

# E-skills: The Next hurdle for ERP implementations

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## Abstract

*Many large companies around the world have made considerable investment in enterprise resource planning (ERP) systems to support their business processes. Many of these companies are now positioning themselves to take advantage of the new internet economy. But what does this "positioning" entail? Is it the purchasing and implementation of the right technology? Is it the redesign of business processes? What skills are needed by these organizations? Recently there has been call in the Australian marketplace for information systems (IS) professionals to possess skills that can handle the move into E-business and E-commerce. In accordance with this we sought the views of information systems professionals working with ERP systems in the Australian and New Zealand marketplace about the skills mix necessary in the "E" world. The main results of this survey showed that the teamwork and deadlines dominated the business skills whilst knowledge of E-business/commerce models dominated the technical skills*

## 1. Introduction

In the age of E-business will a new set of E-skills emerge? At a recent conference, Chris Bennett, Managing Director of SAP Australia in the keynote address quoted the following research

*"Nearly one third of the IT skills in the market today have only emerged in the last year. Sixty seven of the one hundred and thirty three internet related skills are totally new".*

It has been an issue for many companies that have implemented an Enterprise Resource Planning (ERP) system of how to obtain and retain skilled personnel. As many of these companies are now investigating how to utilise the "e" functionality their ERP systems, the issue of

skilled staff is further compounded. The move to e-Business will require all enterprises to manage the broader information chain within the E-business supply chain (Chung, 2000). E-business differs from e-commerce in that it relies on the integration of business processes and the supporting technologies to gain competitive advantage across the extended supply chain [1]. It is more strategic in nature and requires greater skill sets than e-commerce due to the front-end back-end integration. Many people believed that ERP systems would be replaced by e-business solutions [30]. While others considered ERP systems to be the backbone for many e-business solutions [22]. Enterprises will need to decide if their workforce and or consultants will be able to take this next step in the E-world. A recent survey of 350 senior executives worldwide found that 50% of the respondents considered that the lack of e-business skills of their employees was the main obstacle to their e-business strategy implementation. In a recent report commissioned by Australian SAP User Group (Stein and Hawking 2002) it was found the second largest barrier to e-procurement in Australia was the lack of skilled staff. But what are the necessary skills sets to support these types of implementations?

## 2. Large Scale IS Implementations

The implementation of large scale IS software is a major issue facing businesses. The implementation of software is often complex and has a major impact on the business [33]. The complexity of large scale IS implementations have resulted in projects becoming longer and more expensive and often not delivering the expected benefits [2]; [4]. Trepper [32] proposed that if a project team did not possess the required business, interpersonal and technical skills then the chances of project implementation success are negligible. The ISCC'99 report suggested that a contributing factor to the failure of medium to large systems is the failure of universities to prepare their

graduates as to the complexity of these systems [18]. Maxwell [20] believed that part of the blame can be attributed to the complexity of large scale E-procurement or E-business systems, but much of the blame lies squarely with change management and the confusion, resistance and redundancies that can be created. A further factor is that consulting firms ignore the internal politics surrounding a large-scale implementation. Few businesses are flexible enough to change their processes to suite to business models and achieve the implementation on time [19]; [7]. Large-scale projects are particularly challenging and require careful planning of time and budget to avoid project disaster. This has resulted in businesses adopting alternative implementation methods [27]. The purchase [7] and implementation of an application is just the beginning of a large investment in IT, and the E-projects are often different to other kinds of projects that the business has implemented.

Skill shortages in relation to ERP systems have been an ongoing issue for companies. As companies move towards the mature phase of implementation they have tended to developed the necessary skills in house and rely on outside contractors for more specific [34]. However in a recent study of 230 respondents from 85 global companies in relation to their ERP implementation, 53% of the sample believed that their ERP implementation is never complete [8]. ERP systems implementation are used as a catalyst for continuous business improvement as companies try to leverage this large IT investment. ERP systems now incorporate a full range of e-business functionality ranging from business to employee, business to consumer and business to business. Many companies are positioning themselves to take advantage of this new

functionality [15] however the level of e-business skills will be a serious impediment. It is important to identify these specific skill sets in an endeavour to develop the necessary strategies.

### 3. Information Skill Sets

In 2000 the U.S. Departments of Commerce, Labour and Education released the 21st Century Skills report [31] which described a vision of the specific competencies that will be required by 21st century workers. These included the ability to understand complex systems including social, organisational and technological systems. Described in this report are the skill sets of the personnel that handle information within organisations. Broadbent et al [3] and Opie [24] found that the numbers of users actually utilising data and information are increasing, and proposed that the skills required by information managers included networking and project management on the technical side, and business redesign and quality management on the business side. The 21st Century Skills report [31] identified basic technical, organisational and company specific skills as being crucial for workers into the 21st Century. The ISCC'99 submission was a collaboration between industry and academia in an endeavor to identify the skills required in developing and supporting large and complex systems. It recommended that the appropriate skills (Table 1) could be delivered using an inverted curriculum approach which allowed students to experience and analyse real application systems from the beginning of their course [18].

INDUSTRY-DEFINED ATTRIBUTES OF AN ISCC'99 GRADUATE		
Personal Skills	<ul style="list-style-type: none"> <li>• Systemic-thinking skills</li> <li>• Problem-solving skills</li> <li>• Critical-thinking skills</li> <li>• Risk-taking skills</li> </ul>	<ul style="list-style-type: none"> <li>• Personal-discipline skills</li> <li>• Persistence</li> <li>• Curiosity</li> </ul>
Interpersonal Skills	<ul style="list-style-type: none"> <li>• Collaborative skills</li> <li>• Conflict resolution skills</li> </ul>	<ul style="list-style-type: none"> <li>• Communication skills (oral, written, listening, and group)</li> </ul>
Technical Knowledge and Skills	<ul style="list-style-type: none"> <li>• Information abstraction, representation, and organization</li> <li>• Enterprise computing architectures and delivery systems</li> <li>• Concepts of information and systems distribution</li> <li>• Human behavior and computer interaction</li> </ul>	<ul style="list-style-type: none"> <li>• Dynamics of change</li> <li>• Process management and systems development</li> <li>• Information Systems domain knowledge</li> <li>• Use of computing tools to apply knowledge</li> </ul>

**Table 1: Skills of an Industry Ready IT Graduate (Information Systems Centric Curriculum)**

Australian Governments have commissioned studies [12], [26] into the IS skills shortage. The Australian Federal government launched the Innovation Action Plan (IAP) worth \$AUD2.9 billion in January 2001. The plan focused primarily on the supply side of the Information and Communication Technologies (ICT) skill shortage by developing a range of immigration initiatives that would bolster the number of ICT workers. Locally additional funds will be provided for University places but these will not come on-line until 2005. This reliance on buying-in ICT workers negates arguments on building programs where developing skills shortages are identified and addressed within education and training processes in Australia. The IAP program recognises the emerging skill shortage but specifying where the skills gap exists is less clear. The Digital Planet 2000 report [11] forecasts a global market for ICT of US\$3 trillion by 2004. The pace of ICT change will be affected by several factors including; continued expansion of the internet with new “on ramps”, the emergence of new ICT markets including China, India and Brazil, and the transformation of business models with the global adoption of E-business based on exchanges, auctions and integrated supply chains. Given the emergence of E-business what skills will be required by the E-worker? The Deloitte [9] report mapped E-skills into 9 super-types;

- Internet & multimedia,
- Application development,
- Web development tools,
- Operating systems,
- Internetworking,
- LAN administration,
- System software and support,
- Database management,
- Communications installation and maintenance.

Within each of the super-types are sub-types and the report went further and reported the shortages of skills in Australia and then in each state. A report by the New South Wales Government delivered in the Premier’s ICT Skill Forum reported the shortages as;

- Java & C++ developers,
- Communications specialists (radio, mobile, telephony, satellite),
- Real time systems developers,
- Advanced Web designers.

Several European countries have developed Government and Industry consortia to explore and map skill shortages. The Skills Framework for the Information Age [28] was a consortium between the British Government and several large IT vendors like Oracle, Microsoft and IBM. The SFIA had developed a matrix of 71 skill descriptors for

the information age. They have also developed E-skills into Business [14], where a tool is to be developed that will map and match SME’s with the E-skills together with training pathways required to achieve business goals. There is very little industry-based research into skill set development and progression in the E-business area. The availability of historical data concerning E-Business in this emerging area is limited. This lack of historical data is even more critical when applied to companies that have major financial commitments to an ERP system. The collection of such information could assist in project management of E-projects and system implementations and accordingly prevent some of the documented pitfalls that have plagued previous projects.

## 4. Methodology

The primary objective of the study was to survey a range of information system professionals associated with ERP systems and seek responses to issues including the importance of a range of both business and technical skills and the relevance that these skill sets have upon their own professional practice. This paper provides an analysis of the views of 27 IS professionals.

### 4.1 Research Methodology

A leading Australian vendor of enterprise resource planning systems provided two customer data files. The first was the customer file, this contained client name, contact, implementation date and type. The second file contained name, go-live date and module information. The two files were combined into a database. This datastore provided contact details of about 500 information systems professionals that have worked on ERP systems implementations from 1995. The initial survey instrument was developed based on the fields that were identified in the literature and used email as the delivery platform. Several studies [10]; [6], [21], have compared email versus mail information collection methods and have that email surveys compared favourably with postal methods in the areas of cost, speed, quality and response rate. The use of an email directing the respondent to a web site was also investigated but was thought to introduce an additional step in the sampling process. The survey was sent to a random sample of 200 IS professionals with one follow-up reminder. It was necessary to preen the email address book to remove and amend email that had bounced back.

## 5. RESULTS

### 5.1 Survey Instrument

The survey instrument had 30 questions covering three areas, demographics, IS history and business & technical skills importance. Both open and closed questions were used along with Yes/No and five point Likert scale responses. Any response was cross-referenced with the original email master listing allowing organisational type data to be incorporated. Business issues were derived from the IDC report [17] and included project management, client skills, personal skills, communication skills and internal business skills. Technical issues derived from the IDC report included E-systems development, modelling and middleware systems skills. Both business and technical skills used Likert rating for importance as well as importance to the current and future prospects of the IS professional.

### 5.2 Responses

The original email listing contained a random sample of 200 potential respondents from the master file of 387 Australian and New Zealand organisations. It contained multiple email addresses from the organisations and was a historical listing containing information up to 4 years old. A number of emails were undeliverable due to members of the cohort moving positions, having incorrect email addresses, having changed email addresses or automatic out-of-office responses. The overall response rate once removing the undeliverable addresses was 20%. The response rate is presented in Table 2.

Issue	Sent	Not deliverable	Replied	Rate
1st e-survey	200	35	19	
2nd e-survey	149	27	8	
Total	138	62	27	27/138=20%

**Table 2. Response rate %**

### 5.3 Demographics

Responses were received from 27 IS professionals and the data were analysed to present position, company type, company size and IS history. Responses for the whole cohort are presented in Table 3. Respondents were predominantly employed high in the organisational structure being either an IS or business manager. They were mainly from large organisations and the organisations spanned most sectors of the Australian marketplace.

Position	#	Organisation Type	#	Organisation Size (Revenue \$AUDmillion)	#
IS Managers	11	Public Administration	6	Large (>1000)	17
IS Consultant	3	Retail/Wholesale	1	Med-Large (500-1000)	5
Business Managers	3	Mining	2	Medium (50-500)	5
IS Admin.	8	Utility	1	Small (<50)	0
IS Support	2	Finances	0		
		Manufacturing	6		
		IT Services	4		
		Transport	3		
		Communication Services	4		

**Table 3. Demographic Breakdown of respondents (N=27)**

### 5.4 IS History

Respondents indicated the extent of work time they spent on information systems by selecting a value from 1 to 5, with 1 representing 1-20% and a 5 representing 81-100% of work time. Table 4 shows the extent that the respondents were occupied in IS activities as well as the reporting structure they operated within. Respondents were heavily occupied with IS workload and were either 1 or 2 levels from the CEO. The results also indicated that a significant number of respondents were employed at the top of the IS structure in some of Australia's larger organisations. Whilst the sample size is small the position of the respondents shows them to be IS decision makers within major Australian organisations.

IS Workload	No	Report To	No
1-20%	1	CEO	8
21-40%	0	CFO	1
41-60%	1	IS Manager	14
61-80%	5	Business Manager	4
81-100%	20		

**Table 4. Respondent IS History (N=27)**

### 5.5 Business Skills: Importance to E-business/E-commerce

Respondents were asked to rate the importance differing business skills by selecting a value from 1 to 5, with one representing Very Low and a five representing Very High. They were also asked to indicate their level of expertise in relation to these skills Table 5 shows the means and standard deviations for the importance of business skill of the cohort.

Skills	Mean Rating ( $\mu$ )	Standard Deviation ( $\sigma$ )	Respondent Level ( $\mu$ )
Team Work	4.6	0.9	4.5
Deliver Business Solutions	4.3	0.7	3.1
Meet Deadlines	4.3	0.8	4.0
Project Management	4.3	1.1	3.2
Change Management	4.2	1.0	3.9
Client Consulting	4.1	0.9	3.6
Personal Communications	4.1	1.0	3.4
Client Negotiating	3.9	1.1	3.3
Internal Business Politics	3.4	1.2	3.3
Sales & Marketing Skills	2.8	1.5	2.4

**Table 5. Business skills importance to e-business/e-commerce (n=27)**

Team-work scored the highest approval with a very tight standard deviation. Solutions, deadlines and projects scored equal second followed by change management. The least favoured business skill was the need to have sales and marketing skills. This skill also showed a high standard deviation. A knowledge of business politics was not favoured being ranked ninth out of ten. The respondents rated their current skill level in the areas of personal communications and project management considerably below the level that they believed to be important to industry.

### 5.6 Technical Skills: Importance to E-business/E-commerce

Respondents were asked to rate the importance differing technical skills by selecting a value from 1 to 5, with one representing Very Low and a five representing Very High. They were also asked to indicate their level of expertise in relation to these skills Table 6 shows the means and standard deviations for the importance of business skill of the cohort.

Skills	Mean Rating ( $\mu$ )	Standard Deviation ( $\sigma$ )	Respondent Level ( $\mu$ )
Security Firewalls	4.1	1.1	2.7
Software Engineering	4.0	1.0	2.2
Web Design	4.0	1.2	2.4
E-business E-commerce models	3.9	1.2	3.9
Network Skills	3.7	0.9	3.0
SQL/Oracle	3.7	1.1	3.3
Process Modelling	3.6	1.2	2.9
XML	3.6	1.2	1.8
Java	3.2	1.2	1.6
OOE	3.0	1.4	2.0
ASP	2.9	1.1	1.8

**Table 6. Technical skills importance to e-business/e-commerce (n=27)**

The respondents indicated that knowledge of specific programming languages was not as important as other skills such as security, software engineering and web design. The respondents felt that level of expertise for the majority of these areas were well below what they considered important for industry. It also interesting to note that differences between the importance of a skill and the actual level of expertise of that skill was far greater for the technical skills than for the business skills.

## 6. DISCUSSION

There has been a surfeit of reports from the USA, UK, European Council and every Government here in Australia pointing to the current shortage of IS skilled professionals. Many countries, Australia included, are relaxing immigration quotas to get a better share of the pool of IS staff globally. This is reflected in a recent IT&T report [9] predicting that Australian will rely upon recruitment or poaching of skilled professionals rather than developing in-house trained professional. The report indicates that this will lead to increased "churning" and an escalation of the price of IS professionals. Reports from the US [31] and the European Commission [13] all point to the need to improve and expedite training of IS professionals to pave the way into the emerging E-Business marketplace. So there is an accepted shortage of IS professionals, the question is what skills are in short supply and how do we get them. The main source of skill shortages is the changing business process mix that organisations are seeking to exploit for advantage. It seems that any system that has an "E" placed in front of it; e-procurement, e-supply chain, e-business, e-commerce and even the newer m-commerce are driving the development of new skills. Never before have new skills

appeared at such a rate. Just as the newer e-skills are driving change in recruitment what of the business skills that organisations require. Are these “soft” skills also changing in tune with the change in the move to E-systems? This is reinforced in a Forrester report [25] that concluded companies should identify employees by their behaviour rather than focusing on their hard skills. What they refer to as identifying key players by their “behavioural DNA”. They further recommended that these “soft” skills should be fostered within the organisation.

The survey indicated reflects the importance of various business and technical skills as identified by the sample. ERP implementations have often been hampered by the lack of available skills. The evolve nature of these systems have seen the incorporation of more and more “e”-technology. How do companies obtain the necessary skills to implement this type of functionality? What are these skills? People who were involved in ERP implementations were asked in this survey to identify the importance of various business and technical skills as they relate to e-business. It is interesting to note that the sample who were mainly and management and heavily involved in information systems believed that the ability to deliver business solutions and project management were some of the more important skills to have. However they rated their expertise in these areas to be wanting. This is one area you would expect IS management to have expertise. Further investigation should focus on this disparity and identify the importance of tasks which make up these skills.

In regards to the technical skills further research is required to clarify the nature of the skills which are important. The majority of the respondents were involved in IT management and administration and accordingly were decision makers in their organisations. Are the technical skills ranking a reflection of the samples need to improve their knowledge of these skills from a project management perspective or are they ranking them from a “hands on” perspective. As more than likely the sample would not be involved a great deal of technical configuration. Clarification of these issues should occur via interviews with the sample to determine why they ranked certain skills above others.

However once the appropriate skills have been identified for the progression into the e-business arena, a more important issue is to determine how companies develop or source these skills. Under the current economic climate many companies are postponing there “e”-strategy implementations and this may provide the opportunity for skilled resources to be developed in preparation for future initiatives.

## 7. References

- [1] Allen, P. (2001), *Realizing e-Business with Components*, London, Addison Wesley.
- [2] Bell, C., (2000), Who’s to blame, *MIS Australia*, June 2000, pp.33-38
- [3] Broadbent, M., Hansell, A., Dampney, C.N.G., and Butler, C. (1992), Information Systems Management: The Key Issues For 1992, *Australasian Share Guide*, Sydney, Sept..
- [4] Cameron, D.P. & Meyer, L.S., (1998), Rapid ERP Implementation-a contradiction, *Management Accounting*, 80(6), pp.56-60.
- [5] Chung, D., (2000), Where to next?, *MIS Australia*, February 2000, pp.42-46.
- [6] Comley, P., (1996), The Use of the Internet as a Data Collection Method, *Media Futures Report*, Henley Centre, London.
- [7] Davenport, T., (1998), Putting the enterprise into the enterprise system, *HBR*, 76(4), pp.121-131.
- [8] Deloitte Consulting (2000), ERP’s Second Wave, Deloitte Consulting Atlanta.
- [9] Deloitte, Touche, & Tohmatsu, (1999), Future Demand for IT&T Skills in Australia 1999-2004, IT&T Skills Workforce, A Report Developed for the Australian Government, as reported in [www.noie.com.au](http://www.noie.com.au), accessed May 1999.
- [10] Dillman, D., (1998), "Mail and Other Self-Administered Surveys in the 21st Century: The Beginning of a new Era", *Discussion paper of the Social and Economic Sciences Research Centre*, Washington State University, Pullman.
- [11] DP2000, Digital Planet (2000): The Global Information Economy, World Information Technology and Services Alliance(WITSA), November.
- [12] DSD report, (2000), ITskills Report of Tasmanian Government, as located at <http://www.dsd.tas.gov.au/Itskillsreport.pdf> accessed on March 23<sup>rd</sup> 2001,
- [13] European Council, (1998), Job opportunities in the Information Society - Exploiting the potential of the information revolution, A report of the DG V, XII, III, XXII, located at [http://www.europea.eu.int/comm/dg05/soc-dial/info\\_soc](http://www.europea.eu.int/comm/dg05/soc-dial/info_soc), accessed August 2000.
- [14] E-skills NTO, (2000), The National Training Organisation for the Information Age, as located at <http://www.e-skillsnto.org.uk/> accessed on March 23<sup>rd</sup> 2001.
- [15] Hawking P., Stein A.,(2001) “An Insight into the Australian ERP Market”, ICIES 2001, Portugal.

- [16] IAP, (2001), Innovation Action Plan, Australian Government Report, Canberra, January.
- [17] IDC, (1999), ERP Market Statistics, 1999.
- [18] Lidtke, D., Stokes G., Haines J., and Mulder M., (eds), (1999) ISCC'99, An Information Systems-Centric Curriculum '99 Program Guidelines. URL <http://www.iscc.unomaha.edu> accessed March 20<sup>th</sup> 2001
- [19] Lucas, H., (2000), *Information Technology for Management*, 7th ed, Boston, Irwin McGraw Hill.
- [20] Maxwell, K. (1999), Executive study assesses current state of ERP in paper industry, *Pulp & Paper*, 73(10), pp.39-48.
- [21] Mehta, R., & Sivasdas, E., (1995), Comparing response rates and response content in mail versus electronic mail surveys, *Journal of the Market Research society*, 37, pp. 429-439.
- [22] Norris, G., Hurley J., Hartley K., Dunleavy J., Balls J.,(2000), *E-Business and ERP: Transforming the Enterprise*, Wiley, Canada
- [23] NSW, (2000), The Premiers ICT Skills Forum: Bridging the Skills Gap, NSW Minister for Information Technology & Department of Education and Training, as located at <http://www.nsw.gov.au/html/skills.html> accessed on March 23<sup>rd</sup> 2001.
- [24] Opie, A., (1994), Forum for IT, *Department of Employment Gazette*, Department of Employment, Great Britain, Vol. 101 Iss. 10, Oct. 1993, pp.442.
- [25] Overby C, Meringer, J, Ysaguirre D., Jastrzembski E., Dawe C., (2000), Pumping Up Internal eBusiness Talent, Forrester Report, October 2000
- [26] QldIT Report, (2000), IT&T Skills in the Smart State, as located at <http://www.iib.qld.gov.au/skills> accessed on March 23<sup>rd</sup> 2001.
- [27] Ross, J., (1998), The ERP revolution: surviving versus thriving, *Centre for Information Systems Research*, MIT working paper.
- [28] SFIA, (2001), Skills Framework for the Information Age, as located at <http://www.e-skillsnto.org.uk/sfia/>, accessed March 2001.
- [29] Stein A., Hawking P., E-procurement Practices: An Australian Survey 2002 (Unpublished)
- [30] Stodder G., (2000), Roll Over, ERP, Strategic Knowledge, Vol. 3 No. 11, as located at [http://www.intelligententerprise.com/000717/strategic.shtml?supply\\_chain%7Csupply](http://www.intelligententerprise.com/000717/strategic.shtml?supply_chain%7Csupply) accessed May 2002
- [31] Stuart, L., (1999), 21st Century Skills for 21st Century Jobs, US Department of Commerce, as located at <http://www.vpskillssummit.org> , accessed August 2000.
- [32] Trepper, C., (1999), ERP project management is key to a successful implementation, ERP Hub, accessed at [www.erphub.com/stratgey990816.html](http://www.erphub.com/stratgey990816.html).
- [33] Trunick, P., (1999), ERP: Promise or pipe dream? *Transportation and Distribution*, 40(1), pp. 23-26.
- [34] Nolan And Norton Institute. (2000), SAP Benchmarking Report 2000, KPMG Melbourne.