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Information Systems Reengineering for Modern Business Systems

ERP, Supply Chain and E-Commerce Management Solutions

Raul Valverde & Malleswara Rao Talla

30809192

Information Systems Reengineering for Modern Business Systems:

ERP, Supply Chain and E-Commerce Management Solutions

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BUSINESS SCIENCE Reference

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Published in the United States of America by
Business Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com

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Library of Congress Cataloging-in-Publication Data

Information systems reengineering for modern business systems: ERP, supply chain and e-commerce management solutions / Raul Valverde and Malleswara Rao Talla, editors.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-4666-0155-0 (hbk.) -- ISBN 978-1-4666-0156-7 (ebook) -- ISBN 978-1-4666-0157-4 (print & perpetual access) 1. Software reengineering. 2. Management information systems. I. Valverde, Raul, 1970- II. Talla, Malleswara Rao, 1956-
QA76.758.I54 2012
005.1--dc23

2011049470

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

All work contributed to this book is new, previously-unpublished material. The views expressed in this book are those of the authors, but not necessarily of the publisher.

30809192

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Foreword

The target reader for this book is the industrial engineering student or the practitioner in the field. It is a breath of fresh air in having one book listing the documentation of successful and unsuccessful ERP system implementations. While the recent downturn in the economy put a brake on organizations to modernize their business processes, businesses grow and need to adapt to the changing paradigms that ERP systems allow one to integrate the Web and storefront operations. Sticking to the mantra "If it isn't broke, don't change it," the book has points out that technology moves forward to where in retail world, the Web is approaching 50% of annual sales. Sales have two modes (use the net for the catalog with referral to the nearest retail outlook, or present a sales order form for direct order capture. This book shows the large retail store is becoming more of a warehouse operation with quick pick operations.

Legacy ERP systems have to evolve to include Web and more modern approaches (B2B) to doing business, and this book describes the methods used for success and some of the reasons that other systems failed.

The security chapter brought to light information that this foreword author had never known. Using standard technology, it is possible to encrypt data traffic, but it is shown that the vendors of ERP systems fail to protect critical application information from hackers and from uncontrolled access. Too many individuals have unnecessary global sub-system access, password management is poorly done, and databases containing confidential corporate information are not encrypted.

What the authors have pointed out in this book is that if you do not have a good implementation plan, your conversion or upgrade process is doomed. One approach is to suggest a paradigm shift to emulate the processes used in the software industry. The use of an object oriented approach employing the Universal Markup Language (UML) is novel, and should bear good results.

The excellent points in the book are the diversity of considerations presented to the reader. Legacy systems, which were compartmentalized into finance, warehousing, retail store sales, shipping, and receiving, are forced into a coherent ERP system covering one business application integrating the preceding list and adding to it, Web selling functionality, EDI, Supply Chain, and Logistics as a coherent business SOA.

For the coming years, this book will serve as a reference manual for the skilled Business System re-engineer who wants to learn from others experiences in both failure and successful implementations.

Leslie Satenstein
Executive VP Operations & Technology ITBMS Co-founder

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Leslie Satenstein *is a Senior Vice President of Operations and Technology of ITBMS. Leslie is responsible for global operations, Information Technology, product security, corporate development, and customer services. Prior to heading up the technical side of ITMS, Leslie worked for Technology Evaluation Centers as author and Senior ERP analyst. He brings to ITBMS over 25 years of diverse IT technical and managerial experience. Leslie noted that for his first years following university graduation he worked in banking, where he held positions as Mathematician, Senior Architect, and then Application Implementation Manager with the respective team under his responsibility. His mathematical forecasting models and queuing theory analysis resulted in millions of dollars of hardware savings for the Royal Bank of Canada as well as having architected fast transaction rates for ATM transaction, putting the bank's transaction response times ahead of the competition. In the latter part of the 15 years, Leslie moved to Montreal and worked for "Caisses Populaires Desjardins" (CCPEDQ), a Quebec based billion dollar credit union as Senior Architect, implementing on-line banking and secure file transfer applications between the SMBs and the credit union. Moving from Banking to ERP he worked as IT Manager for Frisco Bay Industries and then as an independent ERP consultant, certified in development, administration, and in the areas of distribution, manufacturing, logistics, supply chain, finance, and more. In 2006, he joined Bell Canada Business solutions as a Project Manager/ERP specialist. He brought to Bell over 14 years of IT management experience in the areas of supply chain management (SCM) systems, business process re-engineering, vendor management, finance, HR, EAM, MRO, and project management for enterprise-wide systems, which he acquired from a variety of Fortune 500 companies. These clients include International Truck and Engine, Tyco, IBM, Nortel, Anderson Windows, Technology Evaluation Centers (TEC), and recently, the city of Laguna Beach California. Leslie has also worked on moderately sized municipal government (using GIS and more) to map water, gas and electrical power lines, meters, spare parts, tools warehouses, vehicles, employees, skills, and much more. Leslie's areas of interest include: project management, supply chain management, and designing, manufacturing, and delivering products to market. His interest includes open source systems and applied technology to save the SMB money. His hobbies include Linux and Cloud Computing. Mr. Leslie graduated from Concordia University in Montreal, Quebec (Canada) and received his Bachelor of Science degree in the area of Mathematics and Physics. He holds a Master's Degree in Statistical Mathematics from University of British Columbia, and attended McGill University for studies towards the MBA degree. Leslie is a project management professional (PMP), a certified member of the Canadian Association Production Inventory Control Society (CAPICS) and the IEEE. Leslie is also a part-time "Supply Chain/Logistics" instructor at Champlain College St. Lambert.*

Preface

The vast majority of enterprise Information Systems (IS) were implemented in the early days of computing by using the traditional paradigms and implemented with structured computer languages such as COBOL. These legacy systems are standalone systems that are limited in scope as they tend to be infrastructure-specific, not integrated with other systems, and usually, information is not readily shared between systems.

With recent developments, particularly the trends towards e-Commerce, Enterprise Resource Planning (ERP), and Supply chain management (SCM), many companies are realizing that they will have to migrate to these new systems in order to remain competitive. The migration from legacy systems to modern systems could be challenging from the business and technical point of view. However, such projects often failed for several reasons:

- the new systems were quite expensive,
- cumbersome to implement,
- involve radical or unwanted changes to existing processes,
- resistance to change,
- sharing sensitive information among departments and companies,
- vulnerable to security threats,
- requires extensive training, et cetera.

Each modern system has its own set of challenges when it comes to the migration of legacy systems.

The migration of legacy systems into ERPs is challenging as these are integrated pre-packaged systems designed to support many organizational functions and their customization is normally discouraged. In order to reduce the risk of failure for implementation, vendors encourage business process re-engineering, rather than software customization of ERPs. It is often argued that it is more advantageous for companies to use them without changes as these were built based on best practices that incorporate industry standards. Vendors encourage business process reengineering not only to be able to easily implement ERPs but also in order to achieve dramatic improvements in one or more performance measures in the business that is adopting the ERP. Business process reengineering can increase the risk of failure of a project due to resistance to change from organizations, difficulty in training employees, and business requirements becoming obsolete, and these risks need to be managed properly during the project execution in order to maximize success rates.

The reengineering of legacy systems to E-Commerce can also be a challenge as this process relies heavily on the ability to integrate them with web applications and web services such as payment systems.

For these, legacy systems would need to support Web architectures such as the Service Oriented Architecture. This support would require a change of paradigm from structure to component based systems that would require a change of software models from structured models such as data flow diagrams to UML based models.

Supply Chain Management systems are normally used to integrate business functions and business processes within and across companies, into a cohesive and high-performing business model. Legacy systems need to be reengineered to support modern supply chain management systems such as e-procurement. Some concerns for the reengineering of legacy systems into supply chain management systems include security of data exchanged, integration of business processes among suppliers, data exchange over networks, transformation of legacy systems into Web services, and information flow among different supplier tiers in the supply chain.

Although each modern system might require a different form of legacy systems reengineering, information systems reengineering in general has the objective of extracting the contents, data structures, and flow of data and process contained within existing legacy systems in order to reconstitute in to a new form and subsequent implementation. Businesses must constantly adapt to a dynamically changing environment that requires choosing an adaptive and dynamic information architecture that has the flexibility to support both changes in the business environment and changes in technology.

The book covers different techniques that could be used in industry in order to reengineer business processes and the legacy systems into more flexible systems capable of supporting modern trends such as ERP, Supply chain management systems, and E-commerce. The book also covers related aspects to the reengineering of legacy systems: risk management and obsolescence management of requirements.

The book consists of thirteen chapters, each focusing on reengineering of legacy systems to turn them into modern enterprise systems.

Chapter 1 presents an approach to improve business agility of a legacy IT system by modernizing COBOL application development. The special features in this approach include the introduction of service oriented architecture (SOA) for Web application integration, using model driven development approach with code generation, and agile development process. The legacy systems are often designed using the structured systems analysis and design (SSAD), whereas the modern systems are object oriented using the Unified Modeling Language (UML) documentation.

Chapter 2 highlights the need for converting traditional documentation of legacy systems to object oriented approach, and presents a set of rules to automate the conversion of systems, which were originally modeled using structured techniques to UML.

Chapter 3 discusses the details of systems development and evolution models mainly aiming at an ongoing reengineering of legacy systems, and proposes few strategies for reengineering of both data oriented model and process oriented models. The chapter focuses on legacy systems to incorporate the interfaces to external systems for automatically updating the data, and creating an extended process by including the supplier and customer processes.

Chapter 4 envisions an Information System as a set of interdependent components that provide the intended services, and presents a methodology for component based modeling and development of an information system, starting from the requirements definition phase, arriving at candidate components and creation of final components and their interfaces. The methodology aims at clarifying the intricate details and usage of an information system via business type models and use case models. The chapter proposes a methodology for component reengineering; model-view-control framework for component

evolution, refinement, and replacement to achieve a reengineered Information System that reflects current requirements in business domain.

Chapter 5 focuses on inter-organizational processes and identifies eight process issues that need to be taken into account when evaluating inter-organizational integration configurations. It also presents few examples upon how problems surface in a completely centralized and in a completely decentralized inter-organizational process integration scenarios.

Chapter 6 highlights the need for understanding the requirements obsolescence that differs from business to business, project to project, and also from the stakeholders' point of view to the business users' perspective involved in a project, which is mainly due to changes in business reasoning or business processes. The chapter presents a comprehensive questionnaire with relevant and probing questions that have collected data on obsolescence of requirements, in order to gather data for indentifying risk factors and their impact. This research helps in turning IT project failures into project successes.

Chapter 7 aims at automation of a business process via workflow management system or ERP system embedding workflow functionalities. The wider diffusion of ERP systems tends to favor the latter solution. The chapter reports a study assessing the "workflow ability" of ERP systems and comparing this with that of Workflow Management Systems. Then, an empirical study was conducted regarding two different case studies. The correctness and completeness of the process models implemented using ERP and WfM systems were evaluated and analyzed.

Chapter 8 emphasizes the importance of evaluating the risks while planning and implementation of ERP systems. The chapter presents a case study example focusing on the implementation phase of ERP system, stressing upon the validity of specific risk management model. It covers a brief overview of two ERP projects risk management models; the first model deals with ERP as technology where risks are managed in accordance to Information Technology and Information System (IT & IS) projects governance, while the second model considers the integrated and interdisciplinary nature of ERP systems and introduces the term "ERP Governance" as a model that demand balances between IT and business governance. A third model similar to the second is also proposed, which relies heavily on best-practises and assessment frameworks from the industry.

Chapter 9 explores and assesses the Critical Success Factors (CSF) that influence the implementation of an ERP system. The chapter investigates how many CSFs are strongly correlated with each other for the success of ERP projects in the manufacturing sector. The chapter also tests empirically using the Statistical Package for Social Science Analysis of Moment on Structures (SPSS AMOS 18.0) to justify the level of CSFs among the local and joint-venture companies using a t-test analysis.

Chapter 10 describes a debacle that occurred when a large assembler of fast moving consumer electronics in a newly formed supply chain involving four key players in a sell-buy relationship. The chapter explored mistrust of trading partners as the companies receiving component sets refused liability for damage or defects introduced by upstream companies in the supply chain. A remedial *quick-fix* using centralized inspection at the principal supplier soon was adopted to facilitate supply of complete sets of mechanical parts to the assembler. The chapter highlights significant similarities between the case study supply chain and the concepts used in business process reengineering.

Chapter 11 proposes a framework-based strategy using .net for easier migration from legacy software systems to Web services, and presents software metrics observed during the process of reverse engineering of legacy systems for designing the Web services.

Chapter 12 covers the work to produce an architecture that shows how to reengineer traditional point of sales (POS) terminal payments to adapt payments over the Internet via Web services. In current

environment of global economy, vendors can negotiate about services and fees with payment providers worldwide.

Finally, chapter 13 highlights the importance of software management, especially in Aerospace Industry, and stresses that negligence of any maintenance components can put the organization into risk. Standardizing processes are necessary to avoid or minimize the risks. The chapter looks into a reengineered process to deploy the upgrades proactively in a cost effective manner.

In conclusion, the chapters covered contemporary approaches to legacy systems reengineering into modern enterprise Information Systems, namely ERP, SCM, and E-Commerce systems. The brand new off-the-shelf ERP, SCM, or E-Commerce system requires extensive customization that often goes wrong one way or the other, and mandates extensive training to already resisting internal process owners and technical/operation staff members. The reengineering effort of a legacy system can be welcoming by the process owners as the impact to technical/operation staff is almost negligible, less expensive as the system is already well understood, and reflects upon the business processes more accurately than any new enterprise system. Therefore, the book highlights the need for reengineering a legacy systems to turn it into a contemporary enterprise system that accomplishes the same or better results than any other off-the-shelf system.

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Acknowledgment

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In addition, we would like to extend our special thanks to Prof. F. Nebebe, Prof. S.K. Goyal, and Prof. M. Sharma of Department of Decision Sciences and MIS, Concordia University, Montreal for encouragement throughout this endeavor. We also like to thank Prof. Liette Lapointe, Desautels Faculty of Management, McGill University for encouragement. Finally, we also like to thank our family members for encouragement during this work.

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Improve Business Agility of Legacy IT System 1
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In this chapter, an approach to improve business agility of a legacy IT system by modernizing COBOL application development is presented. The special features in this approach include the introduction of service oriented architecture (SOA) for Web application integration, using model driven development approach with code generation, and agile development process. The component architecture and its framework, together with the infrastructure for development and testing, are also presented.

Chapter 2
Reengineering Structured Legacy System Documentation to UML Object-Oriented Artifacts 30
Terrence P. Fries, Indiana University of Pennsylvania, USA

The need for reengineering of software systems has dramatically increased as legacy systems are migrated to new platforms and rewritten in modern object-oriented languages. Although the de facto standard for describing object-oriented systems is the Unified Modeling Language (UML), many legacy systems have been documented using non-object-oriented structured analysis and design methods. Problems arise in the migration, because non-object-oriented documentation is inherently not conducive to the development of object-oriented systems. This chapter presents a set of rules to automate the conversion of systems, which were originally modeled using structured techniques to UML. The newly created UML documentation can then be used in developing an object-oriented equivalent system. The UML model may also be used by computer aided software engineering tools to implement a new system. The reengineering rules are tested on an example structured system to demonstrate their viability.

Chapter 3
Traditional Data Oriented versus Process Oriented Reengineering of Legacy Systems 54
Raul Valverde, Concordia University, Canada
Malleswara Talla, Concordia University, Canada

The chapter presents data oriented and process oriented models of legacy systems. It discusses the details of systems development and evolution models mainly aiming at an ongoing reengineering of legacy systems. It proposes a few strategies for reengineering of both data oriented model and process oriented models. The legacy systems often miss automatic interfaces to external systems, so the chapter presents a strategy focusing on automatic update of data of the system. Likewise, the chapter also presents a strategy for process reengineering in order to integrate external systems. Finally, a legacy system is envisioned as a comprehensive mix of both data and process oriented, while proposing a gradual ongoing reengineering of both data structures and process methods.

Chapter 4
Component-Based Modeling for Information Systems Reengineering 65
Malleswara Talla, Concordia University, Canada
Raul Valverde, Concordia University, Canada

An Information System can be envisioned as a set of interdependent components that provide the intended services. The component based modeling serves as a tool for collecting requirements of an Information System in user perspective and business perspective at various stages of software development. The chapter presents a methodology for component based modeling and development of an Information System, starting from the requirements definition phase, arriving at candidate components and creation of final components and their interfaces. The methodology aims at clarifying the intricate details and usage of an Information System via business type models and use case models. The chapter presents the interaction diagrams in order to describe interactions among objects in systems perspective, and context diagrams for reflecting upon the business domain. Finally, the chapter proposes component replacement as a methodology for system reengineering, and model-view-control framework for component refinement and evolution in order to achieve a reengineered Information System that reflects upon current requirements in business domain. The reengineering techniques proposed in this chapter can be applied to legacy systems to turn them into a component-oriented reengineered system.

Chapter 5
Critical Issues to Consider when Evaluating Inter-Organizational Process Integration Configurations 81
Frank G. Goethals, IÉSEG School of Management (LEM-CNRS), France
David J. Newlands, IÉSEG School of Management (LEM-CNRS), France

Networks of companies can use a range of configurations to create inter-organizational processes. Problems become apparent when partnering companies decide to set them up. Those problems take a different form in centralized and decentralized inter-organizational process-integration scenarios. This chapter identifies eight process issues to be taken into account when evaluating inter-organizational integration configurations: difficulties to identify when a task should be executed, understanding what a task does exactly, agreeing how to trigger tasks, distributing investments among parties, delivering appropriate

service levels, preserving value of the inter-organizational process, process ownership clarity, and managing in the frame of changing relationships. Examples are given of how problems surface in a completely centralized and in a completely decentralized inter-organizational process integration scenarios.

Chapter 6
Business Risk Analysis: Obsolescence Management in Requirements Engineering 99
Jasbir Virdi, University of Toronto, UK

Most businesses these days depend on and grow with large IT projects. Understanding requirements obsolescence can differ from business to business, project to project, and also from the stakeholders' point of view to the business users' perspective involved in a project. The major reason a requirement or requirements would become obsolete is due to change in business reason or business process. The basis of this research study is a comprehensive questionnaire with relevant and probing questions that have collected data on obsolescence of requirements. Through analysis of the gathered data and information, this study has aimed to present these risk factors, their impact, and a possible way to measure them. The critical factors identified and the result of this research project can be a trigger to conduct further in-depth analysis of project risks based on categories of projects (maintenance & support projects, development projects, data conversion projects, etc.) or rather analysis of projects based on the business area/function. This research study is another attempt to assist in turning IT project failures into project successes.

Chapter 7
Assessing Workflow Ability of ERP and WfM Systems for Implementing Business Processes 127
Lerina Aversano, University of Sannio, Italy
Maria Tortorella, University of Sannio, Italy

Automation of a business process can be obtained by using a workflow management system or ERP system embedding workflow functionalities. The wider diffusion of ERP systems tends to favor the latter solution. There are several practical limitations of most ERP systems when automating business processes. To date, there is a lack of empirical studies aiming at achieving an evidence of these limitations. The work proposed in this chapter reports a study assessing the "workflow ability" of ERP systems and comparing this with that of Workflow Management Systems. Then, an empirical study was conducted regarding with reference to two different case studies. The correctness and completeness of the process models implemented using ERP and WfM systems were evaluated and analyzed.

Chapter 8
Risk Management and Business Processes Reengineering, Success Drivers for ERP Projects:
A Case Study 146
Hussam Eldin I. Agha, University of Liverpool, UK & UNICEF, Sudan

Successful planning, implementation, and use of Enterprise Resource Planning (ERP) systems are critical to the operational performance and to the survival of ERP adopters. While the identification of risk factors and critical success factors for the management of ERP projects has been addressed by some research papers, less attention has been made to the impediments of risks and drivers of success. By using a case study example and focusing on the implementation phase, this chapter presents and emphasises the validity of specific risk management model. Briefly, an overview of another two ERP

projects risk management models will be provided; the first model deals with ERP as technology where risks are managed in accordance to Information Technology and Information System (IT & IS) projects governance. The second model considers the integrated and interdisciplinary nature of ERP systems and introduces the term "ERP Governance" as a model that demands balances between IT and business governance. The third model, while similar to the second, relies heavily on best-practises and assessment frameworks from the industry.

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Reengineering for Enterprise Resource Planning (ERP) Systems Implementation: An Empirical Analysis of Assessing Critical Success Factors (CSFs) of Manufacturing Organizations 185
C. Annamalai, Universiti Sains Malaysia, Malaysia
T. Ramayah, Universiti Sains Malaysia, Malaysia

Reengineering is a concept that is applicable to all industries, particularly information and communication technology (ICT) projects regardless of organizational type, size, culture, and location. This study explores and assesses the CSFs affecting the ERP implementation success. Long term Top management Support (LTS), Perceived ERP benefits (PEB), ERP in-house Training (EIT), Project Tracking (PTG), Visible Project Phases (VPP), Project Phase Update (PPU), Interdepartmental Cooperation (IDP), Strategic IT planning (STP), ERP vendor Support (EVS), and Data Analysis and Conversion (DAC) were found dominant critical factors for the success of the ERP implementation in the manufacturing sector. This study investigates how many CSFs are strongly correlated with each other for the success of ERP projects in the manufacturing sector. Furthermore, this study also tests empirically using the Statistical Package for Social Science Analysis of Moment on Structures (SPSS AMOS 18.0) to justify the level of CSFs among the local and joint-venture companies using a t-test analysis.

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David J. Newlands, IÉSEG School of Management (LEM-CNRS), France

This chapter describes a debacle that occurred when a large assembler of fast moving consumer electronics commissioned the set up of a new supply chain. Four key players undertaking five processes were involved. These companies planned to operate sell-buy relationships. Upon starting to ramp-up of the first product component sets, it became clear that companies did not trust their successors to pay for all goods delivered. Similarly, suppliers were not trusted to deliver perfect goods. Companies receiving component sets refused liability for damage or defects introduced by companies further up the supply chain. A remedial quick-fix using centralised inspection at the principal supplier soon was adopted to facilitate supply of complete sets of mechanical parts to the assembler. Significant similarities exist between the case study supply chain and the concepts used in business process reengineering. The chapter identifies stages undertaken to improve an inbound supply chain for complex plastic mouldings assemblies.

Chapter 11
An Effortless Approach for Migrating from Legacy Software Systems to Web Services 219
K. Velmurugan, Anjalai Ammal Mahalingam Engineering College, India
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