). Chilwane (1995) states that ensuring "that these factors are monitored will contribute to sustaining the investment an organisation has made in this technology".

Executives or users should provide regular feedback on the EIS either formally or informally
Continued alignment of EIS ensures that the system remains useful to the users
Continued executive involvement ensures success of the system
An EIS should be flexible to accommodate the dynamic business environment
As EIS spreads new requirements should be reflected in the system
ISD should provide somebody who knows the business to look after the users
An EIS should help individual managers to monitor their individual CSFs
EIS data should always be consistent with the operational data it summarises
There should be prompt attention to user queries and requirements
An EIS should be portable ie. loaded on a notebook and accessed offline

Table 6. CSFs for the management of an operating EIS
(Source: Adapted from Chilwane, 1995)

- **Researcher No 7: The Benefits and Capabilities of Executive Information Systems**
  The objective of Khan's (1996) research was to identify and evaluate the organisational benefits derived from EIS and to establish which of its capabilities contribute to the realisation of the benefits. Khan (1996) notes that a major problem when implementing an EIS is determining the information requirements for the system (Watson and Frolick, 1993). For these researchers a major developmental problem is determining the information to include in the system.

Khan (1996) notes that practitioners find it difficult to get executives to specify what they want and to keep abreast of executives' changing information desires and needs. Khan's (1996) findings identify six major benefits of EIS and five major capabilities of EIS.

- **Researcher No 8: Experiences Gained from Executive Information Systems**
  Baillache's (1997) research investigated the experiences gained by South African users of EIS. The results are seen as important in identifying problem areas that negatively affected the evolution of EIS in South Africa. Some thirty companies participated in this survey. Four users from each company surveyed were requested to complete a questionnaire.

  This researcher's findings indicate that (1) some important capabilities had been omitted in systems; (2) users expectations of benefits were far greater than benefits delivered; (3) key CSFs did not occur during the implementation of the project; and (4) the growth of the system by new users was not strongly correlated to the CSFs. Baillache's (1997) summary of results of CSFs implemented is reflected in Table 7.

	CSFs Implemented
CSFs supported by the research	Having an executive sponsor on the project System reliability was ensured Quality data The skills of the system designers
CSFs not supported by the research	Having an operating sponsor on the project Local representation of software companies for support
New CSFs which emerged from the research	There was a clear link between the EIS and business objectives Appropriate resources were used from the information systems function Appropriate technology was used Users specified their own information requirements The first deliverable by the ITD was information that was highly valuable The EIS contained information of much value to me The EIS was implemented as quickly as possible The hardware used was reliable Pilot sites were used in the implementation

Table 7: Summary of results of CSFs implemented

- **Researcher No 9: Executive Information Systems Usage: The Impact of Web-based Technologies**
  The objective of Averweg's (2002) study was *inter alia* to identify and rank Web-based technologies in order of their perceived future impact on EIS.

  Only 6.4% of organisations surveyed reported that it is unlikely that the Intranet will impact future EIS implementations. Almost half of organisations surveyed reported that it is unlikely that e-Commerce (Business-to-Consumer) will impact future EIS implementations. WAP and other mobile technologies have similar unlikely future impact levels. It is striking to note that 67.7% of respondents indicated that it is *extremely unlikely* that other technologies (such as portal) will impact future EIS implementations. There was a positive impact level trend for all Web-based technologies on future EIS implementations. The largest trend increase was the Intranet rising from 32.2% to 87.1%. Averweg (2002) suggests that this "should occur as the use of Web-based technologies in the distribution of information becomes more widespread".

- **Researcher No 10: Executive Information Systems: an identification of factors likely to affect user acceptance, usage and adoption of the Unilever EIS**
  The focus of Ako-Nai's (2005) research was "…to investigate and identify potential factors that are likely to affect user acceptance, usage and adoption of an EIS implemented by Unilever South Africa. The research investigation was based on a proposed model derived from Davis (1989) Technology Acceptance Model (TAM) that explores the phenomena of 'perceived usefulness' and 'perceived ease of use', as drivers of user acceptance and illustrates the dynamics of the factors that affect the users' acceptance of the system". Ako-Nai used a case study approach. It should be noted that during the research period, the EIS in Unilever was "…at its earliest stage of diffusion in the company".

  This researcher's findings indicate that (1) users' attitudes towards usage of the Unilever EIS are positively influenced by both their 'perceived usefulness' and 'perceived ease of use' of the system; (2) Unilever EIS users' 'perceived usefulness' of the system positively influences their 'perceived ease of use' of the system; and (3) Unilever EIS users' 'perceived ease of use' of the system has a greater influence on their attitude towards the system usage than their 'perceived usefulness' of the system.

3.4 Discussion of previous EIS research undertaken in South Africa

From Table 1, four EIS researchers (Nos 1, 4, 6 and 8) dealt with CSFs for EIS implementation. A synopsis of the results and findings indicates that there is no consistent 'shopping basket' of CSFs for EIS implementation for use by South African practitioners.

Like other systems, EIS are constantly changing. Khan (1996) suggests an investigation into new technologies being employed in the IT area and "to what extent advances in technology have influenced… EIS". Khan's (1996) EIS research "identified the employment of new technologies as the most important future trend of EIS". The EIS research undertaken by Averweg (2002) serves to fill that gap.

The Web serves as the foundation for new kinds of IS (Laudon and Laudon, 1998). As the Web grows in direct usage by executives, existing EIS implementation models may need to be revisited. While there is no single listing of key variables for EIS success factors (Rainer and Watson, 1995), strong human factors are nevertheless associated with EIS research. These are influenced by cultural, political and other 'soft' human factors. South Africa has "diverse cultures, languages, religions, races and social backgrounds" (Papageorgiou and de Bruyn, 2011: 5). It is therefore neither possible nor valid to generalise experiences on other continents to South Africa's conditions. This makes relevant local studies (in South Africa) of EIS implementation and usage.

3.5 Future EIS trends

IT is more than just computer systems and it is rapidly changing and developing, especially due to the Web, altering the way in which an IS is built. With the Internet, information is no longer a scarce resource. It has changed the way in which organisations are doing business and the way in which they compete.

The environment for EIS is undergoing upheaval based on the emergence of Web-based technologies. The following trends for EIS implementation are envisaged:

- data warehouses store data that have been extracted from the various operational databases of an organisation over some years. The intrinsic design of the Web resembles that of a data warehouse bringing access to data collected and provided by a host of users outside a specific organisation. The immediacy of the Web is *not* seen as a factor for improved decision-making since EIS are rarely used by executives in emergency or critical time-modes;
- with the increasing amount of IS investment and substantial evidence of failures (Remenyi and Lubbe, 1998), many managers and researchers feel that IS justification and evaluation has become a key management issue. It is contended that wise judgement is needed when deciding on the selective use of IS and feel that this is particularly relevant to EIS in South Africa;
- there will be a significant degree of EIS diffusion to lower organisational hierarchical levels and use by these lower levels. EIS in organisations will spread to managers at various levels such as functional areas and other levels of management (Singh *et al*., 2002). This will be in keeping with international trends where EIS are being diffused in organisations as EIS is becoming less strictly defined to support professional decision-makers throughout the organisation. Web-based technologies have enabled EIS to become available to more management levels in the organisation;
- the Web browser has become the common interface to end-user access. While applications can now be accessed by browsers, the capabilities long associated with decision support software are still found (Averweg and Erwin, 2000). Nowadays vendors of decision support software are making their products Web-enabled;
- Xu *et al*. (2003) suggest that the internal information orientation is the main reason for dissatisfaction with EIS. In order to overcome this dissatisfaction, it is felt that greater use will be made from data from *external* sources (for an organisation's CSFs);
- special care will be needed when implementing EIS because of its major potential importance to an organisation's performance – for example, by "creating a competitive edge and [for] adding strategic value" (Papageorgiou and de Bruyn, 2011: 9). Failure can lead to long delays in further attempts to use such technology effectively; and
- in the United States of America (USA), nowadays the term EIS is used infrequently. In the USA, EIS has now become part of Business Intelligence (BI). BI includes the functions of EIS but the emphasis is now on analytics. The trend is to include functionality such as predictive analysis, data mining, *etc* (Turban, 2011).

Generally speaking, this trend is particularly useful for IS practitioners in the planning of future EIS implementations in organisations in South Africa. Specifically this information may be of assistance to those 13 listed JSE organisations (as surveyed by Papageorgiou and de Bruyn, 2011) which plan to implement an EIS.

3.6 Conclusion

An understanding of Web-based technology taxonomies is important to EIS researchers and practitioners. Organisations must "start simple, grow fast" (McKenna Group, 1999) using technologies that will enable it to build on what it has, link to legacy systems, rather than throwing away what has been achieved and developed through each new innovative enhancement iteration. All innovation is now driven by technology in some way (Cramm cited in Papageorgiou and de Bruyn, 2011: 5). EIS will be impacted by these change catalysts as EIS become integrated with Web-based technologies not specifically designed for EIS usage.

EIS is going through a major change to take advantage of Web-based technologies in order to satisfy information needs of an increasing group of users (Averweg and Roldán, 2006). Web technologies are often not just a single technical solution, rather a host of an industry specific with inter-connective capabilities that pull together people, processes and technology infrastructure. EIS is being catalysed through a major change as technical barriers disappear.

3.7 References

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