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# IT CONTROL IN THE AUSTRALIAN PUBLIC SECTOR: AN INTERNATIONAL COMPARISON

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## Abstract

*Despite widespread adoption of IT control frameworks, little academic empirical research has been undertaken to investigate their use. This paper reports upon research to benchmark the maturity levels of 15 key IT control processes from the Control Objectives for Information and Related Technology (COBIT) in public sector organisations across Australia. It also makes a comparison against a similar benchmark for a mixed sector group from a range of nations, a mixed sector group from Asian-Oceanic nations, and for public sector organisations for all geographic areas. The Australian data were collected in a mail survey of the 387 non-financial public sector organisations identified as having more than 50 employees, which returned a 27% response rate. Patterns seen in the original international survey undertaken by the IS Audit and Control Association in 2002 were also seen in the Australian data. However, the Australian public sector performed better than sectors in all the international benchmarks for the 15 most important IT processes.*

*Keywords: IT control, public sector, Australia, IT governance, COBIT.*

# 1    INTRODUCTION

Information Technology (IT) is a rapidly changing area that is accompanied by uncertainty and risk. As the IT environment becomes more dynamic and complex, it is a difficult and frustrating area to manage (Hardy 2002; Tyler 2000). Consequently, dependency on IT requires effective IT governance from management. IT governance is important because the expectations of IT and reality often do not match (Guldentops 2001).

IT governance is considered to be part of corporate governance (Dellit 2002; Hamaker 2003; Machin 2002), and focuses on the strategic alignment of using IT to achieve business goals and objectives. The importance of IT governance to corporate governance is evidenced by an emerging understanding that the most significant IT issues for the near future in both the private and the public sector are not technology-related, but governance-related (Guldentops 2002). Effective IT governance requires control over IT processes (Payne 2003; Rao 2003).

IT processes cover the setting of objectives, giving direction on how to attain objectives and measuring performance in completing these activities (Korac-Kakabadse & Kakabadse 2001). To improve the overall performance of IT and reduce the failure caused by inappropriate IT activities, there is a need for careful design, planning, acquisition and implementation of IT to manage its various activities and risks (Beaumaster 2002; Hardy 2002). It is important to properly manage IT resources through a set of IT processes that provide the information that the enterprise needs to achieve its objectives (Payne 2003).

Effective control over IT processes will help achieve efficient IT governance. Control is considered as "…[t]he policies, procedures, practices and organisational structures designed to provide reasonable assurance that business objectives will be achieved and that undesired events will be prevented, or detected and corrected" (IT Governance Institute 2000 Executive Summary, p. 9). Control frameworks have been developed to help ensure that the IT control processes implemented in an organisation are complete.

# 2    BACKGROUND

## 2.1    Control frameworks

A control framework is "a recognised system of control categories that covers all internal controls expected in an organisation" (IIARF 2002).

Two distinct classes of control frameworks have been recognised (Bae, Epps & Gwathmey 2003); the business focused control frameworks and the more IT focused control frameworks. Business focused control frameworks include *The Committee of Sponsoring Organisations of the Treadway Commission* (COSO), *Statement on Auditing Standards* (SAS) No. 55 and SAS No. 78. IT focused control frameworks include *The IT Infrastructure Library* (ITIL) (an influential set of guidelines on best practices for IT service management), *The International Organisation for Standardisation*/the *Electrotechnical Commission* (ISO/IEC 17799:2000) and the *Security Code of Conduct* from the UK Department of Trade and Industry (Colbert & Bowen 1996; IT Governance Institute 2000; Machin 2002).

As it has become necessary for IT to become an integral part of the business (Lainhart IV 2000), a third class of control frameworks, which align control over IT with business objectives, is desirable. *Control Objectives for Information and Related Technology* (COBIT) is a framework that focuses on the alignment of IT control and the achievement of business goals (Bae *et al.* 2003; Colbert *et al.* 1996).

## 2.2 COBIT

COBIT, produced by the IT Governance Institute, is focused exclusively on controls over IT in support of business processes (Colbert *et al.* 1996). It bridges gaps between business risks, control needs and technical issues by "…offering a baseline of IT controls that relate directly to…business objectives" (Lainhart IV 2001a, p. 21). COBIT "delivers a global perspective on IT governance best practices" (Lainhart IV 2000, p. 8), and was developed from "41 international source documents" (Lainhart IV 2001b, p. 20).

The literature available on COBIT is overwhelmingly practitioner in orientation, rather than academic (Ridley, Young & Carroll 2004). Even though little published literature on COBIT is available that is independent of the IT Governance Institute (Ridley & Carroll 2003), its widespread adoption internationally, both in the public and private sectors, demonstrates its acceptance and credibility. As public sector examples, COBIT has been referenced as the basis for its IT control framework by the *United States Critical Infrastructure Assessment Office,* in its vulnerability assessment framework developed for federal government agencies (Lainhart IV 2001b). COBIT has also been adopted by a range of Australian public sector organisations, such as the *New South Wales Department of Health* (Tyler 2000) and the *Curtin University of Technology* (IT Governance Institute 2002).

The COBIT framework defines 34 IT processes, grouped into four domains; Planning and Organisation, Acquisition and Implementation, Delivery and Support, and Monitoring, as can be seen in Appendix 1. This structure covers "all aspects of information and the technology that supports it" (Lainhart IV 2001a, p. 20). A set of management guidelines included with COBIT provide organisations with tools to assess their IT environment as well as both implement and improve control over IT in a manner that is consistent with their business objectives (Lainhart IV 2001a). "Maturity Models" is one of those management guidelines.

The Maturity Models allow organisations to undertake a self-assessment to measure their level of management processes for each of COBIT's 34 IT processes, facilitating the mapping of an organisation's current status of IT control, the development of strategies for improvement, and comparisons with industry and other norms. The COBIT Maturity Models is based on one defined by the Software Engineering Institute for the maturity of software development capability (IT Governance Institute 2000), associated with Capability Maturity Model Integration (CMMI) models for process improvement in a range of disciplines. It was developed by an international panel of 40 practitioners, analysts and academic experts at a residential workshop, before being subjected to review (ISACA 2005). Appendix 2 shows the generic qualitative maturity model descriptions that were tailored to suit each of COBIT's 34 IT processes.

## 2.3 IT governance in the public sector

Although little literature has been published on IT governance in the public sector, IT governance in the public sector is different to that in the private sector due to characteristic differences between the two sectors (Caudle, Gorr & Newcomer 1991; Lenk 1994). Differences apparent in the public sector when compared to the private sector include:

- Differences in environmental factors (for example, less market exposure, more legal and formal constraints and higher political influences)
- Differences in organisation-environment transactions (for example, more mandatory powers, wider scope of concern, higher level of scrutiny of public officials and greater expectations)
- Differences in internal structures and processes (for example, more complex criteria, managers' power and roles, more frequent rollover of top managers, and greater difficulty in creating incentives for effective and efficient performance) (Rainey, Backoff & Levine 1976).

These differences make IT governance in the public sector more complex than that in the private sector (Hansen 2002). As a consequence, control over IT process is even more important in the public sector than in the private sector (Beaumaster 2002; Management Advisory Committee 2002).

## 2.4 Existing studies on IT control

Traditionally, research on IT governance has focused on arrangements for the control of IT (for example, Brown 1997; Korac-Kakabadse *et al.* 2001; Peterson 2001; Peterson, O'Callaghan & Ribbers 2000; Sambamurthy & Zmud 1999), IT/business alignment (for example, Brown & Magill 1994; Luftman 2003; Van Grembergen & Saull 2001) and performance measurement (for example, Kaplan & Norton 1992; Van Grembergen & Van Bruggen 1997). However, relatively little research has been undertaken to specifically measure IT control.

In 2002 the IS Audit and Control Association (ISACA) conducted an international survey to establish a reference benchmark on IT control and governance maturity of public and private sector organisations (Guldentops, Grembergen & de Haes 2002). The 15 most important IT processes were selected from COBIT's set of 34 for use in the survey, as a result of interviews conducted with approximately 20 senior IT and audit practitioners. From the results of the survey, four categories of international benchmarks of maturity levels of control over IT processes were established: mixed, industry (*finance, public sector, IT service providers, retail and manufacture*, and *others*), geography (*America, Europe, Middle East/Africa, Asia/Oceania*, and *global*) and size (*large, medium* and *small*) (Guldentops *et al.* 2002; ISACA 2003). Note that the nations falling within the geographic regions were not specified. Although it is assumed that some Australian public sector measures of IT control were included in the findings for Asia/Oceania, very few, if any, academic or practitioner publications have investigated control over IT processes in Australian public or private sector organisations. An awareness of the maturity of IT control in Australian organisations will inform those organisations by giving them opportunity to evaluate their progress, develop strategies for improvement and allow best practice comparisons. Further, it is argued that there is a particular need to understand maturity levels of IT control in the Australian public sector, due to the complexity of IT control in that sector.

# 3 METHODOLOGY

The aims of this research are:
- To establish a reference benchmark of maturity levels of control over IT processes in the Australian Public Sector
- To compare the Australian benchmark with some international benchmarks established by ISACA

An objective ontology and positivist epistemology were appropriate for this quantitatively based research, which focused on measurement of IT control.

## 3.1 Data collection and analysis

This research studied control over IT processes in the Australian public sector. The most viable method of undertaking the study was to have senior managers self-report on the level of control over IT processes in their organisations, as the study population was widespread geographically. This approach was also consistent with that of the original study (Guldentops 2002), which facilitated a meaningful comparison with that study. Based on these characteristics, a survey was considered appropriate for this research. Consequently, a mailed, self-administered questionnaire was used because of the advantages of this technique, such as relatively low cost, opportunity for respondent anonymity, and the reduction or avoidance of bias (Neuman 2003).

The population to be used in this research was made up of non-financial public sector organisations with over 50 full time equivalent employees. The limited number of financial public sector organisations was excluded because their different characteristics made them more like private sector organisations. The threshold selected for the number of employees was to ensure that the organisation would have enough IT usage to make its responses viable. It was reasoned that small organisations may have small levels of IT use and limited scope to apply IT controls. Local government organisations were excluded from the population, as most local government organisations in Australia

have less than 50 full time equivalent employees. Educational organisations, health networks, hospitals, and foreign government representations were also excluded from the scope because some of these organisations are controlled by a combination of the Federal Government and state governments (such as universities), while some organisations are financed by government, but the government controls are unclear (ABS 2002; ABS 2003). Organisations listed in Federal or state budget reports were also excluded where their annual reports were not accessible through the Internet.

Public sector organisational lists were first obtained from budget reports of Federal or state governments for 2003–2004, available on the Internet. Then the number of employees for each organisation was determined from its 2002 annual report. As it was found that the total study population was less than 400, sampling was unnecessary and inappropriate. Consequently, a decision was made to select the whole population to maximise validity.

A questionnaire was developed that first sought demographic details, and then asked respondents to assess the maturity level of control for each IT process (ISACA 2003). For example, respondents were asked to tick one box giving the relevant maturity level for the *Monitoring* IT process, *Monitor the Processes (M1)*. A survey reference guide was also designed which contained detailed explanations of maturity levels for each IT process, which used a five-point scale and were similar to the generic maturity levels seen in Appendix 2. The contents of the reference guide were taken directly from the COBIT Management Guidelines, with authority. This reference guide was designed to help the respondents if they were unclear about the scales used in the questionnaire. The maturity levels for the 15 most important IT processes in the international benchmarks (ISACA 2003) reported a mean for each process. The mean was used for this study to allow comparison against the results of the original investigation. A pilot test was conducted to increase the validity and reliability of the instrument. No changes were made to the instrument as a result of the pilot test responses.

Survey questionnaires designed to be completed by senior managers with responsibility for IT/Information Systems (IS) management were mailed to respondents with a stamped, addressed envelope, with a request for it to be returned within two weeks. At the end of the second week, a follow-up letter enclosing another copy of the survey questionnaire was mailed to encourage those who had not returned the questionnaire to respond.

To determine whether the non-respondents were representative of the respondents, a non-response analysis was conducted for the main characteristics of interest. Then a ranked list of the most significant processes for Australian public sector organisations was produced. It was not possible to undertake a test of significance to compare the Australian ranked list with those for the same 15 processes for international organisations, public sector organisations and those from Asia-Oceania, as only the means for each process were available from the ISACA (2003) study, without a standard deviation. Consequently, comparison was undertaken using graphs on which the Australian public sector means of the 15 processes were plotted, along with one each for the same 15 processes for the mixed international organisations, the public sector international organisations and those of Asia-Ocean from the ISACA study.

## 4    RESULTS

Of the 387 questionnaires posted, 55 were returned by "early respondents" before the follow-up, while 3 could not be delivered. When calculating the net response rate, the researcher excluded the undelivered questionnaires from the sample (as was done by Yu & Cooper 1983). Two weeks after the second mail-out, 47 additional responses were received from "late respondents" and 2 more were undelivered. Consequently, an overall net response rate of 27% was achieved.  A total of 28% of the returns came from Federal Government organisations, while the remainder came from state or territory government organisations.  As would be anticipated from the population, New South Wales returned the highest proportion of the responses (22%), and the Northern Territory the lowest (3%).

One invalid questionnaire was not completed due to the organisation having been privatized. A few questions in some questionnaires were left unanswered. The unanswered questions were treated as missing values in data analysis.

The distributions in the early and late respondent groups were examined in terms of level of government (Federal and state) and location (the six Australian states and two territories). A Mann-Whitney U test resulted in a *p* value of greater than 0.05 at a 95% confidence level for level of government (0.912) and location (0.814), indicating that the early and late respondent groups were independent for these characteristics. A Kolmogorov-Smirnov Z test found that there were no significant distribution differences between the early and late respondents for level of government (*p*=1.00) and location (*p*=0.77). As a consequence of the tests of independence and distribution, the assumption was made that there was no non-response bias between the early and the late respondents, and the two groups can be treated as though they came from the same population.

Table 1 lists the unweighted maturity levels of the 15 most important IT processes, as identified by ISACA, for the Australian Public Sector organisations surveyed.

| IT Process | | Maturity Level (mean) | SD | N |
|---|---|---|---|---|
| DS5 | Ensure systems security | 3.40 | 0.96 | 100 |
| PO5 | Manage the IT investment | 3.30 | 1.02 | 101 |
| DS10 | Define the IT organisation and relationships | 3.29 | 1.00 | 99 |
| DS4 | Ensure continuous service | 3.24 | 1.06 | 100 |
| PO10 | Manage projects | 3.19 | 1.10 | 101 |
| AI6 | Manage changes | 3.18 | 1.05 | 100 |
| AI2 | Acquire and maintain application software | 3.15 | 0.98 | 100 |
| PO3 | Determine technological direction | 3.09 | 1.07 | 100 |
| DS11 | Manage data | 3.06 | 1.02 | 99 |
| PO9 | Assess risks | 2.98 | 1.04 | 101 |
| AI1 | Identify automated solutions | 2.95 | 1.00 | 101 |
| PO1 | Define a strategic IT plan | 2.91 | 1.26 | 101 |
| AI5 | Communicate management aims and direction | 2.89 | 1.17 | 99 |
| DS1 | Define and manage service levels | 2.83 | 1.27 | 101 |
| M1 | Monitor the processes | 2.61 | 1.14 | 100 |

*Table 1. Maturity levels of the 15 most important IT processes (in descending order) for Australian public sector organisations*

## 4.1 Comparison to mixed international benchmark results

Figure 1 compares the maturity levels of control in the Australian public sector against the results for the benchmark of organisations from international mixed sectors and size, the public sector and geographic regions, for the 15 most important IT processes. As can be seen, the mixed international results fluctuated between 2 and 3 with most of the maturity levels (67% or 10 out of 15) falling between 2 and 2.5. However the maturity levels of control over IT processes in the Australian public sector were higher, fluctuating between 2.5 and 3.5, with most of the maturity levels (60% or 9 out of 15) falling between 3 and 3.5. The variation in the maturity level between the processes in each of the international mixed benchmark results and the Australian public sector was in most cases 1.0, or a full maturity level on the scale.
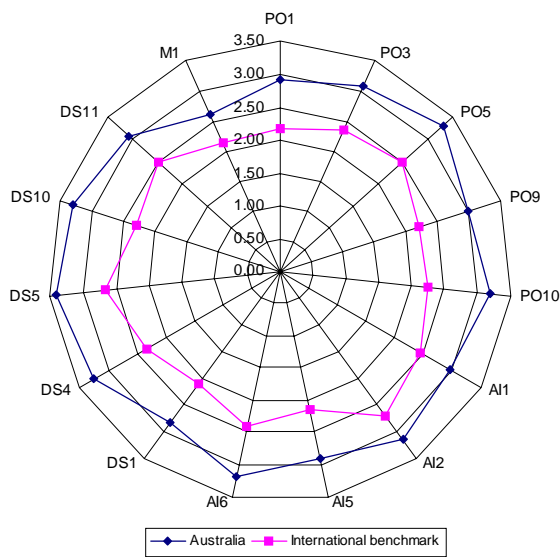
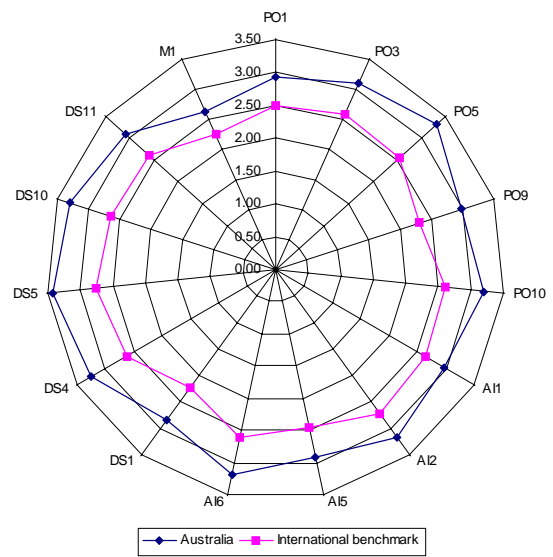*Figure 1. Comparison to mixed international benchmark results*



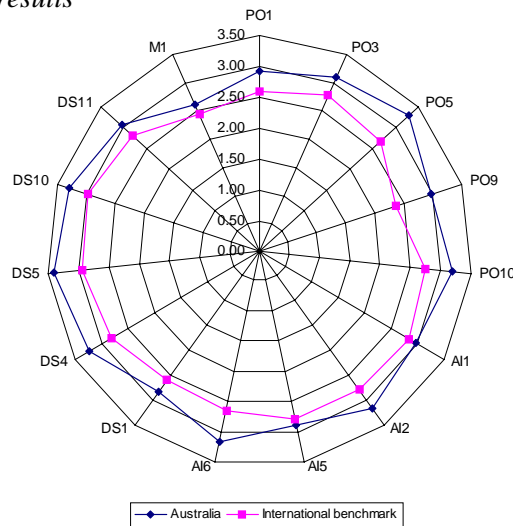*Figure 2. Comparison to public sector international benchmark results*



*Figure 3. Comparison to international benchmark for Asia/Oceania*

## 4.2 Comparison to public sector international benchmark

The maturity levels of control over IT processes in the Australian public sector were also higher than those of the international benchmark for the public sector, which fluctuated between 2 and 3 with most maturity levels (87% or 13 out of 15) falling between 2.5 and 3.0 (Figure 2). The maturity levels of control over IT processes in the Australian public sector fluctuated between 2.5 and 3.5 with most maturity levels (60% or 9 out of 15) falling between 3 and 3.5. Therefore, the maturity levels of the majority of the IT processes showed a 0.5 (or half a maturity level) variation when comparison was made between the international public sector results and those for the Australian public sector. Not only was the difference in variation for the majority of the IT processes less for the international public sector and Australian public sector comparison than when the Australian public sector results

were compared against the mixed international results, but the shape of the two graphs also more closely mirrored each other.

### 4.3 Comparison to international benchmark for Asia/Oceania

When comparing the maturity levels of control over IT processes in the Australian public sector with the mixed international benchmark for Asia/Oceania, Figure 3 reveals that the maturity levels of control over IT processes in the Australian public sector were higher than those of the regional results. The maturity levels of control over IT processes for the mixed international benchmark for Asia/Oceania fluctuated between 2 and 3 with the maturity levels of most IT processes investigated (87% or 13 out of 15) falling between 2.5 and 3. However, the maturity levels of control over IT processes in the Australian public sector fluctuated between 2.5 and 3.5 with the majority being between 3 and 3.5 (60% or 9 out of 15). For the majority of IT processes examined, the Australian public sector results were 0.5 higher, or half a level on the maturity scale, when compared against the mixed results for Asia/Oceania. Although there was similarity in the shape of the two graphs, they were not as close as the graphs of the Australian and international public sector results.

## 5 DISCUSSION

### 5.1 Comparison of IT processes

The Australian public sector had a better performance for IT control over the 15 most important IT processes than the mixed by sector, size and region international benchmark, the international benchmark for the public sector, and the mixed benchmark for its region, Asia/Oceania. However, one of the interesting findings from the above three comparisons, as shown in figures 1, 2, and 3, was that the contours in each pair in these three sets of comparisons shared some similarity in shape, particularly for the international and the Australian public sectors. This characteristic suggests that where the maturity levels of control over IT processes in the Australian Public Sector differed from the international benchmarks, the differences were not caused by a random error of measurement, but by a real difference in perception of performance of control over IT processes in the Australian public sector. Further, this characteristic strengthens the validity of the self-reporting method utilised in this study. It appears that the either the Australian public sector allocated a greater proportion of its attention and/or resources to each IT process than was done in the international organisations, and/or, it achieved a higher standard with more effective results. It also appears that the public sector internationally shares a common view of the most important IT processes, as can be seen from the similarity in the graphs for the Australian and international public sectors.

The difference between the international and the Australian benchmarks may have been influenced by other factors. As this research was conducted one year after the ISACA's survey was undertaken, organisations may have been more aware of the importance of IT controls. Moreover, the emerging Australian standard, *Governance of Information and Communication Technology* (ICT) (Standards Australia 2003), may suggest a shared understanding of the importance of IT governance in Australia. Such awareness may have exceeded that of the nations surveyed for the international benchmark.

### 5.2 Comparison of Australian public sector and mixed international benchmarks

This section considers the ranking of the most important 15 IT processes in the Australian public sector and the mixed international organisations. The surprising similarity in the comparison of control over IT processes in the Australian public sector with those of the mixed international benchmark suggests that the priority placed on specific IT processes in the Australian public sector is largely consistent with that of other nations, regardless of organisational size, or if private or public sector.

The three common IT processes in the top five IT processes for the two benchmarks, DS5 *Ensure systems security*, DS10 *Manage problems and incidents*, and DS4 *Ensure continuous service*, suggests

that Australian Public Sector organisations have placed an emphasis on their capabilities in handling security and contingency issues, as have all industry sectors of other nations. Terrorist attacks from 2001 may help explain the higher focus on control over these IT processes (Guldentops *et al.* 2002).

The *Australian Computer Emergency Response Team* (Auscert 2002) conducted a computer crime and security survey in Australian organisations in 2002, in which over 19% of respondents who participated were from the Australian public sector. This survey revealed that 67% of respondents experienced a computer security incident in 2002, while 35% of these suffered six or more incidents. It was found that 70% of Australian organisations had increased their investment in information security over the previous 12 months. These figures from Auscert also help to explain the high maturity levels for the IT processes DS5, DS10 and DS4 in the Australian Public Sector.

The remaining two IT processes that appeared in the top five in the Australian Public Sector results were PO5 *Manage the IT investment* and PO10 *Manage projects*. These IT processes differed from the remaining two of the leading five in the international benchmark overall results, AI2 *Acquire and maintain application software* and AI1 *Identify automated solutions*. With higher political influences acting upon it (Rainey *et al.* 1976), the public sector needs to put more priority on managing investment and projects. Attributes specific to the public sector might have contributed to the difference in the remaining two of the five most highly ranked IT processes in the Australian benchmark and mixed international benchmark results.

Four IT processes, M1 *Monitor the processes*, DS1 *Define and manage service levels*, AI5 *Install and accredit systems* and PO1 *Define a strategic IT plan*, appeared in the lowest five of the most important IT processes in both the Australian benchmark and the mixed international benchmark results, implying a remarkable shared understanding of priority across nations, organisational size and sectors.

The IT process, AI1 *Identify automated solutions*, appeared in the lowest five scoring group of the Australian public sector results, while PO9 *Assess risks* appeared in the same group in the mixed international benchmark results. The higher political influence in the public sector, particularly as government is primarily financed by taxation (ABS 2003), may require the public sector to pay more attention to risks than to identify automated solutions.

# 6    CONCLUSION

The comparison of the results for this study with those of the early ISACA study is limited by a lack of detail provided in the publication on the original study.  For example, it is not known the degree to which Australian organisations featured in the Asia/Oceania results.  However, the very limited research available in this area and the potential of IT control to bring about more effective use of IT in the public sector and other organisations encourages the current research.

The surprisingly strong response rate for an unsolicited survey of senior managers with responsibility for IS/IT reveals interest in IT control in the Australian public sector, and that the research was timely. The results of the non-response analysis suggests that the results can be generalised to other non-financial Federal and state public sector organisations in Australia with over 50 employees.

The unexpected similarity between the ranking of the leading IT processes in the Australian public sector, and those for the international benchmarks, both private and public sector, suggest that global influences are at play, rather than regional ones or those related to sector. The higher scores for the Australian public sector control over the leading 15 IT processes when compared against a public sector international benchmark, a mixed international benchmark and a mixed benchmark for a basket of Asian and Oceanic nations suggests either that the Australian public sector organisations were more effective at controlling the IT processes examined, or, as the results were self-reported, Australian public sector senior IS/IT managers were erroneously confident about their IT control, when compared against international IS/IT managers. The latter is unlikely as the same Australian managers reported remarkably consistent rankings for the 15 most important IT processes with their international private and public sector counterparts, and the international results were also self-reported.

As awareness of the importance of IT governance to effective corporate governance increases, the adoption of COBIT and other IT control frameworks by practitioners throughout the world has grown. Although these frameworks are used to control IT processes in many organisations, little academic research has focussed on them. The research reported upon in this paper has contributed to the limited empirical research in the area by establishing a reference benchmark of maturity levels of control over IT processes in the Australian public sector, and appears to be the first research to do so. By establishing an Australian benchmark, it enables future evaluations to be made of change from the base benchmarks, both for each of the 15 most significant individual IT processes, and for the basket of the most important IT processes. The research also facilitates future comparisons of the Australian benchmark against those established for other nations.

## References:

ABS (2002) Government use of Information Technology, cat. no. 8119.0 1999–2000, Australian Bureau of Statistics, Retrieved: 28 May, 2003, from AusStats database

ABS (2003) Year book Australian 2003, cat. no. 1301.0 2003, Australian Bureau of Statistics, Retrieved: 28 May, 2003, from AusStats database

Auscert (2002) 2002 Australian computer crime and security survey, Retrieved: 28 September, 2003, from http://www.auscert.org.au/render.html?it=2001&cid=1920

Bae, B., Epps, R. W. and Gwathmey, S. S. (2003) Internal control issues: the case of changes to information processes, Information Systems Control Journal, Vol. 4, pp. 44–46

Beaumaster, S. (2002) Local government IT implementation issues: a challenge for public administration, Proceedings of Hawaii International Conference on System Sciences, Hawaii,

Brown, C. V. (1997) Examining the emergence of hybrid IS governance solutions: evidence from a single case site, Information Systems Research, Vol. 8, No. 1, pp. 69–94

Brown, C. V. and Magill, S. L. (1994) Alignment of the IS functions with the enterprise: toward a model of antecedents, MIS Quarterly, Vol. 18, No. 4, pp. 371–403

Caudle, S. L.,Gorr, W. L. and Newcomer, K. E. (1991) Key information systems management issues for the public sector, MIS Quarterly, Vol. 15, No. 2, pp. 171–188

Colbert, J. L. and Bowen, P. L. (1996) A comparison of internal controls: COBIT, SAC, COSO and SAS 55/78, IS Audit & Control Journal, Vol. 4, pp. 26–35

Dellit, C. (2002) Governance and the emerging salience of technology, Software, Vol. October, pp. 19–24

Guldentops, E. (2001) Asking the right questions for IT governance, Information Systems Control Journal, Vol. 4, pp. 13–15

Guldentops, E. (2002) Knowing the environment: top five IT issues, Information Systems Control Journal, Vol. 4, pp. 15–16

Guldentops, E., Grembergen, W. V. and De Haes, S. (2002) Control and governance maturity survey: establishing a reference benchmark and a self-assessment tool, Information Systems Control Journal, Vol. 6, pp. 32–35

Hamaker, S. (2003) Spotlight on governance, Information Systems Control Journal, Vol. 1, pp. 15–19

Hansen, K. (2002) Open to the public, Australian CPA, Vol. 72, No. 7, pp. 38–39

Hardy, G. (2002) Make sure management and IT are on the same page: implementing an IT governance framework, Information Systems Control Journal, Vol. 3, pp. 14–16

IIARF (2002) Systems assurance and control - glossary, Retrieved: 30 August, 2003, from http://www.theiia.org/esac/index.cfm?fuseaction=or&page=glos

ISACA (2003) Further material on IT governance maturity, Retrieved: 2 October, 2003, from http://www.isaca.org/Content/ContentGroups/InfoBytes/20032/art26.pdf

ISACA (2005) What is the overall quality of COBIT…, Retrieved 20 March, 2005, from http://www.isaca.org/template.cfm?template=/ContentManagement/ContentDisplay.cfm&ContentID=3980 - c6

IT Governance Institute (2000) Control objectives for information and related technology (COBIT), 3rd ed., IT Governance Institute

IT Governance Institute (2002) IT governance case studies, Retrieved: March 14, 2003, from http://www.itgovernance.org/casestudy2.htm

Kaplan, R. S. and Norton, D. P. (1992) The balanced scorecard -- measures that drive performance, Harvard Business Review, Vol. January-February, pp. 71–79

Korac-Kakabadse, N. and Kakabadse, A. (2001) IS/IT governance: need for an integrated model, Corporate Governance, Vol. 1, No. 4, pp. 9–11

Lainhart IV, J. W. (2000) Aligning IT controls with business objectives is crucial to sustained enterprise success, EDPACS, Vol. 28, No. 4, pp. 1–11

Lainhart IV, J. W. (2001a) Businesses today are undergoing a chemical change, Information Systems Control Journal, Vol. 1, pp. 18–19

Lainhart IV, J. W. (2001b) An IT assurance framework for the future, Ohio CPA Journal, Vol. 60, No. 1, pp. 19–23

Lenk, K. (1994) Information systems in public administration: from research to design, Informatization and the Public Sector, Vol. 3, pp. 305–324

Luftman, J. (2003) Assessing IT/business alignment, Information Strategy: The Executive's Journal, Vol. 20, No. 1, pp. 7–14

Machin, J. (2002) The ABCs of corporate governance, Retrieved: 15 August, 2003, from http://www.xisec.com/abcs.pdf

Management Advisory Committee (2002) Australian government use of information and communications technology: a new governance and investment framework, Retrieved: March 30, 2003, from http://www.apsc.gov.au/mac/technology.htm

Neuman, W. L. (2003) Social research methods: qualitative and quantitative approaches, 5th ed., Pearson Education, Inc.

Payne, N. (2003) IT governance and audit, Accountancy SA, Vol. Jan 2003, p. 35

Peterson, R. R. (2001) Configurations and coordination for global information technology governance: complex designs in a transnational European context, Proceedings of Hawaii International Conference on System Sciences, Maui, Hawaii,

Peterson, R. R., O'Callaghan, R. and Ribbers, P. M. A. (2000) Information technology governance by design: investigating hybrid configurations and integration mechanisms, Proceedings of International Conference on Information Systems, Brisbane, Queensland, Australia, pp. 435–452

Rainey, H. G., Backoff, R. W. and Levine, C. H. (1976) Comparing public and private organizations, Public Administration Review, Vol. 36, No. 2, pp. 233–244

Rao, M. (2003) Enterprise IT governance - the obvious step, Retrieved: 31 March, 2003, from http://www.networkmagazineindia.com/200301/cover5.shtml

Ridley, G. and Carroll, P. (2003) An emerging Australian ICT governance standard: a comparative case study, Proceedings of ECITE 2003 Madrid, Spain, pp. 537–546

Ridley, G.,Young, J. and Carroll, P. (2004) COBIT and its utilization: a framework from the literature, Proceedings of Hawaii International Conference on System Sciences, Big Island, Hawaii

Sambamurthy, V. and Zmud, R. W. (1999) Arrangements for information technology governance: a theory of multiple contingencies, MIS Quarterly, Vol. 23, No. 2, pp. 261–290

Standards Australia (2003) Governance of information and communication technology (Draft), Retrieved: March 30, 2003, from https://committees.standards.com.au/committees/it-030/z0009/it-030-z0009.doc

Tyler, R. (2000) Implementing COBIT in New South Wales Health, Information Systems Control Journal, Vol. 3, pp. 30–32

Van Grembergen, W. and Saull, R. (2001) Aligning business and information technology through the balanced scorecard at a major Canadian financial group: its status measured with an IT BSC maturity model, Proceedings of Hawaii International Conference on System Sciences, Maui, Hawaii, pp. 1–10

Van Grembergen, W. and Van Bruggen, R. (1997) Measuring and improving corporate information technology through the balanced scorecard, The Electronic Journal of Information Systems

Evaluation, Vol. 1, Iss. 1, Retrieved from
http://www.iteva.rug.nl/ejise/vol1/issue1/paper3/paper.html

Yu, J. and Cooper, H. (1983) A quantitative review of research design effects on response rates to questionnaires, Journal of Marketing Research, Vol. 20, pp. 36–44

## Appendix 1: COBIT's Set of IT Processes, Grouped into Four Domains

| | |
|---|---|
| PO1 Define a strategic plan | DS1 Define and manage service levels |
| PO2 Define the information architecture | DS2 Manage third-party services |
| PO3 Determine technological direction | DS3 Manage performance and capacity |
| PO4 Determine the IT organisation and relationships | DS4 Ensure continuous service |
| PO5 Manage the IT investment | DS5 Ensure systems security |
| PO6 Communicate management aims and direction | DS6 Identify and allocate costs |
| PO7 Manage human resources | DS7 Educate and train users |
| PO8 Ensure compliance with external requirements | DS8 Assist and advise customers |
| PO9 Assess risks | DS9 Manage the configuration |
| PO10 Manage projects | DS10 Manage problems and incidents |
| PO11 Manage quality | DS11 Manage data |
| AI1 Identify automated solutions | DS12 Manage facilities |
| AI2 Acquire and maintain application software | DS13 Manage operations |
| AI3 Acquire and maintain technology infrastructure | M1 Monitor the processes |
| AI4 Develop and maintain procedures | M2 Assess internal control adequacy |
| AI5 Install and accredit systems | M3 Obtain independent assurance |
| AI6 Manage changes | M4 Provide for independent audit |

*PO:* Planning & Organisation*; AI:* Acquisition & Implementation*; DS:* Delivery & Support*; M:* Monitoring *(IT Governance Institute 2000)*

## Appendix 2: Generic Maturity Model

Generic Maturity Model

0  Non-Existent. Complete lack of any recognisable processes. The organisation has not even recognised that there is an issue to be addressed.

1  Initial. There is evidence that the organisation has recognised that the issues exist and need to be addressed. There is however no standardised processes but instead there are ad hoc approaches that tend to be applied on an individual or case-by-case basis. The overall approach to management is disorganised.

2 Repeatable. Processes have developed to the stage where similar procedures are followed by different people undertaking the same task. There is no formal training or communication of standard procedures and responsibility is left to the individual. There is a high degree of reliance on the knowledge of individuals and therefore errors are likely.

3 Defined. Procedures have been standardised and documented, and communicated through training. It is however left to the individual to follow these processes, and it is unlikely that deviations will be detected. The procedures themselves are not sophisticated but are the formalisation of existing practices.

4  Managed. It is possible to monitor and measure compliance with procedures and to take action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way.

5  Optimised. Processes have been refined to a level of best practice, based on the results of continuous improvement and maturity modelling with other organisations. IT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt.

(COBIT, 3rd edition, IT Governance Institute 2000)