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Practical Studies In E-Governance: An Empirical Exploration Of Enterprise Resource Planning

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Public e-procurement has enabled innovation in government and transformed technological platforms and the way governments procure goods and services and engage with suppliers (Hardy and Williams, 2007; Lee, Tan and Trimi, 2005; Moe, 2004). Leveraging information technology to achieve better information, value for money, efficiencies, and maximize procurement effectiveness is now widely used in both the public and private sectors (Hardy and Williams, 2007; Moe, 2004; Carayannis and Popescu, 2005; and Puschmann and Alt, 2005). While public e-procurement has similarities with the private sector in terms of its focus on value for money and competitiveness, it differs amongst other things because of the need for transparency and accountability in the spending of public moneys (HAR 07). This is particularly so with respect to aid or development funds provided by various organizations such as the UN, World Bank, Asian Development Bank or the International Monetary Fund, to ensure fund transparency and that funds provided are not spent corruptly. Also, e-governments can influence the uptake of e-procurement transactions with business which achieve flow through effects to influence the environment in which government to business transactions take place (PAN 04).

Keywords: Enterprise Resource Planning; technology entrepreneur; ICT; transaction costs; data base; social capital; trust; environment; transparency.

1.0 Introduction

Some e-government agencies in both developed and developing countries are taking advantage of the efficiency

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gains which can result from the evolution of new e-business models (PAN 04). Such agencies are attempting to adopt and adapt the new technologies for public e-procurement in order to achieve the benefits being realised by entities in the private sector (PAN 04). In the private sector, this is usually undertaken through the adoption of enterprise resource planning (ERP).

Enterprise resource planning (ERP) is an organization wide computer software system used to manage and coordinate all the resources, information and functions of a business from shared data stores (EST 04). An ERP system can facilitate the smooth flow of common functional information and reduce cycle times. However, without top management support and an appropriate business strategy, plan and vision, the re-engineering of business processes, effective project management, user involvement and education and training, government agencies cannot embrace the full benefits of such complex systems. The risk of failure might be at a high level (ALF 08). Due to the complexities of most ERP systems and the negative consequences of a failed ERP implementation, most ERP vendors have included 'best practice' into their software. These are what the ERP vendor may deem as the most efficient way to carry out a particular business process in an integrated enterprise-wide system (MON 09) – that is, from the ERP vendors point of view and not necessarily from an e-government agency's point of view.

It seems necessary for e-government agencies to perform a thorough business process analysis before selecting an ERP vendor and undertaking ERP implementation. Such analysis should map current structures, organization, systems and operational processes to enable the selection of an ERP vendor whose standard modules are most closely aligned with the established e-government agency (KIN 05; YUS 04). ERP implementation is difficult and can be politically charged in

government which is often structured into nearly independent functions, each having different processes, business rules, data semantics, authorization hierarchies and decision centres (DAN 08). ERP implementation can cause significant centralization of arrangements, such that once implemented may then limit the freedom and flexibility or needs of governments to adapt quickly to environmental changes without incurring significant costs, lengthy duration, significant change management and organizational turmoil.

Senior management in government who are seeking cost savings and improved effectiveness and efficiency may undertake a review their current e-procurement data arrangements. Large, medium and small governments around the world are considering or reconsidering enterprise resource planning (ERP), and are looking for guidance as to how ERP can be used with highest amenity, lowest cost and least change. They have variously considered ERP as a pervasive government wide tool for coordinating many activities such as e-procurement, HR, project management, finance, and budgeting. This adoption has been because downsizing and outsourcing pressures to reduce costs have been and will continue to be intense. While the adoption of ERP has been viewed as a means of reducing costs, in practice such implementation often increases costs (COR 97; COR 2006; COR 2001). Such costs vary from government to government, country to country. The ICT Development Index provides IT benchmarking information across nations indicating that 'large disparities remain among countries' (ITU 09). Low income countries are low on the index, with an important element being 'the cost of ICT services' (ITU 09).

ERP data is often spread throughout different organizational functions such as accounting, project management, purchasing and procurement, and supply logistics. Wittmann & Cullen (WIT 00) suggest that such data is a key value driver. In many government organizations it remains an untapped source of core government business data. It could be that this is because its value is not recognised by governments, or that some or all

of these functions have been outsourced to an external provider and so have become opaque to management. Whilst it may be an attractive option, outsourcing such a core function may lead to becoming dependent upon external, often rent seeking, ERP vendors. Such rent seeking can take the form of demands for system and software adoption and subsequent upgrades, specialist training for staff, ongoing license fees on a per user basis (so limiting the number of users within the e-government agency because of the cost per user), consultancy fees, special service fees and so on. Once committed to such ERP arrangements, it is difficult for the e-government agency to break out of such contracts without suffering heavy expense. But to remain in the arrangement is also very expensive – it becomes a most effective monopoly for the ERP vendor.

The benefits of ERP are that it enables masses of information, previously dispersed and fragmented, difficult and expensive to bring together manually in a timely way, to be brought together and interrogated in seconds (WAI 07). This contributes to improved e-government efficiency and effectiveness, and to a lowering of an e-government's transaction costs and environmental impacts. Because ERP can be used to collect, correlate, track and aggregate electronic transactions quickly and easily, it has the potential to become a valuable source of strategic and operational knowledge with cost saving and performance management potential. ERP can encompass activities across the back offices of e-government, as well as other areas. For example, an ERP supply management system enables various data from functions such as accounting, finance, logistics, e-procurement, and project management to be collected, collated, coordinated, and disseminated. ERP systems may be designed to record and hence provide the data for measuring critical aspects of 'core' business operations across an organization's back office, from strategy development, planning and execution, to management, operations, and control. They can do this by providing data to management which can be used to measure and hence evaluate organizational processes and functions that were previously disparate and disjointed (BOU 05). Through these means, an ERP data base can help in the facilitation of more efficient completion of day-to-day tasks; reduce redundant and overlapping activities that waste time and resources by

standardizing ‘core’ processes and procedures; eliminate data silos by creating a single, central repository of timely, accurate data; and enable more effective resource allocation and management (BUS 08).

ERP databases and systems are core business for any organization, yet they are often outsourced to ERP vendors at considerable capital set up costs and subsequent ongoing service and maintenance costs. This outsourcing then leaves them vulnerable to activities over which they have little control, including virus infections to the ERP vendor or Internet service provider, or ‘ghost net’ activities (MAR 09). Organizations have often risked modifying their operations to suit the software of the ERP vendor. Alternatively, if an organization requires the ERP vendor’s software to be modified, the organization will pay for all modifications and then often does not exclusively own the intellectual property so developed which is divested to the ERP vendor. The ERP vendor may then be at liberty to use it with the organization’s competitors. During environmentally demanding, difficult periods such as the end of the year financial report periods, a government may need to wait in queue for service from the ERP vendor.

2.0 Literature Review

ERP vendor solutions often include significant change management requirements coordination. A disadvantage usually attributed to ERP is that business process redesign to fit the standardized ERP vendor modules can lead to a loss of existing competitive, quality, or efficiency and effectiveness advantages. While documented cases exist where this has occurred, other cases show that following thorough process preparation, ERP systems can increase sustainable competitive advantage (TUR 08; DEH 03). Koch and Wailgum (KOC 07) suggest that ERP attempts to integrate all departments and functions across an organization onto a single computer system that can serve different individual’s particular needs. Individuals should all be able to see the same information.

Most ERP vendor systems were initially designed to be used by discrete manufacturing companies rather than for government (KOC 07). While this is changing, e-government agencies have variously struggled with different ERP vendors to modify core ERP vendor programs to their needs (KOC 07). Vendors have only recently begun to offer specially tailored ERP application sets, but there is still much customization work to do (KOC 07). Packaged applications now target e-government agencies including higher education (KOC 07). The issue here is that the ERP vendors have become both the researchers and the applicators, so can academic research based on ERP vendor information be deemed rigorous or objective?

It is critical for e-government agencies to determine if their way of doing business will fit a standard ERP vendor package (KOC 07), before contracts are signed. There are options – public agencies can change their business structure, systems and processes to accommodate the ERP vendor software, or they can modify the software to fit their structure and processes. ERP vendors argue that modifying their software will 'slow down the project, introduce dangerous bugs into the system and make upgrading the software to the ERP vendor's next release excruciatingly difficult because the customizations will need to be torn apart and rewritten to fit with the new version' (KOC 07).

An ERP study conducted by Lugwigshafen University of Applied Science (LUG 04) surveyed 192 companies. It concluded that companies which implemented SAP's industry best practices decreased mission-critical project tasks such as configuration, documentation, testing and training – but how objective was such research? Much of the literature is sourced from and based upon evidence provided by the ERP vendors themselves, their data, their perspectives and their advice. ERP vendors have designed their systems around their perceptions of best business practices for specific industries. Different ERP vendors have different types of processes but all

are of a standard, modular nature. Some may well be suited to e-government agencies, but which one will suit best? E-government agencies that want to implement ERP vendor systems may consequently be forced to adapt their organizations to the ERP vendor's standardized processes, or adapt the ERP vendor's package to the organization's existing structure, systems and processes (TUR 08). Neglecting to map current business processes prior to starting ERP implementation is a main reason for failure of ERP projects (BRO 03).

A Meta Group (now Gartner) (MET 02) ERP vendor total cost of ownership study investigated hardware, software, professional services and internal staff costs. Costs included initial installation and the two year period that followed. Among the 63 companies surveyed - including small, medium and large companies in a range of industries - the average total cost of ownership was US$15m (the highest was US$300m and lowest was US$400,000). The total cost of ownership for a single user over that period was US$53,320. This study also found that it took eight months after the new system was installed (31 months in total) to see any benefits. Results from a 2007 Aberdeen Group survey (JUT 07) of more than 1,680 manufacturing companies of all sizes found a correlation between the size of an ERP vendor deployment and the total costs. For example, a company with less than US$50m in revenue should expect to pay an average of US$384,295 in total ERP vendor costs, according to the survey results. A mid-market company with US$50m to US$100m in revenues can expect to pay (on average) just over US$1m in total costs; a much bigger mid-market company, with US$500m to US$1b in revenues, should expect to pay just over US$3m in total costs. Companies with more than US$1b in revenues can expect to pay, on average, nearly US$6m in total ERP vendor costs. Could governments with budgets of these orders expect to pay

around the same amount and wait an equivalent period of time for an ERP system to be installed and be effective?

The hidden vendor costs of ERP most likely to result in budget overrun are training (expensive); integration and testing (high risk); customization (expensive); data conversion (from old systems to new ERP vendor systems); data analysis (combined with data from external systems for analysis purposes); consultants (ad infinitum); retaining the organization's trained ERP employees; implementation (never stops); waiting for the organization's ROI; post-ERP depression; and adjusting to the new ERP vendor system. In a Deloitte Consulting survey of 64 Fortune 500 companies (DEL 08; KHO 06; SAL 06), one in four admitted they suffered a drop in performance when their ERP vendor system went live - the most common reason for the performance problems was that everything looked and worked differently from the way it did before, which occurs when people can't do their jobs in the familiar way and haven't yet mastered the new way. Implementing ERP vendor systems is a difficult and costly process that has caused serious business losses because the planning, development and training necessary to re-engineer their business processes were underestimated. The training of end users is also a key success factor to achieving benefits.

An example of a public sector education institution adopting an ERP vendor system is the RMIT University, an Australian top 200 global university in 2007 (FIN 08). The system was to integrate basic student administration (and related financial) tasks with Web-enrolments, the alumni system and other peripheral tasks. It went live in October 2001. According to Gray (GRA 03), the PeopleSoft ERP implementation was subsequently the subject of a Victorian Government Auditor General's Report (VIC 03) following the ERP vendor system's

failure to deliver. The problems that followed cost RMIT University more than AU$47m, or 3.7 times the original budget (VIC 03), and ultimately the resignation of the University's Vice Chancellor. The structural and process changes required were underestimated, as was the time allowed for implementation. The system went live at a time when, from both a technology perspective and a business ready perspective, it wasn't ready and there wasn't a fallback position. There was an expectation that the early issues were technology problems that would be fixed fairly quickly. By the time the University realised how committed it was, it was too late to revert to its previous system.

Another example is an estimated AU$65m ERP vendor implementation failure in 2002 which involved 14 major Australian corporations as Founding Shareholders (Amcor, AMP, ANZ, Australia Post, BHP, Coca- Cola Amatil, Coles Myer, Fosters, Goodman Fielder, Orica, Pacific Dunlop, Qantas, Telstra and Wesfarmers). Price Waterhouse Coopers were consultants for the development of a regional ERP entrepreneurial venture, corProcure, based in Melbourne, Australia. This was to provide an e-marketplace for electronic trading across buyers and sellers, and the integration and provision of other ERP e-procurement services and processes (Australia Post, 2003). After 18 months of intensive and expensive development, the project failed and the entity was sold off to one of the Founding Shareholders, Australia Post, for $1 (HEA 03).

Yet another example is that of a waste-disposal company. Waste Management announced in March 2008 that it was suing SAP, seeking the recovery of US$100m in project expenses that related to a failed ERP vendor implementation started in 2005. In the complaint, Waste Management alleges that SAP executives participated in a fraudulent sales scheme and that

SAP's Waste and Recycling ERP product was actually fake software that was still not ready for Waste Management's use by Spring 2008 (FIN 08).

Similar examples abound. Gray (GRA 03) suggests that rather than trying to modify the ERP vendor software systems to suit an organization's business processes, there is a need to look at ways of modifying the business's processes to suit the ERP vendor system. However, this may lead to other acute and expensive complications in writing software variations and revising and adjusting business structures and processes. Is this 'the tail wagging the dog'? Is an ERP system a tool of management or vice versa?

Why do ERP projects fail so often? At its simplest level, Koch and Wailgum (KOC 07) suggest that ERP is a set of 'best practices' for performing different functions including e-procurement, logistics, finance, HR, and other processes. To get the most from the ERP vendor software, they argue that employees need to adopt the work methods outlined in the software. If public servants in the different government departments that will use ERP don't agree that the work methods embedded in the software are better than the ones they currently use, they will resist using the software or will want IT to change the software to match the ways they currently do things. This can be where ERP vendor projects break down. Political fights break out over how, or even whether, the ERP vendor software should be installed. IT becomes involved in long, expensive customization efforts to modify the ERP vendor software to fit the business requirements. Customizations make the software more unstable and harder to maintain when it is implemented. Because ERP covers so much of what government does, a failure in the software can bring a government to a halt.

Every e-government agency is different, with unique work methods that an ERP vendor cannot account for when developing its software. Further, changing a public servant's work processes and habits will also create difficulties, and getting them to use the ERP vendor's software to improve the ways they do their jobs may be a harder challenge, particularly if it means that on success, many public servants will lose their jobs through 'productivity benefits and efficiency gains'. If the government organization is resistant to change, then an ERP project is more likely to fail.

So rapid have been software and hardware improvements that strategy developing and decision making senior public servants are sometimes unaware of the inherent latent usable potential available to prosecute their interests – there may also be generational issues here. In some government organizations, existing public servant ICT expertise may not be being realized or valued. Since 2000, there have been significant improvements in the computing power of generic software database tools for which there are 'at no cost' upgrades. Inexpensive training in the use of generic database software is accessible at low cost. Such may be the skill and curiosity of many public sector employees about ICT that no additional training is necessary. These ICT skills may be applicable to ICT challenges such as ERP, which function through establishing central databases. Standardization of software code makes it possible for e-government agencies to develop their own ERP arrangements using their own public servants who are already familiar with their government's structure, organization and culture.

3.0 Purpose

The purpose of this paper is to describe how one e-government agency used its internal resources to develop an efficient and effective ERP model at low cost over 12 months. The challenge

was to implement government ICT policy through the practical development of an organization wide central ERP e-procurement database using standard generic database software, existing resources and data at lowest cost, in minimum time with maximum organization acceptance. This evidence based, longitudinal action research is the story about how the challenge to develop and implement an ERP database model within an e-government organization was achieved using existing e-government employees.

The Australian Department of Defence is a complex, high tech Australian Federal Government Department of around 90,000 employees. In 2008-09 the Australian Department of Defence will spend more than $9.6 billion acquiring and sustaining military equipment and services, and will employ over 7,500 people in more than 40 locations around Australia and overseas (DEF 09). This comprises the procurement of products (goods and services) and their support and maintenance from almost every industry sector, on a global basis. Hundreds of small to large enterprises are dependent on the Australian Department of Defence for orders, so whatever software is adopted by this large organization will have an impact on them also. The anticipation was that this entrepreneurial venture could not only help the organization become an inclusive knowledge based learning society, but subsequently provide an inexpensive database model for other government organizations, large or small, in developed or under-developed countries (ITU 2009).

4.0 Twelve Months, Two Entrepreneurs Part time, Develop an ERP Data Base

This action research was undertaken on a longitudinal basis by the two Australian Department of Defence public servants networking closely with the many internal and external stakeholders. One of the entrepreneurs was an experienced senior executive and project manager/engineer, the other a computer scientist/logistician. They also had the use of an administrative assistant on a part time basis. The selection of Microsoft Access software (MIC 07) was made simply because the Australian Department of Defence was already committed

to generic Microsoft software as its standard. The researchers had no choice but to keep development costs to a minimum. But any other current database software such as IBM DB2, Oracle, Sybase, MySQL, PostgreSQL is likely to be satisfactory (ALT 09).

5.0 Performance Criteria

The ERP design performance specification was determined after lengthy discussions with many internal and external stakeholders. These were:

Firstly, it had to be simple, reliable, accurate and timely and kept current with new data entry as e-procurement transactions occurred;

Secondly, it had to respond to internal customer's many and varied needs on an established work priority basis but be capable of modification or adjustment should these needs change;

Thirdly, it had to be user friendly, easy and intuitive to use with minimal if any training, simple to understand in concept and structure, and be perceived and accepted by authorized users as of value and not as a threat to their jobs; and

Finally, it needed to be developed, installed and maintained using existing data and resources at no additional resource, transaction or capital cost to the organization.

6.0 Database Model Capacity and Boundaries

To achieve these performance criteria, the boundaries of the model were based on existing financial data for each financial year's transactions. This data was readily available, but spread throughout the Australian Department of Defence in various functional areas such as accounting, project management, procurement and supply logistics. Initial exploratory research found there were around 250,000 electronic procurement transactions per annum, around 200,000 of which were under AU$2,000 in individual value. The ERP data for these less than

AU$2,000 commodity purchases, large in number but individually very small in value, was already available through bank card statements and could be added to the database later if necessary. Details of the remaining (approximately) 50,000 e-procurement transactions, each above the Australian Department of Defence bank card delegation of AU$2,000, were publicly available and formed the basis of the initial generic ERP database. These data were collected from a range of internal and external stakeholders.

7.0 One Unique Field Required

For ERP database development, an unique attribute common to every e-procurement transaction is necessary and was identified. This unique field, the Australian Department of Defence Purchase Order number, provided the means by which data within and across each financial year was identified. This unique attribute thus provided the basis for the individual records of related data to be selected, interrogated, dissected, grouped and extracted in many shapes and forms. A 'flat file' transparent approach made access to all data in the database easy and quick to access by authorized employees with very limited training. This approach ensured every authorized employee was able to intelligently determine the usefulness of the database to their own particular needs. Any masking of the 'flat file' data restricts and limits the usefulness of the database. Usually ERP vendors do not advocate such transparency of the entire database to all authorized users, or that a simple database such as MS Access is sufficient to cope with the challenge. The simple MS Access relational database 'flat file' structure used did not overload or make the database complicated or difficult to interrogate by authorized users. Relational database fields were subsequently added as 'pull down' menus, such as Zip Codes and Industry Codes (ANZIC). Pull down menus for buyer and seller attributes, such as address, contact person, email addresses, telephone numbers and so on were also added. E-procurement and supply reports were structured to meet a variety of e-goveernment needs at the various organizational levels, for example, strategic, tactical, operational or for other specific needs. Other tailored reports were designed and developed as necessary.

8.0 Intuitive Use of Comprehensive Data

The structure of the extended relational database fields with each individual record tied to its unique Purchase Order (P/O) number was based on the chronology of the Australian Department of Defence capability acquisition ie in the order in which the processes occurred - from the Australian Department of Defence buyer to product/price to seller to delivery to final location – no changes to existing Australian Department of Defence systems or processes were required. This included fields for the buyer's name, buyer's address and contact details, contract, contract type, account number, purchase order number and date, portfolio, department, division, branch, agency, and postcode, and details of payment arrangements and progress; product description and ANZIC industry code (Australian Bureau of Statistics, 1998), value and industry sector; seller company number, name and address, and contact details. Other data required by specialist Australian Department of Defence areas could be added as required. In this format, the data was able to be intuitively understood and interrogated by users of the database, who were able to draw upon accurate and timely procurement, financial, project and supply records continuously updated with new information at the end of each month. Thus the Australian Department of Defence's AU$3b to AU$4b per annum history of strategic capability acquisition over six financial years was established on a part time basis by the two technology entrepreneurs over a twelve month period. Good relations with all stakeholders were maintained during the development period, no consultants, or expensive vendor software, or special training or ongoing license fees were necessary in the development and establishment of this ERP database.

Some of the many possible fields used in the database are shown in Figure 1. These fields reflect the nature of the ERP business of the Australian Department of Defence organization, which are largely common to most e-procurement activities. The 'flat file' database structure can be readily and rapidly 'cut and diced' by any user to obtain desired data. No change

management or adjustments to systems or processes were required, no changes to the Australian Department of Defence organization or structure, and no threat of job losses to employees.

P/O no	Date 2008	Value (AU$K)	A/C to date AU$K)	Australian Department of Defence Cost Centre	Supplies description	Qty	Supplier
446	18Dec	9,103	8,197	DCPM	PINTAIL radios	20	Stanilite Electronic
447	25Dec	7,557	6,000	DNSDC	Lep'chaun lease	1	Dan Murphy
448	01Jan	6,320	0	MM	Goods	65	Disney Land

Figure 1: *An example of some few of the possible database attributes (columns) and records (rows).*

9.0 One Database, Many Users, Many Uses

An important issue was the accessibility of the ERP database information to authorized general and specialist users, and the ability of these users to easily interrogate the information. Many authorized users were already familiar with MS Access and so had few difficulties. Others not so familiar could take a short training program with an MS Access training organization at minimum cost. The data was made available to authorized users on a 'flat file' basis, that is, all attributes and individual records were made available to all authorised users all of the time. This approach is not one that is generally advised by ERP vendors, who may wish to retain and limit such access for themselves. With 'flat file' access to the database fields, the same up to date ERP database information was accessible

across the Australian Department of Defence organization. Because of this easy access to the flat file data, authorized users were able to quickly and accurately answer questions however these were framed, provide formatted regular reports or develop specific reports themselves using the one central database of up to date information ie one database, many users and uses.

The database was designed to be responsive, intuitive, easy to use, and adaptable – and this proved to be the outcome. For example, typical and unpredictable questions included Questions With/Without Notice from Australian Federal Parliament Government Ministers requesting advice on Australian Department of Defence related industry located in a Minister's electorate, how much was being spent there, with which company, when, for what and so on; what spend did the Australian Department of Defence have with a particular company or country; or what was the Australian Department of Defence's contractual arrangements and their state of completion with certain suppliers. Other examples included Australian Department of Defence's specific exposure across a wide range of contracts to companies whose financial status was uncertain or deteriorating. In being able to access the ERP database, reports and responses to government or other stakeholder questions could be easily, quickly and accurately addressed by few staff, thus significantly reducing the transaction costs and lengthy time previously associated with responding to these questions, in particular coordination costs and time.

10.0 Corrupt Practices

With this ERP database, the coordination and knowledge management problems associated with incomplete supply and transaction information and corporate governance issues are reduced. With accurate scrutiny of historical e-sourcing data over several financial years, a government is better able to choose the most efficient and effective e-sourcing arrangements so reducing its transaction and other costs. It is also able to better synchronize the motivation of its agencies

and its suppliers by reducing the differences of interest and information between the two, with panoptican transparency and trust (BEN, 1785), so reducing the opportunities for rent seeking activities. The ERP database could immediately provide accurate details of each product (good or service) purchased, by whom and from which supplier in which industry, when and where, at what cost, as well as the current status of the account. This transparency in itself reduces the potential for, or possibility of, corrupt practices.

11.0 Need to Know, Now

Government organizations, for a wide range of reasons, need to know with whom they are doing business, what business, and what financial exposure they have at any particular point of time. They need to know now, not in a month, or a week, or tomorrow, but now. Access to this ERP database enabled the Australian Department of Defence to know immediately the number and value of transactions, and with whom the Australian Department of Defence was doing business over the six financial years the database covered. This is demonstrated across two financial years of the Australian Department of Defence ERP database (Figure 2). Each of the transactions comprising the data can be individually sourced. The Australian Department of Defence ERP database provided an immediate, accurate, and timely summary of such information. Without the database, it was difficult, slow and costly to obtain and coordinate current or historical data from the various Australian Department of Defence departments.

Value Bracket	F/Y 1: No of transactions	F/Y 1: Value AU$m	F/Y 2: No of transactions	F/Y 2: Value AU$m
$150m and	4	1404	2	1515

over				
$100m to $150m	nil	nil	nil	nil
$50m to $100m	3	178	4	306
$20m to $50m	7	195	6	187
$10m to $20m	18	241	12	177
$5m to $10m	28	191	28	197
$1m to $5m	193	395	253	549
$100k to $1m	2221	590	2205	583
$30k to $100k	4746	250	4410	231
$2k to $30k	43769	327	42035	309
Less than $2k	200,000	50	200,000	50
Greater than $2k	50,989	3,768	48,955	4,054

Figure 2. *Value and Number of Australian Department of Defence e-Procurement Transactions.*

12.0 Benchmark Buyer Delegation Limit

Figure 3 provides a typical summary extract from two financial years of the Australian Department of Defence ERP database. This extract demonstrates the number of notifications of value

greater than the (then) Australian Department of Defence bank card delegation limit of AU$2,000 and the total value of the notifications in this category. This information is useful if the level of delegations is to be reconsidered, particularly as each product (good or service) comprising the data can be identified. Such information can also be used to benchmark an public sector's performance intra or inter organizationally, regionally or internationally.

Financial Year	**FY1**	**FY2**
Number of Australian Department of Defence Notifications >AU$2,000	50,989	48,995
Value of Notifications >AU$2,000 (then year prices)	3768.06	4054.03
Value of Notifications (AU$m) at constant prices	3768.06	4159.94

Figure 3. *Australian Department of Defence E-Procurement Statistics – Global Summary*

13.0 Strategic Sourcing Policy: International Technology Transfer

Major Australian Department of Defence capability contracts, often high tech projects, were a focus of the Australian Department of Defence's strategic management policy because of the potential for technology transfer and local high tech industry development and the national benefits to be derived therefrom. The Figure 4 example summary, quickly and easily extracted from the Australian Department of Defence ERP database, provides an indication of whether a local high tech strategic sourcing policy was working or not. Detailed investigation of each contract from the ERP database gave information on the technology, performance, supplier details and much other information of national, strategic or operational

importance. Such information gave a very good indication of the breadth and depth of high technology transfer, innovation and entrepreneurship being undertaken. For example, in FY1, out of the total value of AU$2208.7m (of those contracts greater than AU$5m), AU$1074.1m was spent with Australia based suppliers. In the following F/Y, this increased to AU$1528.3m, indicating an increase of AU$454.2m in local spend with Australia based industry. This indicated that from a value perspective, strategic insourcing policies were being successfully applied. With instant access to each contract's details through the ERP database, it was also possible to confirm the nature, quality, value and content of the technology transfer.

F/Y	Total value (AU$m)	Number of contracts	Value to local suppliers ($m)	Total number of contracts awarded to local suppliers
1	2208.7	60	1074.1	52
2	2382.8	52	1528.3	43

Figure 4. *E-Procurement Contracts greater than $5m*

14.0 Offshore Capability Sourcing

The Australian Department of Defence was interested in its offshore capability delivery vulnerability and spend. If there was a major disaster such as a tsunami, earthquake or epidemic, then it is necessary for the Australian Department of Defence to be quickly aware of the possible effects on its offshore suppliers. Figure 5 provides an example of aggregated data of country of origin from which the Australian Department of Defence was obtaining supplies over one financial year, with the specific details of each individual transaction comprising the summary data being able to be identified instantly from the ERP database:

Country of Origin	F/Y1: Number of suppliers	F/Y1: Value
Belgium	5	$2,121,098
Canada	7	$40,493,060
Denmark	1	$7,271,003
Fiji	1	$670,000
France	4	$2,603,403
Germany	3	$548,256
Greece	nil	nil
Indonesia	1	$200,000
Ireland	1	$173,040
Israel	2	$416,963
Italy	2	$333,379
Netherlands	2	$375,028
Norway	nil	nil
NZ	12	$5,196,147
Singapore	1	$152,480
Spain	1	$127,001
Sweden	2	$1,466,168
Switzerland	6	$1,207,153
UK	33	$14,770,414

USA	126	$1,1444,801,682
Total	210	$1,222,926,275

Figure 5. *Australian Department of Defence E-Procurements Greater Than $100,000 From Non Local Suppliers*

15.0 Business Centre Comparative Performance

Compilation of summary data by each of Australian Department of Defence's Business Centres for each financial year was also easily, accurately and quickly obtained (Figure 6). This summary of the activities being undertaken by each Australian Department of Defence business unit each financial year can be used by management to review the human resources allocated to each cost centre, and their performance commensurate with the type of procurements being undertaken and their location. Resourcing equity across Business Centres was a key issue for Australian Department of Defence management because it could provide the basis for resource allocation so affecting the efficiency and effectiveness of program budgeting and capability delivery.

Australian Department of Defence Program (Business Centre)	Number of Notifications (each > AU$2,000)	Value of Notifications (AU$m)
Forces Executive	1532	40.37
Navy	6734	359.77
Army	11845	342.57
Air Force	14251	452.51
Strategy and Intelligence	211	10.25
Acquisition	2778	1660.40
Budget and Management	7589	731.31
Science and Technology	3308	62.59
London	973	33.25
Washington	1496	72.61
Unstated	272	2.42
Total Organization (Australian Department of Defence)	50989	3768.06

Figure 6: *Australian Department of Defence E-Procurement by Business Unit*

16.0 Top Ten Principal Industry Sectors

The Australian Department of Defence sources its capabilities across most UN/NATO/ANZ Industry Sectors. Each e-procurement can be placed in an industry sector. In summary, Figure 7 provides an example of the top ten principal industry sectors within which the Australian Department of Defence invested its sourcing activities. This information, drawn instantly from the ERP database, is valuable for a multitude of Australian Department of Defence purposes, and particularly for the development of Australian Department of Defence strategic industry policy. The specific details supporting each of the contributing transactions can be made immediately available.

Industry Code	Industry Sector Title	No of Notifications	Value (AU$m)	% by value
15	Transport equipment	4457	1380	37
22	Construction and Construction services	4889	729	19
27	Consultancy, Property and Business services	6313	477	13
18	Computer, office Equipment and Electrical equipment not elsewhere classified	7196	422	11
11	Chemicals, Petroleum and Coal Products	2332	146	4
19	Industrial machinery and equipment	2507	108	3
17	Electrical equipment,hardware,household appliances	3846	91	2

16	Photographic, Professional and Scientific equipment	2398	56	1
8	Textiles, clothing and footwear	1366	49	1
25	Communication services	435	47	1
Total		35739	3505	93

Figure 7: *Top Ten Australian Department of Defence Industry Sector E-Sourcing over one F/Y*

17.0 Top Ten Suppliers by Value

A summary of the top ten Australian Department of Defence suppliers by value each F/Y was also readily available from the ERP database. For the Australian Department of Defence, this data is significant from industrial, national and international perspectives (Figure 8).

No	Supplier	No of procurements	Value (AU$m)	% by value
1	Lockheed Martin	14	916	24
2	Civil and civic	9	239	6
3	NQEA	36	188	5
4	ADI	646	165	4
5	Raytheon	3	156	4
6	DAS	1730	99	3
7	Rockwell	55	91	2
8	CSP	26	77	2
9	Forgacs	4	63	2
10	Shell	490	50	1
	Total top ten suppliers	2987	2046	54
	Other suppliers	48002	1723	46
	Total suppliers	50989	3768	100

Figure 8: *Top Ten Australian Department of Defence E-Sources by Value*

18.0 Price Setting and Competitive Bids

ERP data is able to be used for strategic procurement and supply development purposes. For example, supplier data can quickly reveal different or in some cases the same suppliers supplying an organization with the same 'off the shelf' product at significantly different prices. This knowledge can be used to re-arrange competitive bids by fewer suppliers at better prices and so lower overall prices and transaction costs. Alternatively, because ERP data is accurate, timely and easy to access, there may be no need to limit the number of suppliers of a particular product but price setting may be to a buyer's and seller's advantage. Such technological innovation enables an organization to review, revise and renew its existing buyer-supplier strategic sourcing relationships.

19.0 Conclusion

This practical longitudinal action research by two part time public servants over a twelve month period gave rise to an inexpensive generic ERP database. The ERP database did not require any adjustment of existing (or any future) organization structures, systems or processes, or any additional resources, change management or special training. This ERP model, which may be considered for adoption by other e-government agencies was based on the Australian Department of Defence's e-procurement of its strategic capability across almost all industry sectors. The ERP database model developed for use by a major high tech organization indicates that it is possible for such an ERP database to be developed by other e-government agencies, particularly those whose scope is not as complex as that of the Australian Department of Defence, and particularly by developing countries and organizations with limited resources. It provides both centralized and decentralized functionality, high amenity, search sensitivity and speed to data by authorized users. The ERP database information is transparent, systematic, logical, high quality and ultimately a routine basis for the collection, collation and dissemination of both strategic and detailed government e-procurement data. This was undertaken through the establishment of one central

ERP database using available generic database software. The ERP database model enables the unhindered networking of information sharing by authorized users both inside and outside an e-government agency, and provides an accurate historical corporate memory which can be used for many strategic and operational purposes.

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