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ERP implementation issues in advanced and developing countries

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Abstract *There is an increasing need to implement a total business solution which supports major functionalities of a business. Enterprise resource planning (ERP) software is designed to meet this need, and has been widely adopted by organizations in developed countries. Meanwhile, ERP is beginning to appear in many organizations of developing countries. Little research has been conducted to compare the implementation practices of ERP in developed vs developing countries. Our research shows that ERP technology faces additional challenges in developing countries related to economic, cultural, and basic infrastructure issues. This article identifies a range of issues concerning ERP implementation by making a comparison of advanced and developing countries.*

Introduction

Enterprise resource planning (ERP) is an industry term for the broad set of activities supported by multi-module application software that helps a manufacturer or a service business manage the important parts of its business. Evolving from MRP systems, ERP has played a significant role in IT for several decades. Since the first symbiotic ERP product SAP created in 1972, ERP market revenues are expected to be as high as \$52 billion by the year 2002 (AMR data available at: <http://www.amrresearch.com>). While there is wide acceptance of ERP in developed countries such as the USA, Canada, the UK, and Australia, developing countries lag far behind. At present, North America occupies 66 percent of the ERP market, Europe takes 22 percent, while the whole of Asia is only at 9 percent. However, due to economic growth, developing countries in Asia and Latin America are becoming major targets of big ERP vendors.

In order to understand ERP practices around the globe, a framework is proposed. Using the framework, ERP implementations in selected developed and developing countries are discussed. Finally, implications for both practitioners and researchers are discussed.

A framework for examining ERP implementation

IS implementation issues in general have been long explored (Lucas *et al.*, 1988, Delone and McLean, 1992). However, the complexity of ERP makes it

challenging to implement. Studies on ERP implementation have appeared in recent years (Davenport, 1998; Bingi *et al.*, 1999; Holland and Light, 1999; Koh *et al.*, 2000). The following framework (Figure 1) in the global context is derived from the literature and our previous research (Huang and Palvia, 2000a,b).

The implementation of ERP is affected by two broad categories of factors: national/environmental and organizational/internal, each of which comprises five variables.

- *Economy and economic growth.* Economic status of a nation is a broad indicator of its IT/IS development. Rapid economic growth fuels IT/IS development because enterprises are eager to gain competitive advantage. Thus sound economic background provides a solid foundation for IT/IS development as well as ERP implementation.
- *Infrastructure.* Infrastructure, including both basic and IT infrastructure, constitutes the basic prerequisite for ERP implementation. ERP cuts across several functions, including the internal operations of the company itself and its suppliers, customers, banks, etc. The soundness of the entire infrastructure is necessary to facilitate complete value chain management enabled by ERP.
- *IT maturity.* The level of IT maturity can significantly influence an organization's strategic decision in acquiring and deploying IT/IS. IT mature organizations have better understanding of IS implementation, can collaborate effectively with ERP vendors, and are more likely to succeed in ERP implementation.
- *Computer culture.* Although somewhat related to IT maturity, this refers to the company's history of computing, employees' attitudes towards computers, and organizational dependence on computers. A

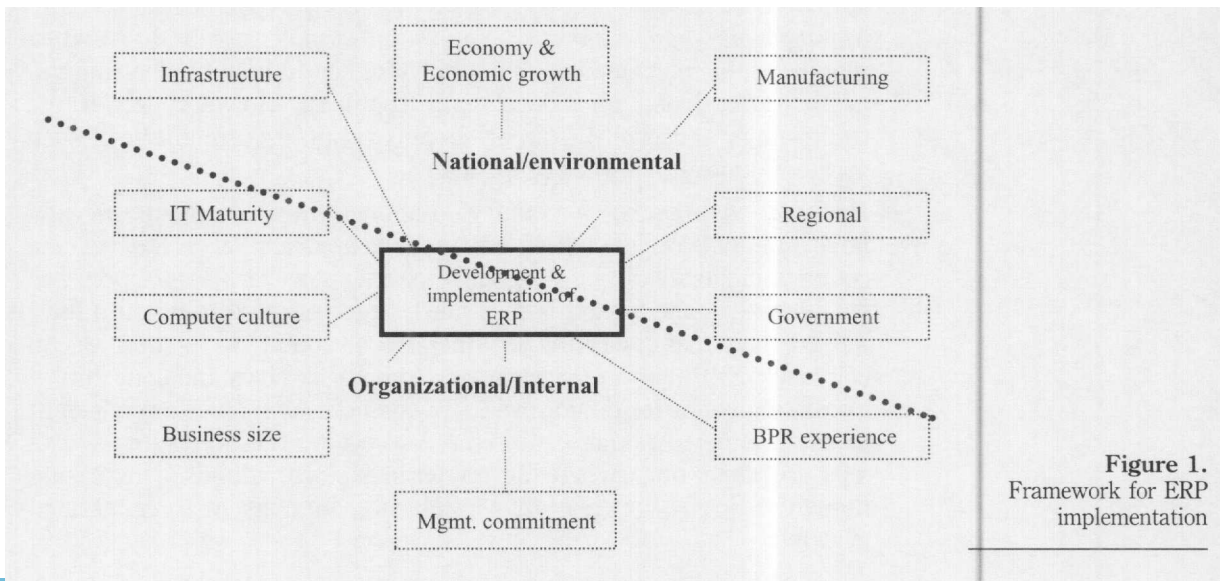


Figure 1.
Framework for ERP
implementation

company with a strong culture would have better understanding of application functionality, data management, and more accepting of ERP systems.

- *Business size.* Business size is an important determinant of organizational IT investment and usage. Many big systems started in big companies and ERP systems were initiated by large organizations. Today, smaller organizations are beginning to use ERP due to two factors. First, ERP vendors are putting more efforts on small and middle sized enterprises, and second, small businesses sense the pressure to use ERP for competitive edge.
- *BPR experience.* ERP, as a process management tool, always invokes a need of working flow redesign or process reengineering (Davenport and Short, 1990; Davenport, 1998). The target of ERP is the whole enterprise; therefore, BPR is often needed before ERP implementation. A company having richer experience in process management and BPR is more likely to succeed with ERP.
- *Manufacturing strengths.* Although changing, historically, ERP solutions have had greater functionality in manufacturing areas. While service industries have begun to enter this market, firms with traditional manufacturing strengths are more likely to implement ERP.
- *Government regulations.* Governments can encourage IT diffusion, and regulations can encourage or remove barriers to the introduction of IT and ERP systems. For instance, some Chinese government departments are required to use accounting software to replace manual accounting systems for audit. As a result, financial/accounting software has become pervasive (Huang and Palvia, 2000a).
- *Management commitment.* Given the complexity and resource requirements, management commitment is key to ERP implementation in both developed and developing countries. However, given the rudimentary status of ERP in developing countries, it might be of even greater importance in such countries.
- *Regional environment.* A country's regional environment/culture may have an impact on its IT/ERP use. Japan is an example. As a developed country, Japan should be a big ERP market, however, Japan's presence is in infancy. One reason is that most large Japanese companies have moved their manufacturing to other Asian countries. In these Asian countries, ERP use is not pervasive. As ERP is not standalone, and if partnering countries do not use ERP, Japanese companies are reluctant to use it either. Another example is low penetration in countries with massive populations, where they prefer to explore methods of increasing human efficiency rather than replacing humans with integrated systems.

ERP in developed countries

ERP systems have been widely used by companies in developed countries. Organizations in manufacturing, service, and energy industries adopt ERP to:

- automate the deployment and management of material, finance and human resources;
- streamline processes and achieve process improvement; and
- achieve global competitiveness.

In this section, North America, Europe, and Japan are selected as representative developed countries.

North America (USA, Canada)

Europeans designed the first integrated ERP system – SAP in Germany, 1972, whereas, organizations in North America seem to have richer experience in this kind of software and have used integrated software solutions for decades. As commercial systems evolved from material planning (MRP) to enterprise planning (ERP), companies continued investment to bring in newer systems. Currently, two out of three ERP deals in North America are replacement deals.

The USA is the primary target of ERP and represents 66 percent of revenues for the major vendors. Before 2000, one major concern of North American corporations was Y2K problems. After Y2K, management turned its eyes to extending its enterprises. Several trends have appeared. E-commerce is a major force. Organizations want their ERP systems to connect more tightly with suppliers and customers via e-commerce. Supply chain management (SCM) products, regarded as post-ERP, are now entering into North American organizations. SCM functions include demand forecasting, sourcing and procurement, inventory and warehouse management, and distribution logistics.

Europe (UK, Germany, France)

Europe is the second largest target ERP sales market (at 22 percent). Many big ERP vendors started their business from Europe; e.g. SAP AG, Baan, JBA International and Intenia. Historically, strong manufacturing industry is an underlying reason for so many ERP vendors in Europe. There are several reasons for Europe's ERP market. First, economically advanced countries have a solid industrial and manufacturing base. Second, there is a strong national information infrastructure. Third, the multiple-language and multi-currency requirements make the ERP software attractive. Fourth, quality employees are available to implement advanced technologies.

Japan

Japan, an advanced industrial country, albeit has a different story. The sales of ERP in Japan represent a very small proportion of the global market. However, Japan is predicted to be a major ERP market as it shifts from custom software

to packaged systems. While ERP use is not widespread, the SCM market has seen a significant increase. According to Asia Pulse, sales of SCM software almost doubled to 2.4 billion yen in 1998. The Tokyo research firm projected sales of 50 billion yen for ERP and 6 billion yen for SCM software in 1999.

Japan's regional environment and organizational culture are partially responsible for its situation. Most Asian countries are developing countries and IT's use is limited. Non-English languages cause further impediments. IT infrastructures in some countries are far from desirable. Japan's economy is highly linked to its neighbors for manufacturing and distribution. Under such circumstances, implementing ERP systems that link with suppliers and customers in other countries is difficult. Additionally, Japanese organizations do not see pressure to install ERP systems, as they emphasize human resources over others like IT.

Characteristics of ERP implementation in developed countries

It is easy to understand why North America and Europe occupy the largest ERP market. From national and environmental perspectives, these countries have excellent infrastructures which effectively facilitate IT diffusion. Strong economic base and growth further drive the need for new technology. Governmental IT policy, deregulation and organizational enthusiasm for IT fuel technology development. New technologies such as ERP, SCM and others are quickly absorbed by organizations in almost all industries.

Japan's situation is unique. Although Japanese organizations emphasize process management, Japan's geographic/regional location and IT culture constrain ERP usage. Japanese organizations emphasize employee loyalty and provide all means to retain employees. BPR before implementing ERP violates this belief and restricts the use of ERP. Instead, they build systems in-house or customize existing software.

From an organizational perspective, companies in developed countries are more likely to succeed. Higher IT maturity and favorable computer culture make organizations ready to handle complex technology. Also organizations are developing a strong process management orientation (Davenport, 1994). BPR is practiced frequently in North American and European countries.

Some trends are observable. First, small and middle sized enterprises (SMEs) are becoming targets of ERP vendors. Second, ERP coupled with e-commerce functionality will dominate the market. E-commerce is becoming a new way of doing business between business and business (B2B) and between business and customer (B2C). CIOs are planning to build electronic commerce and decision-support extensions to ERP implementations (Neil, 1999). Meanwhile, e-commerce based ERP systems are commercially available (McKie, 1998). Third, SCM software is making inroads. Organizations are pursuing support for the whole supply chain beyond what ERP can provide.

ERP in developing countries

ERP software vendors are experiencing global expansion. Asia/Pacific and Latin American countries are taking the lead. The Asia-Pacific ERP market accounts for 9 percent of revenues, and Latin America for 3 percent. Economic expansion, especially in Asian countries, is the major reason. Second, fierce competition and pressures from Western corporations force firms in developing countries to vigorously pursue information technology.

However, ERP is in its early stages in developing countries. Inadequate IT infrastructure, governmental policies, small size of companies, lack of IT/ERP experience, and low IT maturity seriously affect the adoption decision.

China, India, and Brazil are selected as representative countries for ERP discussion.

China

China has achieved impressive economic growth in recent years. It is undergoing a technological change with huge IT investments in both public and private sectors. However, there are only a handful of companies using ERP systems.

International vendors play a primary role. There are a few local software packages that are low cost but are primarily accounting and financial applications. For example, Yongyou[®] software is widely utilized, but it focuses on accounting functions and is not a real ERP system. There are no local professional ERP vendors. Major international vendors have opened their business in major cities. Some vendors access the market via their delegated international companies such as IBM, Compaq, Andersen, and Price Waterhouse Coopers.

Infrastructure is a major problem. Telecommunications, though significant improvements have been made in recent years, is good only in major cities. The telephone density, although increasing, is still quite low (Dutta, 1996). Internet service is expensive, not to mention ISDN, ATM, T1, T3 and other broadband services. The government is finding it necessary to allow competition and profit making organizations (even foreign companies) to raise the telephone density to its target of eight per 100 by year 2000.

Low IT maturity of China's industries is also a major problem. Low IT maturity manifests into several symptoms. Enterprises lack a long-term MIS strategy, and IS departments/staff (if they exist) lack project experience. Often, companies have limited process management knowledge, and BPR is seldom conducted. Chinese management style, informal planning and process modeling, highly interdependent social and organizational relationships, and attitudes towards organizational change all limit process innovation efforts (Martinsons, 1998). Most companies have limited knowledge of international business practice. Language is also an important concern. Mandarin is the official language and spoken by most Chinese, whereas English is used by MNCs. The language causes communication barriers between Chinese users and international ERP vendors. Furthermore, high economic growth built on a

weak base has led to diverse business practices and cross industry enterprise structure.

Owing to these reasons, major ERP customers in China are limited to global MNC corporations. Some large state-owned organizations are potential ERP users but they are haunted by high costs. Small and middle-sized enterprises are virtually excluded out of this market.

India

India has also achieved significant economic growth in recent years. Its IT industry growth is quite admirable. India is the largest developing country base for global software outsourcing (Heeks, 1996). Moreover, global software outsourcing continues to grow rapidly, with over US\$3.00 billion in contracts from developing countries in 2000 (and expected to be \$15 billion by 2003). India also owns the best software engineers in the world. Because English is the official business language, its IT staff can communicate effectively with counterparts in the world.

However, IT diffusion and implementation lags far behind, and ERP growth in India has been quite slow except in recent years (Erry, 1998). While the country boasts of decades of manufacturing, availability of skilled workers, English as the business language, and the first MRP-II/ERP systems introduced over a decade ago, yet the ERP penetration is estimated at a piddling 6 percent. Even this rate was achieved after a 75 percent growth in the last two years. According to one estimate, this market was expected to be only around US\$10 million by year 2000 (Erry, 1998).

The low ERP penetration is due to several reasons. The first reason is that the infrastructure is far below any organizational requirements. The country's telephone density is quite low with 0.6 phones per 100 in 1990 (Dutta 1996), although it has increased some since then. The telecom industry is still a monopoly of the state government. In 1997, Asia Pacific Telecommunication Indicators pointed out that India would need to invest \$14.43 billion over three years to achieve a telephone density of 2.34 per 100.

The second reason, both for India and China, is that organizations lack a culture that regards computers as a pervasive way of doing business. Indian state excise authorities refuse to accept excise returns in a format other than manual registers. India's PC penetration is only at 0.7 per 1,000 (Erry, 1998). IT maturity is quite low among local firms. Although the economy has been opened up, foreign investors face daunting procedures for governmental approvals. Local corporations lack stiff competition; thus there is little stimulus to adopt technology.

The third has to do with common perceptions about ERP. The common belief is ERP systems are only for larger companies because of the high costs of acquisition, implementation and maintenance. As a result, service and support are rudimentary. Most organizations are first-time users and perceive a lack of expertise. Additionally, some companies did not have a very successful experience with ERP and do not see many benefits.

Brazil

Brazil is the eighth largest industrial economy and with a population of 171 million makes up half of Latin American density. Brazil typically acts as the point of entry into Latin America for US tech companies. The ERP market is just emerging. Big ERP vendors like SAP, Baan and PeopleSoft have begun to invest in this market, but with alternative marketing strategies to attract small companies. PeopleSoft, with \$10 million investment in Brazil, estimated that Brazil's ERP market would turn over \$250 million in 1998 (Franca, 1998).

ERP market growth in Brazil could be optimistic with some caveats. Through the 1980s/1990s, Brazil played high-tech catch-up and was the most tech-saturated in Latin America. Its improved economic and political stability attracted more foreign investments (Saba, 1999). It began privatizing its Telebras telecommunications and vastly expanded the telecommunications network. These are positive factors for ERP development. However, aged and weak basic and telecommunication infrastructure, and biased development of economic and IT capabilities in selected locations can be detrimental to the entire IT industry. Other factors include small firm sizes, low BPR experience, and low IT maturity. Also, IT development has been achieved only in recent years, many firms are still not comfortable using computers for doing business and ERP vendors may need more patience.

Characteristics of ERP implementation in developing countries

Several factors from the framework were significant in ERP implementation in developing countries. Among national/environmental factors, current economic status and economic growth, infrastructure, and government regulations fundamentally impact on IT adoption and ERP penetration. In infrastructure such as transportation, telecommunications, Internet and intranet, mobile telecommunications, and public database systems, developing countries obviously have a poor record and suffer from the consequences. ERP is not a stand-alone system and has to work in an integrated environment to gain maximum value. However, infrastructure alone cannot boost ERP adoption: other factors such as governmental policy encouraging foreign investment and fair competition are also essential.

From an organizational and internal perspective, low IT maturity, small firm size, and lack of process management and BPR experience hamper ERP adoption. Enterprises commonly lack MIS long-term strategy and project experience. As a result, most customers of IT applications are not domestic companies, but subsidiaries of MNCs. In developing countries, SMEs play a major role in the national economy. Therefore, affordability and availability are major concerns. Firms also lack process management orientation and BPR experience. Unlike past computer systems, ERP systems are off-the-shelf and impose their own logic on the company, often forcing companies to change the way they do business. While promising, the actual experience of using IT to redesign business processes is limited in developing countries.

Conclusion

A framework for examining ERP implementation was proposed. Using the framework, we discussed ERP implementation in selected developed and developing countries. Problems, issues, and characteristics of ERP implementation were identified. Vendors who contemplate entering foreign markets can use the framework to better understand global ERP markets and develop better strategies. Implementers can recognize the environmental and internal requirements and prepare accordingly. Future research may include: empirically testing and refining the framework, and exploring relationships among the various variables. Case studies and field studies may be the appropriate vehicles for such research.

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