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Ed Watson
Louisiana State University

Mary Sumner
Southern Illinois University Edwardsville

Gail Corbitt
California State University Chico

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Ed Watson
Louisiana State University
ewatson@lsu.edu

Mary Sumner
Southern Illinois University Edwardsville
msumner@siue.edu

Gail Corbitt
California State University Chico
gcorbitt@csuchico.edu

ABSTRACT

The purpose of this study is to identify the ERP competencies which are important to industry. A content analysis of IT job web sites was used to develop a list of core competencies for positions as ERP project managers, business analysts, programmer analysts, application developers, auditors, security administrators, system administrators, quality assurance engineers, trainers, database administrators, and change management consultants. These competencies can provide a basis for developing ERP curricula to meet market needs for trained graduates.

Keywords

Enterprise resource planning systems, ERP competencies

INTRODUCTION

The purpose of this study is to determine which competencies in Enterprise Resource Planning are important to industry as a basis for preparing graduates with the skills and knowledge needed for roles as ERP project managers, business analysts, programmer analysts, application developers, auditors, security administrators, system administrators, quality assurance engineers, trainers, database administrators, and change management consultants.

Most MIS competencies have been developed by academic professionals who are teaching MIS concepts and applications. The IS 2002 Model Curriculum does not specifically address ERP competencies. The graduate MSIS 2000 curriculum model proposes one course entitled "Integrating the Enterprise" (MSIS 2000.6.1), which includes a limited set of competencies associated with ERP (MSIS 2000 Model Curriculum, www.acm.org/education/curricula.html).

As yet, there is no comprehensive needs assessment of ERP competencies from an industry viewpoint. Such a list would be of value in determining how much emphasis to place on ERP skills and knowledge in preparing students for careers in ERP systems planning, implementation, use and assessment. Since we are building necessary competencies, we want to start from the ground up. We feel it is important to understand industry's needs before developing an academic model. The ERP competencies that are developed can be used to enhance the IS model curricula.

REVIEW OF THE LITERATURE

ERP systems are prevalent in business, and these systems provide the foundation for business decisions using integrated information. Both large and mid-sized businesses now use ERP as a foundation for financial, materials management, sales and distribution, and manufacturing and production processes.

In industry, ERP is typically introduced into environments where "silos," or functional areas (e.g. Accounting, Sales, Manufacturing) exist. As ERP evolves, the "best practices" introduced by ERP systems provide cross-functional processes and integrated data. ERP facilitates business process re-engineering for improved performance and responsiveness.

The growing importance of ERP in the business world has challenged the academic community to teach ERP in the business curriculum. The stage evolution of ERP in the curriculum follows the same type of maturity model as the stage evolution of ERP within business organizations, described by Holland and Light (Holland and Light, 2001).

In business schools, the organizational structure reflects the "silo" or functional area approach. Most business faculty are trained in disciplines, such as Marketing, Accounting, Finance, and Production and Operations Management. Curricula is organized around these disciplines.

The introduction of ERP concepts and applications into the curriculum is addressed at the initial stage, Stage 1 (Antonucci, 2004). ERP may be introduced within a specific discipline (e.g. Accounting, Operations Management), since this structure follows the structure of the existing curriculum. As ERP evolves into the curriculum in Stage 2, ERP is integrated across disciplines, including Accounting, Production and Operations Management, and Marketing. This integration enables cross-functional approaches in later stages, enabling the coverage of Supply Chain Management and Customer Relationship Management.

The specific competencies to be included within the curriculum should be based upon job competencies which emerge within industry. In initial stages of ERP implementation, individuals typically "learned by doing," since no formal education existed for these roles. In the late 1990's, the shortage of ERP-trained professionals boosted salaries to unprecedented levels in many corporations.

In the mid- to late-90's, universities joined partnerships (e.g. the SAP Academic Alliance), and acquired the software and training for teaching ERP. At the initial stages, teaching ERP focused upon understanding the foundations of ERP: transactions processing. As ERP systems evolved beyond systems supporting operational performance, new business processes such as supply chain management, customer relationship management, and business warehouse management emerged. A "second wave" of ERP education demands that students understand the strategic implications of ERP initiatives which integrate business processes and facilitate organizational change (Hawking, et. al., 2004).

The Market Power of ERP-trained Graduates

There is evidence of the market power of ERP-trained graduates. Based upon follow-up studies, the marketability of ERP-trained graduates is high, and graduates with ERP background command higher salaries than students without ERP background (Sager, et. al., 2004).

Based on a survey of 12 hiring companies that recruited graduates from California State University Chico and the University of Southern California, Connolly, et. al. found that companies hiring ERP-trained graduates have identified significant benefits, including tangible and intangible benefits. Tangible benefits include reduction in training costs, less training, readiness for clients' engagements, ability to contribute earlier, mitigation of hiring risk, and a higher level of confidence on the job. Intangible benefits are teamwork and interpersonal skills, better preparation for hard work, ability to analyze requirements, and stronger knowledge of company operations (Connolly, et. al, 2005). These findings illustrate the importance of designing curricula which address market needs.

The Continuing Role of Schools of Business in Teaching ERP

Educational institutions can play a significant role in facilitating the effective implementation of ERP systems by providing trained personnel who understand best practices and cross-functional business processes. In successive stages of ERP implementation, these competencies grow in importance, particularly competencies for business analyst roles. The ERP analyst needs to understand how re-engineering business processes and integrating data across functional areas of the business improves performance, reduces costs, and increases responsiveness.

To teach these competencies successfully, business schools may need to re-engineer the curriculum to integrate a cross-functional approach, rather than teaching from the perspective of the "silos" (e.g. isolated functional areas). In other words, the challenge of teaching ERP may break down the discipline-specific domains in favor of a more integrated, interdisciplinary curriculum.

In order to meet the needs of industry for ERP-trained professionals, it is important to re-visit the question: "What are the core competencies needed for effective performance in key positions, such as the ERP business analyst.?" This study addresses this question.

RESEARCH METHODS

Identifying ERP Competencies

Since we are interested in identifying the ERP competencies which industry seeks, we used IT web sites. The search was predominantly done using three popular IT job websites: www.dice.com, www.monster.com, and www.erp-jobs.com during the fall, 2005 semester. We used a set of search keywords (see list of keywords below) to obtain about 1500 search results.

Keywords:

- SAP

- ERP

- SAP+ERP+Functional

- SAP+Technical

- ERP+Oracle

- ERP+Peoplesoft

- Functional 8.BASIS

Two graduate students used the same process to develop the set of competencies from the job postings, using the same keywords. Using the results, we identified a set of job titles which were comprehensive (e.g. see list of job titles below), and searched for common, recurring responsibilities for each job title. We used content analysis to synthesize job descriptions for each job title and to develop a list of core competencies or essential skills for each title. The results are not specific to any ERP application but are common to all ERP applications, e.g., SAP, Oracle ERP, etc.

ERP Job Titles:
- ERP project manager
- ERP business analyst
- ERP programmer analyst
- ERP application developer
- ERP auditor
- ERP security administrator
- ERP system administrator
- ERP quality assurance and test engineer
- ERP trainer
- ERP database administrator
- ERP change management consultant
- General skills

The researchers analyzed the list of competencies generated from the content analysis and further integrated and consolidated the list to eliminate redundancy. A second round of job postings were analyzed and used to develop additional competencies using the same process. The competencies defined in this second round were integrated into the list of competencies developed during the first round to generate a final list of competencies.

The list of competencies was reviewed by five experienced ERP project managers in order to obtain their feedback on changes, additions, or deletions. Using their feedback, a final list of ERP competencies was compiled and used to develop the questionnaire. This list of competencies is included as Appendix A: ERP Competencies.

Questionnaire Design

Using the ERP competencies, a questionnaire was designed to provide the industry participants with an opportunity to assess the competencies with respect to degree of importance to meeting their needs, with 5 representing "of great importance," 3 representing "of moderate importance," and 1 representing "of low importance."

Population and Sample

The ERP questionnaire is being administered as a web-based questionnaire. Respondents are ERP project managers from companies serving on the MIS advisory boards at Louisiana State University, Southern Illinois University Edwardsville, and California State University Chico. These industry advisors identify the skill and knowledge expectations for MIS graduates, and their input is important in designing courses and programs to meet these needs, including the need for ERP-trained graduates. These results will represent industry needs from a range of geographic regions, including the Southeast, Midwest, and West. We expect to obtain the first round of industry feedback by May 15, 2006 so that the findings will be ready to report at the 2006 AMCIS Conference.

Because of the wide range of ERP competencies defined in the job postings, we plan to use the Delphi Technique to develop a list of "common" competencies which are most important to practitioners.

Implications for the Curriculum

A list of core competencies for ERP is a valuable input into the design of academic programs in ERP concepts and applications. It will enable academic professionals to conduct a "gap analysis" to determine which core competencies are being taught in existing curricula and which competencies are not being addressed. Some of the new and emerging job responsibilities, such as the role of the ERP business analyst, may require the development of innovative cross-functional and interdisciplinary programs to address market needs. The findings of this study will be disseminated through presentations and publications in MIS education journals, and they may be useful as input into the MIS curriculum models.

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Appendix A: ERP Competencies

Project Management

1.   Manage ERP project implementation
2.   Define tasks and timeline for successful "go live"
3.   Define, track, and manage the project budget
4.   Manage team communications and communications with executives and vendors
5.   Understand and apply risk management techniques
6.   Understand and employ change management strategies
7.   Manage project resources
8.   Understand and apply project procurement management
9.   Understand human resource management (team development, motivation, etc.)

ERP Business Analyst

1.   Conduct requirements analysis
2.   Perform business process modeling and analysis
3.   Develop design specifications
4.   Configure ERP modules
5.   Test from a functional business area perspective
6.   Document requirements for configuring ERP applications
7.   Communicate technical information to both IT and business professionals
8.   Demonstrate knowledge of SQL and reporting tools (e.g. Crystal Reports)
9.   Use continuous improvement methodologies for systems support
10. Demonstrate expertise in ERP modules
11. Knowledge of best business practices

ERP Programmer Analyst

1.   Understand the software development lifecycle process
2.   Perform business process modeling and analysis
3.   Create and maintain documentation
4.   Test, debug, and install programs to support application integration
5.   Identify deficiencies with application design
6.   Act as a liaison to technical services for application troubleshooting
7.   Demonstrate expertise in ERP modules
8.   Provide integration design with current legacy systems

ERP Application Developer

1.   Develop specifications and enhancements to ERP module(s)
2.   Integrate "bolt on" solutions
3.   Creating customizations to the ERP modules
4.   Demonstrate knowledge of interfacing ERP modules with legacy applications
5.   Design custom components, including data entry screens, reports, queries, and interfaces
6.   Test and document ERP modules
7.   Demonstrate object-oriented programming skills (e.g. ABAP and/or Java)
8.   Demonstrate understanding of database technologies
9.   Demonstrate knowledge of application security and controls
10. Demonstrate expertise in ERP modules
11. Demonstrate ability to integrate ERP modules and legacy applications

ERP Auditor

1.   Develop a successful audit plan for ERP implementation
2.   Audit and review business systems that support key business processes
3.   Conduct risk assessment, including technology risks
4.   Ensure compliance with audit and regulatory standards

5. Demonstrate knowledge of information systems audit processes and general IT controls, including application controls
6. Demonstrate knowledge of the Sarbanes Oxley Act, especially section 404
7. Demonstrate knowledge of business processes supported by ERP systems
8. Demonstrate knowledge of ERP application security, including super user accounts, user profiles, and segregation of duties
9. Demonstrate knowledge of control management software

ERP Change Management Consultant

1. Demonstrate knowledge of change management
2. Create and implement an ERP change management strategy
3. Coach senior-level clients on their role in major transformations
4. Assess organizational risks
5. Develop transition strategies
6. Understand and implement quality management

ERP Security Administrator

1. Determine IT security best practices, policies, and procedures
2. Design, build, and monitor role-based security
3. Create user authorization and user profiles
4. Provide user administration, including user profile administration and activity groups' administration
5. Demonstrate knowledge of ERP application security and authorization procedures
6. Demonstrate knowledge of Sarbanes-Oxley tasks and approve changes that impact SOX compliance
7. Implement information security strategies, including password protection, access control, and segregation of duties
8. Demonstrate knowledge of Oracle and Unix
9. Conduct vulnerability scanning and intrusion detection

ERP System Administrator

1. Implement system installation, upgrades, and version control
2. Demonstrate working knowledge of systems software
3. Perform ERP administration tasks, including batch scheduling, spool management, transaction administration, and workload analysis
4. Provide configuration, maintenance, performance tuning, and system monitoring
5. Troubleshoot problems in systems management and apply patches and fixes
6. Provide troubleshooting and technical support
7. Implement plans for business continuity and disaster recovery
8. Determine the optimal solution to incorporate the ERP system into the current IT architecture

ERP Quality Assurance and Test Engineer

1. Oversee the test strategy (develop test standards, execute test scenarios)
2. Utilize defect tracking and test management tools
3. Analyze performance test results and offer specific tuning recommendations
4. Perform test system integration with internal applications to ensure compatibility
5. Define and monitor metrics supporting quality management

ERP Trainer

1. Design end-user training for ERP, including training related to ERP reporting tools
2. Develop end-user training material
3. Provide/oversee instruction
4. Develop/review training documentation
5. Provide progress tracking and reporting

ERP Database Administrator

1. Provide database installation, configuration, maintenance, and performance tuning

2. Implement database security, database backup and recovery strategies
3. Create/administer database schema objects
4. Provide data replication, data conversion, data loading, data modeling
5. Demonstrate knowledge of UNIX, NT, TCP/IP
6. Perform database sizing, growth forecasting, and capacity planning
7. Perform database sizing and performance tuning
8. Integrate data between different databases

General Skill Sets

1. Demonstrate effective communications skills
2. Demonstrate analytical and problem-solving skills
3. Manage time and priorities effectively
4. Demonstrate initiative and creativity
5. Use good judgment in resolving issues
6. Demonstrate effective organizational skills
7. Develop technical documentation
8. Demonstrate a team-oriented attitude
9. Demonstrate knowledge of general business processes

ERP Business Owner (Champion)

1. Understand current business processes and gap between the current and desired state
2. Understand the capabilities of the ERP system
3. Demonstrated willingness to change business processes to adapt to the functionality of the ERP system
4. Demonstrate the ability to influence senior management on the values of implementing ERP software
5. Work in partnership with IS to implement the ERP system

ERP Business Subject Matter Expert

1. Demonstrate expertise in current business processes
2. Understand current business processes and the gap between the current and desired state
3. Understand the capabilities of the ERP system
4. Make timely decisions on the implementation of ERP system
5. Develop and execute business test cases
6. Communicate business issues when functionality does not meet business needs