December 2006

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ABSTRACT

The objective of this study is to establish a base for understanding inflexibility, with different kinds of integration problems being examined and explained. Studies of process integration have focused mostly on the design and management of efficient operation with information technology but very little on the difficulty in making changes with tightly linked processes. In order to eliminate risks of integration failure, there is a need for deep understanding of the types and causes of inflexibility with process integration.

Based on the literature and reported cases of process integration and enterprise flexibility/inflexibility, this study proposes that inflexibility can be classified as either operational, organizational, or systems inflexibility. The incompleteness of business design and the misalignment of users' and system designers' capability seem to be key sources of inflexibility. Though the propositions are to be further tested, the proposed framework with different categories of inflexibility and different sources for inflexibility provides a reference for planning effective management of process integration.

Keywords

Process integration, enterprise integration, process flexibility, process inflexibility

INTRODUCTION

Process integration technologies have been applied by many businesses in the hope of establishing enterprise flexibility. Enterprise flexibility means the changeability a firm can control and manipulate at various levels to fulfill the need for change. Process integration technologies with complete information and coordinated activities provide a platform for facilitating speedy decision-making and a variety of methods of problem handling.

In order to cope with rapid environmental changes, companies strive to integrate business processes by applying systems such as enterprise systems (ES) and business process management (BPM) systems to increase business responsiveness, enhance resource movements, enable organizational collaboration, and increase system adaptability. However, integration is not synonymous with flexibility (Crowe 1992). Problems such as slow business responsiveness, bureaucratic delays, and restricted system modifications have been reported. These inflexibilities can be costly in daily operation as well as strategic movement.

Studies of process integration have focused mostly on the design and application of process integration technologies but very little on the difficulty in making changes with tightly linked processes. In order to eliminate the risks of integration failure, there is a need for deep understanding of the types and causes of inflexibility with process integration.

The objective of this study is to establish a base for understanding inflexibility, with different kinds of integration problems being examined and explained. Two linked research questions are planned in this research to build knowledge on inflexibility with integrated processes:

- What kinds of inflexibility can be found with process integration?
- Why do organizations experience inflexibility in integrated processes?

Scrutinizing the potential problems with integration, especially those relating to its strategic objective—flexibility—is an effective approach to building practical insights on process integration. Based on the literature on process integration, the reported downsides, and verified with four experienced business integration managers (described in table 1) who have accumulated experience on process integration management, this study proposes that inflexibility can be classified as operational, organizational, and systems inflexibility. Incompleteness of business design and misalignment of users' and system designers' knowledge seem to be key sources of enterprise inflexibility.

Job description	Experience in process integration
Manager of process integration	MRP systems, ERP systems, workflow management systems
Manager of enterprise integration	ERP systems, workflow management systems
Management consultant for business integration	CRM systems, enterprise application integration systems
Management consultant for business change	ERP systems, CRM systems, business process management systems

Table 1 Description of experienced process integration manager

PROCESS FLEXIBILITY AND INFLEXIBILITY

To build a clear understanding of integration inflexibility, this section starts with a review of the literature with regard to integration flexibility and extends into cases on opposite impacts of integration. Three types of flexibility/inflexibility are described after a brief description of integration and flexibility. Next, propositions, which were verified by experienced integration managers, are formed with a description of possible sources of integration inflexibility.

Process Integration and Flexibility

Process integration means a set of processes that are consistent and mutually supportive in supporting business objectives (Waring and Wainwright 2000; Roldán and Leal 2003; Singletary 2003; Spathis and Constantinides 2003; Themistocleous 2004; Volkoff et al 2005). It is usually enabled by the application of information technology (IT). Information technology supports, and sometimes enforces, standardization of data and processes within a firm (Shang 2005). The standardized data and the process architecture allow for coordinated, organization-wide responses to rapidly changing business environments.

Businesses usually adopt packaged enterprise systems such as computer-integrated manufacturing (CIM), material resource planning (MRP), enterprise resource planning (ERP), customer relationship management (CRM), and supply chain management (SCM) systems to build an integrated infrastructure with shared data and tightly linked operations to react quickly to business changes (Waring and Wainwright 2000). These enterprise system packages provide optional processes and configurable tables that allow a large degree of flexibility "out of the box" (Volkoff et al 2005). These parameter-driven approaches meet some of the flexibility requirements by allowing the data input formats to be modified and process algorithms varied within a pre-defined range. Business process management (BPM) systems were introduced subsequently to supports inter-and-intra enterprise integration with process modeling and designing tools incorporating various process integration standards (Shang 2005). There are neither predefined reference models nor pre-built processes. Both *ad-hoc* and heterogeneous processes can all be managed. Today, many businesses apply both enterprise systems and BPM systems to build integrated processes, expecting that with better data and process integration every triggered activity can run cooperatively and efficiently across functions. Process integration is considered the key enabler of business success in process re-engineering (Hammer 1995) and mass customization (Pine 1993).

Many organizations have applied process integration technologies to achieve the goal of flexibility in operation, management, and information systems. Process integration is praised for increasing business responsiveness (Kuan and Chau. 2001; Roldán and Leal 2003; Singletary 2003;), enhancing resource utilization (Roldán and Leal, 2003; Singletary 2003; Themistocleous 2004; Li-Ling 2004), enhancing organizational collaboration (McNurlin 2001; Goodhue et al. 1992; Singletary 2003; Spathis and Constantinides 2003), and increasing system functionality (Singletary 2003; Themistocleous 2004; Spathis and Constantinides 2003).

Flexibility, at the enterprise level, has two important measures in relation to change—speed and variety (Edward 1995). Speed means accomplishing things with minimal time and effort so that the firm can adapt to change. Variety means the range of optional solutions that can be applied to different business situations. Process integration, with its complete information on enterprise resources and its coordinated activities, provides a platform for speedy decision making and the application of various means of handling problems and developing innovations.

Types of Flexibility/Inflexibility

Enterprise flexibility has been mainly recognized by research in strategic management (Sanchez 1995; Sushil 2001; Hsu 2005; Swink et al 2005), organization management (Lau 1996; Bhandari et al 2004; Homa 1992), operations management (Sanchez 1995; Lau 1996; Sushil 2001; Duclous et al 2003; Sethi and Sethi 1990), financial manageTment (Sushil 2001), and information systems management (Lacity et al 1995, Sushil 2001;). Though these studies have used different terms in describing enterprise flexibility (Sushil 2001) based on impacts of process integration within the enterprise, we classify flexibility and inflexibility into three main areas: organizational, operational, and systems.

Organizational flexibility/inflexibility is reflected in reorganizing structures, allocating resources, and coordination in cross-departmental decision making with regard to anticipated and unanticipated environmental changes.

Operational flexibility/inflexibility is reflected in the operational efficiency and effectiveness in responding to changes in internal and external changes. These changes are related to customer requests, supplier moves, market turbulence, technology innovations or strategic changes. Operational flexibility and inflexibility can be noted in value chain processes from marketing, sales, planning, manufacturing, production to logistic processes.

Systems flexibility/inflexibility is reflected in the capability of making changes to and fixing problems in integrated information systems. The need for system change comes from both business and technology sides. The system's capability in responding to these changes is highly critical to the enterprise running.

Integration Flexibility and Inflexibility

As summarized in Table 2, by contrasting noted cases of flexibility and inflexibility of process integration this section describes these positive and negative impacts on the organizational, operational, and information systems areas.

Organizational flexibility	**Organizational inflexibility**
l Fluid and networked structure with open communication across departments l Empowered employees providing better services to customers l Multi-skilled employees managing larger scope of work	l Bureaucratic delays in cross-functional decision-making l Reduce local autonomy and loss of local effectiveness l Turmoil/chaos when systems are not working, employees/organization relying completely on the powerful system processes
Operational flexibility	**Operational inflexibility**
l Increased response to customers l Quick change in process l Product flexibility / Manufacturing flexibility / Supply chain flexibility l Increased resource coordination and allocation (material, workforce, finance.) l Increased flexibility in report generation	l Difficult & time consuming to source problem and make quick fix l Incapable of handling unanticipated situation l Longer cycle time for managing the flexible system l Excessive crosschecks and reduced responsiveness and efficiency l Information overload and complicated to retrieve
Systems flexibility	**Systems inflexibility**
l Reusable components provides manageable solutions l Easy maintenance of the system l Easy maintenance of database	l Too time consuming, more difficult to operate/maintain l Hard to make quick fix l System easy to collapse with one process faults

Table 2 Contrasting flexibility and inflexibility of process integration

Organizational Flexibility/Inflexibility

Organizational flexibility mainly has to do with communication fluency and employee empowerment. With networked functions (Sushil 2001) and increased teamwork (Singletary 2003), jobs are easily coordinated (Sushil 2001; Spathis and Constantinides 2003), and work improvements are facilitated within and across departments (McNurlin 2001; Goodhue et al. 1992; Singletary 2003; Spathis and Constantinides 2003). At the individual level, workers are empowered to assume more responsibilities within an expanded work scope (Sushil 2001). The coordination performed by IS integration enables more views to be shared, employee awareness to be broadened, and customer expectations to be tracked and met.

Technology usually provides the potential for empowerment and decentralization. However, when a monolithic organization becomes too large and complex, over-control starts to grow. To play safe, decision-making processes tend to involve everyone in the cycle, and the excessive cross-departmental checking can cause slowness in response (Sheth and Larson 1990; Goodhue et al. 1992; Themistocleous 2004) and can restrict local units from responding to requests efficiently (Goodhue et al 1992; Gupta and Govindarajan 1986; Tito 1989). Meanwhile, practitioners have also noted that it is time consuming to get cross-departmental approvals for resource allocation (Shang 2005).

With regard to employees, though they may be empowered to carry out various jobs, they rely heavily on the integrated system and lack the capability of managing manual work when the system is down (Sheth and Larson 1990; Goodhue et al. 1992; Singletary 2003, 2004).

Operational Flexibility/Inflexibility

Operational flexibility is reflected in quick responsiveness, and in increased resource allocation, deployment, and utilization (Kuan and Chau. 2001; Roldán and Leal 2003; Singletary 2003; Themistocleous 2004; Li-Ling 2004; Spathis and Constantinides 2003). With integrated systems standard data and processes made standardized resources interchangeable and visible to manage.

The streamlined operations have reduced time and cost of work (Goodhue et al. 1992; Singletary 2003; Li-Ling 2004) and increased productivity (Mahesh 1996; Kuan and Chau. 2001; McNurlin 2001).

However, studies have found that greater data integration tends to lead to more bureaucratic delay (Goodhue et al. 1992), and tightly linked processes may lead to loss of flexibility in responding to local events. Reduced responsiveness has been found in tightly linked processes because of the inability to handle unanticipated exceptions (Goodhue et el. 1992). A single failure points has greater impact on all related processes, and it is time consuming to trace and fix problems in the operation (Singletary 2003, 2004; Linthicum 2004). Problem sourcing hence becomes difficult and time consuming (Singletary 2003, 2004). Disaster recovery becomes complex and requires deep planning of resource management and education (Hecht 1997; Singletary 2003, 2004).

Furthermore, one recent study (Volkoff et al 2005) has shown that enterprise systems-enabled integration can lead to inflexibility in operation that are 1) across different business units performing different functions, 2) across different stages of processes, and 3) across different functions with different functional objectives..

System Flexibility/Inflexibility

Process integration systems tend to be flexible as far as being able to adapt to different business situations. The reusable components (Themistocleous 2004) and centralized data make system maintenance easier and the system more portable (McNurlin 2001; Goodhue et al. 1992; Dawes 1996; Singletary 2003; Spathis and Constantinides 2003; Linthicum 2004; Themistocleous 2004).

In reality, however, integrated systems have been reported as being hard to fix and complicated to maintain (Hecht 1997; Singletary 2003, 2004; Sheth and Larson 1990; Themistocleous 2004) because errors are difficult to trace and fix (Singletary 2003, 2004).

SOURCES OF INTEGRATION INFLEXIBILITY

Existing research has offered general explanations of integration difficulties in the areas of (1) implementation management, (2) methodology applied, and (3) the uncertain environment of the integration project (Goodhue et el. 1992). It has been found that contingency factors such as top management support and expectation management are important tactics for success in implementing integration. Next, the implementation methodology, including data analysis and business evaluation, is an important source for a successful design of an integrated system. Environmental uncertainty or turbulence, interdependence, and differences between subunits are affecting factors of the cost of integration (Goodhue et el. 1992). These explanations address both the macro and micro background of process integration and management strategies for

project implementation. For the purpose of examining sources of inflexibility, we need to move from the surface level of environmental and project-based analysis into to the social environment (O'Sullivan 1992) where workers, managers, and designers interact directly with the system throughout its implementation and running life (Markus 1983). Based on the limited literature on process flexibility and inflexibility (mainly in the area of manufacturing), we form preliminary propositions that the completeness of business design and the alignment of users' and system designers' capability to the flexible systems are likely to be the key sources for inflexibility in integrated systems.

Business Design

Achieving flexibility is not just the task of a designer but also that of management, which plays an important role in enabling a philosophy that encourages flexibility rather than constraining it.

Based on research studies (Crowe 1992; Goodhue et al 1992; Upton 1995; Sanchez 1995; Waring and Wainwright 2000; Singletary 2004; Volkoff et al 2005) and reported cases (Fitzgerald and Siddiqui 2002; Akkermans and Helden 2002), enterprise inflexibility seems to be related to business designs that involve (1) incomplete analysis and clarification of business rules, (2) exceptions arising from different situations, and (3) varying requirement of different business units.

Process integration systems usually provide the integration architecture that delineates the standards and interfaces of task modules. This integration platform can quickly link together the resources and capabilities of many business units that can respond flexibly—i.e., broadly, quickly, and at low cost (Sanchez 1995)—to environmental change. An inadequately planned and under-designed integration project could end up with "hard" integration, with processes linked in a fixed and rigid manner (Crowe 1992), such as hard integration reduces, rather than enhances, flexibility. On the other hand, fully planned and robustly implemented integration projects can achieve a considerable degree of flexibility (Crowe 1992).

First, process integration technology strictly separates tasks, and establishes system-wide business rules. However, universal rules can cause unneeded controls in to be applied to simple operations and can make the process complicated. Central authority, with control over the logical aspects of information at all levels of processes can cause delays in both daily operations and resource allocation (Goodhue et al 1992; Singletary 2004).

Second, system integration is often based on current needs and does not necessarily address future needs sufficiently well (Fitzgerald 1990). In many business cases, little attention appears to be devoted to making sure that the new processes are designed to accommodate change. Inflexibilities, therefore, tend to appear in unplanned areas. Process integration systems often establish standardization across the entire enterprise, but these standardized systems are not always able to cover all exceptions. When unexpected specific events occur, it sometimes takes an inordinate amount of time to wait for a superior to delegate authority.

Critical processes, involving either customer interaction or product-related issues require quick cures to avoid capriciousness. A rigidly designed process with no room for exception handling can be costly in terms of customer retention. Flexible design of products in manufacturing can give customers a range of selection without increased economic burden to the manufacturing organization because modular components can often be used to construct different outputs. Meanwhile, manufacturing flexibility is beneficial when yield capacity can be easily adjusted to suit production if unexpected declining demands occur. The exceptions are noted in all areas, including internal resources allocations and changes in strategy, structure, and personnel; external changes from customer requests; supplier movements; and market turbulence (Fitzgerald 1990). Using a flexibility analysis such as that proposed by Fitzgerald (1990), which is undertaken when an integrated information system is developed, the likely future changes that might be required for the system are identified. In addition to changes in the external environment and technical advances, organizational changes in strategy, structure, finance, and personnel are reviewed and put into consideration in the design of the processes.

With regard to designing for local responsiveness, implementing an integrated process usually involves compromises in meeting local information needs (Goodhue et al 1992). It is important for a firm to analyze the local environment and to design processes that facilitate the meeting of important local requirements. The tasks within a multi-divisional firm are intentionally designed to require low levels of coordination so that they can be carried out by an organizational structure of quasi-independent divisions functioning loosely with coupled subsystems (Weick 1976). An important property of this hierarchical structural decomposition is that the impacts of environmental disturbances may be localized within specific subsystems, increasing the survivability and adaptability of the overall system in a turbulent environment (Orton and Weick 1990). A loosely coupled organization in which each participating component development unit can function autonomously and concurrently under the embedded coordination of a modular architecture appears to correspond closely to Daft and Lewin's (1993) notion of modular organizations "that continuously change and solve problems through interconnected, coordinated, self-organized processes."

Incomplete business design of integrated processes has a direct link with inflexibility in all areas. Business managers not only need to differentiate business controls of different situations and requirements of different units but also need to plan for exceptions in order to execute possible future changes. Critical tasks for business managers to undertake include the design of control vs. autonomy in decision making and the authorization to maintain centralization as well as local response; uniformity vs. diversity to reserve room for operational flexibility in addressing unanticipated requests; and analysis of the depth of data sharing among different business units.

The above explanation of inflexibility leads to the following propositions.

Proposition 1a: The completeness of business design can affect the development of organizational inflexibility in process integration.

Proposition 1b: The completeness of business design can affect the development of operational inflexibility in process integration.

Proposition 1c: The completeness of business design can affect the development of systems inflexibility in process integration.

Users' Capability

It is important to combine people with information systems to create flexibility (Crowe 1992). The implementing of integrated processes is closely tied to changes in people's capabilities in decision making and operations management. A business solution that supports flexibility and rapid response requires the incorporation of the very best human expertise and supporting data within the operation of the system.

However, as shown by Upton (1995) on 61 CIM projects in North America, computer integration reduced flexibility in range and change-over times because managers put too much faith in computer-integrated machines and too little faith in the day-to-day management of people. It was found that inflexibility may come from (1) mismatched abilities for information interpretation and decision making, (2) improper rewards and measures to stress the importance of flexibility and reward productivity rather than change-over, and (3) an improper workforce assembled and trained for process flexibility.

In cases of process integration enterprise flexibility requires both knowledge of the business area and proper decision-making capabilities. Integration systems such as ERP systems support operation management with the information required by decision-makers to make judgments and decisions. In the computer-automated and integrated environment, timely and resourceful decisions depend not only on fast data sampling and easy-to-use software but also on high responsive capability and effective communication. With an integrated system, which incorporates knowledge to provide users with general-level considerations in specific and narrow application domains, a decision maker needs to have the flexibility and adaptability to support solutions to semi-structured and unstructured problems.

Sometimes, process integration can be over-praised to ignore user's effect. In cases of complicated and demanding integration project users tended return to original habit after an acceptance of test in implementing IT system. This leads to low utilization and causes less effective than what had been anticipated (Benson et al 1991; King and Sethi 1998; Gallivan et al 2005; Moore and Love 2005).

Regarding the workforce, research has found that more experienced workers were less mobile (Upton 1995). When flexibility started to become critical, less-experienced crews tended to develop their own novel ways of making change-over and viewed change as a defining part of their jobs, whereas a team with a combination of both senior and junior staff members tended to establish stability in the work and remained innovative in executing changes.

The above explanation of inflexibility leads to the following propositions.

Proposition 2a: The willingness and capability of users can affect the development of organizational inflexibility in process integration.

Proposition 2b: The willingness and capability of users can affect the development of operational inflexibility in process integration.

Proposition 2c: The willingness and capability of users can affect the development of systems inflexibility in process integration.

Designer's capability

Technology has been identified as a means to unlock a whole range of possibilities through flexible and adaptive processes to support different ways of meeting enterprise objectives (e.g., Darnton and Giacoletto, 1989; Perez, 1985). However,

technology has a potential dual role—as a liberator and enabler of organizational flexibility, and as a barrier. On the one hand, information technology is one of the elements of flexibility that allow organizations to establish labor, management, facilities, and manufacturing processes, and to be able to adapt to new circumstances quickly and inexpensively (Frazelle 1986). On the other hand, it has been noted that information systems have the potential to obstruct organizational flexibility due to "difficult, time-consuming, and costly adjustments when changes were needed," and this has been an on-going theme (Hedberg and Jönsson 1978; Lambert and Peppard 1993; Eardley et al 1997) with regard to certain packaged enterprise integration systems that have inhibited the ability of organizations to exploit business opportunities by preventing changes in business strategy.

Inflexibility has usually been blamed for the problems with design and maintenance of integrated information systems. With integrated systems, processes are dependent upon one another, sharing the same standards, interfaces, and data (Linthicum 2004). Such coupled systems can cease to function if one or more of the systems goes down. An ERP system usually contains complicated data structures and process rules. However, damage could also happen through defective design of integration. It takes time for the system implementer to comprehend the system knowledge and the embedded business knowledge and make proper configurations for the business processes. Further, after the implementation, difficulty in system maintenance often results from a lack of system knowledge resulting from the departure implementation consultants or key employees.

It has been noted that in many process integration projects, engineers lack the skills to perform large-scale system planning, analysis, and design functions, particularly in cases of shortened planning cycles. Most engineers are trained and experienced in one element of the integration architecture. Few have the broad experience and systems skills needed (Crowe 1992) to guide systems integration. Being able to design and configure the reusable components and to trace and fix problems for design and maintenance is critical for minimizing the risk of enterprise inflexibility. The advantage will lie in the expertise of the providers in implementing the organizational rules within their custom engines in a way that will enhance agility. The range of relevant system knowledge could involve: data/configuration tables for core, static information that is required; process networks; decision trees for all linear business decision making; business rule engines in which rules are rapidly or regularly changing; matching systems in which there is a requirement for a non-linear search against a large number of variables that needs to be changed with ease; and custom engines that give significant advantage over generic solutions.

The above explanation of inflexibility leads to the following propositions.

Proposition 3a: The knowledge and management of system designers can affect the development of organizational inflexibility in process integration.

Proposition 3b: The knowledge and management of system designers can affect the development of operational inflexibility in process integration.

Proposition 3c: The knowledge and management of system designers can affect the development of systems inflexibility in process integration.

CONCLUSION

Process integration technologies with shared data and coordinated operation provides businesses with a platform for organizational, operational and system flexibility. However, inflexibility could occur in the tightly-linked flow and with management uniformity. This can be worsened by users' misinterpretation of the information and unwillingness of making the use of the flexible systems. Meanwhile, the system designers' incapability of comprehending the complexity of the system structure and configuration options is another key factor for process inflexibility to happen. In some cases, downsides come naturally with integration. Managers would need to be prepared for the trade-off of integration. In other cases, inflexibility can be prevented with well-designed system-people interaction and aligned users' and designers' capability.

Based on literature, reported cases and integration managers' experience this study proposes that inflexibility can be classified as either operational, organizational, or systems inflexibility. The completeness of business design together with users' and system designers' capability seem to be key sources of inflexibility. Though the propositions are to be further tested, the proposed framework and sources of inflexibility provide a reference for planning effective management of process integration and a base for field verification.

REFERENCES

1. Akkermans, H., and Helden. K. (2002) Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors. *European Journal of Information Systems*, 11, 35-46.
2. Benson, P. G., Saraph, J. V., and Schroeder, R. G. (1991) The Effects of Organizational Context on Quality Management: An Empirical Investigation, *Management Science*, 37, 9, 1107.

3. Bhandari, G., Bliemel, M., Harold, A., and Hassanein, K. (2004) Flexibility in e-Business Strategies: A Requirement for Success, *Global Journal of Flexible Systems Management*, 5, 2/3, 11.

4. Crowe, T. J. (1992) Integration Is Not Synonymous with Flexibility, *International Journal of Operations & Production Management*, 12, 10, 26.

5. Darnton, G. and Giacoletto, S. (1989) Towards an Enterprise Information Model, DEC, *Geneva/Switzerland, GD&SD*.

6. Dawes, S. S. (1996) Interagency information sharing: Expected benefits, manageable risks, *Journal of Policy Analysis and Management*, 15, 3, 377.

7. Draft, R. L., and Lewin, A. Y. (1993) Where are the theories for the "new" organizational forms? An editorial essay, *Organization Science*, 4, 4, i-vi.

8. Duclous, L. K., Vokurka, R. J., and Lummus, R. R. (2003) A conceptual model of supply chain flexibility, *Industrial Management + Data Systems*, 103, 5/6, 446.

9. Eardley, A., Avison, D., and Powell, P. (1997) Developing Information Systems to Support Flexible Strategy, *Journal of Organizational Computing and Electronic Commerce*, 7, 1, 57-77.

10. Edward H. B., and Bruce M. K. (1995) Redesigning the Firm, *Oxford University Press*.

11. Fitzgerald, G. (1990) Achieving flexible information systems: the case for improved analysis, *Journal of Information Technology*, 5, 5-11.

12. Fitzgerald, G., and Siddiqui, F. A. (2002) Business process reengineering and flexibility: A case for unification, *International Journal of Flexible Manufacturing Systems*, 14, 1, 73.

13. Frazelle, E. H. (1986) Flexibility: A Strategic Response in Changing Times, *Industrial Engineering*, 18, 3, 17-20.

14. Gallivan, M. J., Spitler, V. K., and Koufaris, M. (2005) Does Information Technology Training Really Matter? A Social Information Processing Analysis of Coworkers' Influence on IT Usage in the Workplace, *Journal of Management Information Systems*, 22, 1, 153.

15. Goodhue, D. L., Wybo M. D., and Kirsch L. J. (1992) The Impact of Data Integration on the Costs and Benefits of, *MIS Quarterly*, 16, 3, 293.

16. Gupta, A. K., and Govindarajan, V. (1986) Resource Sharing Among SBUs: Strategic Antecedents and Administrative Implications, *Academy of Management Journal*, 29, 4, 695.

17. Hammer, M. (1995) The art of change. *Success*, 42, 3, 44.

18. Hecht, B. (1997) Choose the right ERP software, *Datamation*, 43, 3, 56.

19. Hedberg, B., and Jönsson, S. (1978) Designing Semi-Confusing Information Systems for Organizations in Changing Environments, *Accounting Organisations Society*, 3, 1, 47-64.

20. Homa, B (1992) The Emerging Flexible Organization: Perspectives from Silicon Valley, *California Management Review*, 34, 4, 33.

21. Hsu, K. H. (2005) Using Balanced Scorecard and Fuzzy Data Envelopment Analysis for Multinational R & D Project Performance Assessment, *Journal of American Academy of Business*, Cambridge, 7, 1, 189.

22. Hsu, L. L., and Chen, M. (2004) Impacts of ERP systems on the integrated-interaction performance of manufacturing and marketing, *Industrial Management + Data Systems*, 104, 1/2, 42.

23. King, R. C., and Sethi, V. (1998) The Impact of Socialization on the Role Adjustment of Information Systems Professionals, *Journal of Management Information Systems*, 14, 4, 195.

24. Kuan, K. K. Y., and Chau, P. Y. K. (2001) A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework, *Information & Management*, 38, 507–521.

25. Lacity, M. C., Willcocks, L. P., and Feeny, D. F. (1995) IT outsourcing: Maximize flexibility and control, *Harvard Business Review*, 73, 3, 84.

26. Lambert, R., and Peppard, J. (1993) Information Technology and New Organisational Forms: Destination but no Road Map?, *Journal of Strategic Information Systems*, 2, 3, 180-205.

27. Lau, R. S. M. (1996) Strategic flexibility: A new reality for world-class manufacturing, *S.A.M. Advanced Management Journal*, 61, 2, 11.

28. Linthicum, D. S. (2004) Integration in Common. *Intelligent Enterprise*, 7, 6, 36.

29. Mahesh, G. (1996) Operations effectiveness for a successful implementation of CIM, *Technovation*, 16, 10, 589.

30. Markus M. L.(1983) Power, politics, and MIS implementation, *Communications of the ACM*, 26, 6, 430-444

31. McNurlin, B. (2001) Will Users of ERP Stay Satisfied? *MIT Sloan Management Review*, 42, 2, 13.

32. Moore, J. E., and Love, M. S. (2005) IT professionals as organizational citizens, *Association for Computing Machinery, Communications of the ACM*, 48, 6, 88.

33. O'Sullivan, D. (1992) Development of integrated manufacturing systems, *Computer Integrated Manufacturing Systems*, 5, 1, 39-53.

34. Orton, J. D. and Weick, K. E. (1990) Loosely coupled systems: A re-conceptualization. *Academy of Management Review*, 15, 203-223.

35. Perez, C., (1985) Microelectronics, Long Waves and World Structural Change: New Perspectives for Developing Countries, *World Development*, 13, 3, 441-463.

36. Pine, B. J. (1993) Mass Customization – The New Frontier in Business Competition, Boston, MA: *Harvard Business School Press*.

37. Roldán, J. L., and Leal, A. (2003) A validation test of an adaptation of the DeLone and McLean's Model in the Spanish EIS field. In Jeimy J. Cano (Eds.). *Critical Reflections on Information Systems: A Systemic Approach*. Hershey, PA: Idea Group Publishing.

38. Sanchez, R. (1995) Strategic flexibility in product competition, *Strategic Management Journal*, 16, 135.

39. Sethi, A. K. R., and Sethi, S. P. R. (1990) Flexibility in Manufacturing: a survey. *The International Journal of Flexible Manufacturing Systems*, 2, 289-328.

40. Shang, S. (2005) A comparative study on users' role in of ERP software and BPM software implementation, *eBusiness Journal*, 2005, 331-351.

41. Sheth, A. P., and Larson J. A. (1990) Federated Database Systems for Managing Distributed, Heterogeneous, and Autonomous Databases, *ACM Computing Surveys*, 22, 3,184-236.

42. Singletary, L. A. (2003) Empirical study of attributes and perceived benefits of applications integration for enterprise systems, Louisiana State University and Agricultural & Mechanical College: United States -- Louisiana.

43. Singletary, L. A. (2004) Applications Integration: Is it Always Desirable?, *Proceedings of the 37th Hawaii International Conference on System Sciences*

44. Spathis, C., and Constantinides, S. (2003) The usefulness of ERP systems for effective management, *Industrial Management + Data Systems*, 103, 8/9, 677.

45. Sushil, (2001) Enterprise Flexibility, *Global Journal of Flexible Systems Management*, 2, 4, 53.

46. Swink, M., Narasimhan, R., and Kim. S. W. (2005) Manufacturing Practices and Strategy Integration: Effects on Cost Efficiency, Flexibility, and Market-Based Performance, *Decision Sciences*, 36, 3, 427.

47. Themistocleous, M. (2004) Justifying the decisions for EAI implementations: a validated proposition of influential factors, *Journal of Enterprise Information Management*, 17, 2, 85.

48. Tito, C. (1989) Process Management and Quality Function Deployment, *Quality Progress*, 22, 12, 45.

49. Upton, D. M. (1995) What really makes factories flexible? *Harvard Business Review*, 73, 4, 74.

50. Volkoff, O., Strong, D. M., and Elmes, M. B. (2005) Understanding enterprise systems-enabled integration, *European Journal of Information Systems*, 14, 110-120.

51. Waring, T. and Wainwright, D. (2000) Interpreting integration with respect to information systems in organizations - image, theory and reality, *Journal of Information Technology*, 15, 2, 131.

52. Weick, K. E. (1976) Educational organizations as loosely coupled systems, *Administrative Science Quality*, 21, 1-19.