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Survey of executive information systems in well-established organizations in KwaZulu-Natal

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1 Introduction

Information systems (IS) at strategic decision-making levels are commonly characterized as being 'executive'. Executive information systems (EIS) are a computer-based technology designed in response to the specific needs of executives (Turban, Rainer and Potter 2005). IS that support decisions made by executives and top level managers therefore require careful planning both in their features and their applicability to organizational situations. EIS applications support executive information needs and decision-making activities (Gillan and McPherson 1993). An effective way to evaluate the success of EIS is to obtain opinions from the executive users (Monash University 1996). This article presents the results of detailed interviews on EIS in a sample of large well-established organizations in KwaZulu-Natal. It contributes to the existing body of knowledge on EIS in this province as no other investigations of similar nature have been conducted. It investigates all issues related to EIS for the first time in KwaZulu-Natal and compares the findings published in other countries.

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2 Background to executive information systems (EIS)

EIS systems grew out of the information needs of executives and are designed to serve the needs of users in strategic planning and decision-making (Averweg and Roldán 2004). Executives deal mostly with ill-structured decision-making (Lee and Chen 1997). Definitions of EIS are varied (see, for example, Carlsson and Widmeyer 1990; Watson, Rainer and Koh 1991; Westland and Walls 1991; Millet and Mawhinney 1992; Rainer, Snider and Watson 1992; Turban *et al*. 2005). All definitions identify the need for information that supports decisions about the business as the most important reason for the existence of EIS (Khan 1996). In this article, EIS are 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, Houdeshel and Rainer 1997).

The terms 'executive information systems' and 'executive support systems (ESS)' are sometimes used interchangeably (Turban *et al.* 2005). However, ESS usually refers to a system with a more extensive set of capabilities than EIS (Mallach 1994). Watson *et al.* (1991) report that these extra capabilities include the provision of data analysis capabilities [e.g. spreadsheets, query languages and decision support systems (DSS)] and the provision of organization tools (e.g. electronic calendars, personal information filing and management). EIS may include analysis support, communications, office automation and intelligence support (Turban *et al.* 2005). Business intelligence (BI) is a broad category of applications and techniques for gathering, storing, analysing and providing access to data to help users in organizations make better business and strategic decisions (Oguz 2003). Many software vendors provide ESS/DSS integrated tools that are sold as part of a BI suite (Turban, McLean and Wetherbe 2004).

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3 Executive information system constituencies

Some studies suggest that EIS should not only be accessed by executive users (see, for example, Volonino, Watson and Robinson 1995; Rai and Bajwa 1997). These researchers suggest that EIS should be viewed as technology to be used to solve major business problems arising from global competitive and recessionary forces. Salmeron (2001) label EIS as the technology for information delivery for all business end-users. The non-executive users or data providers include personnel from functional areas that include treasurers, accounting managers and controllers. It is evident that EIS require continuous input from three different

stakeholder groups (known as constituencies):

- EIS executives/users;
- EIS providers (i.e. persons responsible for developing and maintaining the EIS); and
- EIS vendors or consultants.

These constituencies were used in the authors' data sampling.

EIS are high-risk information technology (IT) investments. With the emergence of global information technology (IT), existing paradigms are being altered, which are spawning new considerations for successful IT implementation (Averweg and Erwin 2000). Web-based technologies are causing a revisit to existing IT implementation models, including EIS. The World-Wide Web (the Web) is 'a perfect medium' for deploying decision support and EIS capabilities on a global basis (Turban *et al.* 2005). Web technologies allow integration of information via Web sites that can be linked to corporate databases to provide real-time access to information (Looney and Chatterjee 2002). While current generation EIS are useful in identifying problems and opportunities, the authors contend that future generation EIS implementations in organizations are likely to be significantly impacted by the Internet and Web-based technologies.

To survey the current state of EIS implementations in organizations in KwaZulu-Natal, the authors developed a questionnaire.

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4 Survey instrument development

The questionnaire was validated using expert opinion. It was based on previous instruments used in published research papers. Particular attention was given to Straub's (1989) guideline of a pretest for the technical validation of the research instrument. This validation included the use of 'previously validated instruments wherever possible' (Straub 1989). Watson and Frolick (1993) note that numerical information comes from the questionnaire. The findings of the authors' survey will be based on the survey instrument.

As a preamble to the interview, the classification of the various types of IS and the distinguishing characteristics of EIS were discussed with each interviewee. A working definition of EIS (as used earlier in this article) was also given. This preamble to the actual interview meant that the interviewee was properly focused on the EIS in the organization. Questionnaires usually comprise sections (Remenyi, Williams, Money and Swartz 1998). The authors' survey instrument consisted of two parts:

- Section 1 dealt with an organization's demographics. Questions were extracted from the Roldán (2000) EIS questionnaire, translated from Spanish to English and adapted for the authors' survey. The measurement of demographic variables of interest was consistent with prior research in sociology and organizational behaviour (Venkatesh and Morris 2000); and
- Section 2 dealt with the attributes of the organization's EIS. Questions were extracted from the Roldán (2000) EIS questionnaire, translated from Spanish to English and adapted for the authors' survey.

Pre-testing a survey instrument is common practice. Roldán and Leal (2003) report that their 'instrument was pre-tested with consultants and business and IS professors'. Pre-testing of the questionnaire needs to be undertaken before it is finally admitted (Remenyi *et al.* 1998). A similar process was undertaken and experienced by the authors who solicited expert opinion

for 'additions, modifications and/or deletions to the survey' instrument.

A pilot study was conducted to ensure that the interview schedule was clear, intelligible and unambiguous. To evaluate the initial questionnaire design, an executive who used EIS and four academics participated in separate field tests. Their comments led to a refinement of the questionnaire instrument. Their contributions are gratefully acknowledged. The survey instrument was submitted to three EIS software vendors [Cognos, JD Edwards (now part of PeopleSoft) and ProClarity] in South Africa. A senior employee (e.g. managing director) from each vendor independently furnished some suggestions regarding the survey instrument. Some appropriate suggestions were adopted by the first author and incorporated in the survey instrument.

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5 Data collection

A formal extensive interview schedule was compiled and used for the semi-structured interviews. No questionnaires were sent in advance to respondents. Thirty-one interviews were conducted by the first author during the period May to June 2002.

The sample was selected using the unbiased 'snowball' sampling technique. Cooper and Emory (1995) state that this technique has found a niche in recent years in applications where respondents are difficult to identify and are best located through referral networks. The snowball sampling technique was also adopted by Roldán and Leal (2003) in their EIS study of organizations in Spain.

Organizations considered for interview were chosen over a spread of industries (e.g. banking, manufacturing, metropolitan municipality, retail). Using the snowball sampling technique, the authors targeted 31 sizeable and well-established organizations with EIS experience in the eThekwini Municipality Area (EMA) of KwaZulu-Natal. EMA is the most populous municipality in South Africa (SA2002–2003 2002). Its geographic area size is 2300 km^2 with a population of 3,09 million citizens (Statistics South Africa 2001). The authors' survey of organizations in KwaZulu-Natal that have implemented EIS was confined to the EMA.

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6 Data analysis and interpretation of the results

From the 31 interviews conducted using the authors' survey instrument, 31 completed questionnaires were analysed. Frequency tables were constructed. Such approaches are common in EIS research (see, for example, Salmeron, Luna and Martinez 2001; Roldán and Leal 2003). The authors adopted a similar descriptive statistical process.

6.1 Demographics of organizations participating in the study

From a tally of interviewees' responses, the organizations participating in the study belonged primarily to the manufacturing (22,6%) and financial services (19,5%) sectors. The prominence of these two sectors is also reported in the Spanish EIS survey by Roldán and Leal (2003). The corresponding Spanish activity sector percentages are manufacturing (37,1%) and banking/financial services (24,3%).

Regarding the number of permanent employees in organizations surveyed, 20 (64,5%) of these organizations had more than 500 employees. This percentage compares favourably with the Spanish EIS survey percentage of 71,0% (Roldán and Leal 2003; Averweg and

Roldán 2004).

According to the number of years of existence of organizations surveyed, 28 (90,3%) of organizations surveyed had existed for more than a decade. This suggested that these organizations were well-established in the EMA. The only surveyed organization that existed for less than five years was from the IT services sector.

The classification of organizations surveyed showed that 35,5% were publicly listed companies, 29,0% were private and 19,3% were government related. It suggests that the existence of EIS in organizations was not limited to a single organizational classification. As EIS differ considerably in scope and purpose 'the primary purpose of the system will change from one organization to another' (Roldán and Leal 2003).

An alphabetic inventory of interviewee's job titles showed that some interviewees had identical job titles (director, managing director, regional manager and systems analyst). Twelve (38,7%) interviewees held IT positions in organizations surveyed. The authors objectively classified respondents into one of three stakeholder groups: EIS executive/business end-users (64,5%), EIS providers (22,6%) and EIS vendors or consultants (12,9%). From an analysis of interviewee's responses, 29 respondents indicated that they were EIS users in their organizations. Two respondents reported that they were EIS implementers.

This concludes the analysis and findings of the interviewee's responses to Section 1 of the authors' survey instrument. Interviewees' responses to the questions in Section 2 of the survey instrument are now analysed and discussed.

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6.2 EIS in respondent's organization participating in study

Roldán and Leal (2003) surveyed organizations whose EIS were 'operative or in an implementation stage sufficiently advanced'. In the authors' survey, 87,1% of the organizations had their EIS operational, while 9,7% had it under development and one case was reported as a failure. This failure was ascribed to the most *recent* EIS implementation.

From the 27 operational EIS in use by executives/business end-users in the organizations surveyed, one used the system within three days, another four within a month and three within 24 to 36 months. The average time taken before the EIS was in use by executives and business end-users was 9,01 months. This compared favourably with the Roldán and Leal (2003) average time of 8,53 months. Salmeron *et al.* (2001) report that the development of an EIS (in Spain) usually takes six to 12 months. These average times should be considered long term when compared with previous studies (Watson *et al*. 1991; Park, Min, Lim and Chun 1997), which could negatively affect users' acceptance of the system (Young and Watson 1995).

Pervan and Phua (1997) report that the ability to access current status information, such as performance reports, is the main feature most highly used by executives in obtaining the day-to-day information needed for their decision-making. According to the authors' results, the two highest scoring EIS applications used in respondents' organizations confirmed the Australian EIS survey findings. Jones (2002) notes: 'Executives need to be able to draw upon corporate knowledge and make decisions based on hard facts, not assumptions.'

The hierarchical employee levels where EIS was used in organizations surveyed were also analysed. Middle managers showed significantly higher EIS utilization levels (77,4%) than

top managers [managing director/chief executive officer (45,2%) and director (58,1%)]. This middle manager utilization level (77,4%) corresponded with the Liang and Hung (1997) survey but was higher than the Roldán and Leal (2003) middle manager survey result of 68,6%. While Roldán and Leal (2003) report a 'close similarity' between EIS utilization by middle managers (68,6%) and EIS utilization by managing directors (70,0%), this similarity was not evidenced by the authors' findings.

According to the authors' findings, 12 (38,7%) were business end-users and one (3,2%) financial consultant below the line manager hierarchical level. The total percentage (41,9%) of these EIS users was significantly higher than the Roldán and Leal (2003) survey of 21,4% (Averweg and Roldán 2004). This suggests that the degree of EIS diffusion to lower organizational hierarchical levels and utilization by these levels in organizations surveyed in KwaZulu-Natal was on par with organizations surveyed in Taiwan, but was significantly higher than experienced by organizations in Spain. As Liang and Hung (1997) note, a 'reason for this may be the extension of EIS to everybody information systems' (sic). EIS are becoming less strictly defined to support professional decision makers throughout the organization (Turban and Aronson 1998). Turban and Aronson (1998) state that 'there is now [an] increasing number of tools designed to help functional managers (finance, marketing); these tools are integrated with EIS'.

The functional areas where EIS are used in organizations were investigated as well. The highest scoring functional areas were finance (64,5%) and marketing (64,5%). The lowest scoring functional area was personnel (16,1%). Therefore, the functional areas where EIS were used in organizations surveyed were quite broad. Similar broad findings are reported by Liang and Hung (1997) in organizations surveyed in Taiwan.

The results on the different types of information held by EIS in an organization showed that financial information (90,3%) appeared as the most important item, followed by business/sales (74,2%) and then strategic planning (35,5%). In the Roldán and Leal (2003) survey, the three highest ranking types of information held by an EIS in an organization were commercial and sales information (89,2%), financial information (65,7%) and production information (55,7%). While previous research studies agree in presenting these three types of information (sales, financial and production) as the most relevant ones (Allison 1996; Kirlidog 1997), the authors' survey partially supported these findings with business/sales (74,2%) and finance (90,3%) types of information. Holding strategic planning information in EIS appeared to have a higher importance in organizations in KwaZulu-Natal than holding production information.

Regarding the different types of sources of information that support an EIS in an organization, one of the capabilities or characteristics of EIS is the filtering, organization and consolidation of multiple data sources. These quantitative data stem from corporate databases (80,6%) and operational databases (64,5%). Data aggregation takes place when data from various sources are integrated to provide critical information requested by decision makers (Liang and Hung 1997).

The approach taken for EIS development varies. In-house development with assistance from the vendor (38,7%) was the most common approach taken. A 'piece meal' strategy, where in-house EIS development with critical features was conducted initially and then operational features were added over time using existing or purchased software tools, was preferred (33,0%) most by organizations surveyed in Australia (Pervan and Phua 1997). A similar pattern (29,0%) was evidenced in organizations surveyed in KwaZulu-Natal.

Roldán and Leal (2003) report a 'low number of cases in which the systems have been developed with software produced by the organization itself (5,7%)'. In the authors' survey,

in-house development using existing software tools was somewhat higher (19,4%). A possible explanation is that some organizations surveyed may not yet have migrated from their first (in-house developed) EIS.

Cognos was the most frequently (60,0%) reported commercially packaged EIS software tool. It was followed by JD Edwards and Oracle (13,3% each), Hyperion and Lotus Notes (1,0% each), Pilot and Business Objects (6,7%) and others. Roldán and Leal (2003) found that 'Commander from Comshare (39,1%), DSS Agents from MicroStrategy (21,9%), Forest & Trees from Platinum Technology (15,6%) and Focus/EIS from Information Builders (10,9%)' were the popular EIS software tools in organizations surveyed in Spain. From the authors' results and the Spanish survey findings it appears that little use was made of ERP software with EIS features. EIS products 'tend to be included in larger software systems, becoming a module integrated in quite a few ERP systems such as SAP' (Roldán and Leal 2003). However, the authors' findings suggesed that there was a strong *usage* preference for commercially purchased EIS software tools (as opposed to ERP software with EIS features) by organizations surveyed in KwaZulu-Natal.

The authors found that frequent (several times per day) and regular use of the EIS were reported by a total of 25 (80,6%) respondents. In the survey of EIS applications in Taiwan, Liang and Hung (1997) state that 'over half of the respondents reported using their systems every day. Twenty-two percent used the system very often'. Liang and Hung (1997) report that organizations with EIS 'rely heavily on their systems for support decision making'. In the authors' survey, some respondents reported different EIS use frequencies during the month (e.g. higher EIS use during month end). One respondent stated 'First week of month is a lot busier. Towards end of the month not more than an hour'. An EIS has the effect of multiplying the frequency of use (Palvia, Kumar, Kumar and Hendon 1996). The low EIS use frequencies could be ascribed to the fact that three EIS implementations in organizations were under development and implementation.

There is little information available to assist practitioners regarding the question of how to minimize the risk of EIS failure (Watson *et al.* 1991). Watson and Glover (1989) carried out a study of 21 EIS failures. From their findings they identified the following factors that contribute to EIS failure: inadequate or inappropriate technology, failure of the system to meet user needs, lack of executive commitment and executive resistance to technology. In the Pervan and Phua (1997) study of EIS failures in organizations surveyed in Australia, inadequate or inappropriate technology was reported as being the major EIS failure factor. During the authors' interview of the respondent who reported that his most recent EIS implementation was unsuccessful, the interviewee cited that 'there were some political reasons for its failure'. At first glance this finding appeared inconsistent with the Watson and Glover (1989) and the more recent Pervan and Phua (1997) studies.

This concludes the analysis and findings of the interviewee's responses to Section 2 of the authors' survey instrument.

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7 Some concluding remarks

The Web is the ideal medium for deploying decision support capabilities, such as EIS, on a wide basis in organizations. The Web is an incredibly rich source of BI (Turban *et al*. 2004). In organizations, new Web-based architectures may replace old architectures or they may integrate legacy systems into their structures . As the usage of IT increases, Web-enabled IT can provide the means for greater access to information from disparate computer applications and other information resources (Eder 2000). Decisions at all levels in the organization

contribute to the success of a business. There exists a high degree of similarity between the characteristics of a 'good EIS' and Web-based technologies (Tang, Lee and Yen 1997).

EIS is now clearly in a state of flux. As users need systems that provide access to diverse types of information, there is both scope and need for research in the area of future EIS implementations being impacted by Web-based technologies. The authors' survey of the current state of EIS in organizations in KwaZulu-Natal provides such a suitable landscape.

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