

The effect of national differences on multinational ERP implementation: an exploratory study

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ABSTRACT *Previous ERP implementation studies focused primarily on single-site and domestic implementations. The issue of ERP implementation at facilities across nations has been seldom discussed, although industry has indicated such a need. This exploratory study investigates the relationships between national differences and multi-national ERP implementation. Using case research that involves direct observation and systematic interview at four US and Taiwanese manufacturing firms, this study investigates what and how national differences affect implementation practices across nations. The results suggest that language, culture, politics, government regulations, management style, time zone, and labour skills impact several ERP implementation practices. Understanding such effects will enable companies to be more proactive in planning for multinational ERP implementation. Managerial implications of the findings and future research issues are discussed.*

Introduction

Enterprise Resource Planning (ERP) is an information system that manages, through integration, all aspects of a business including production planning, purchasing, manufacturing, sales, distribution, accounting and customer service (Scalle and Cotteleer, 1999). Different functions are linked by the system to one another and to the database. Figure 1 provides an overview of the scope of ERP systems and the integration of information between a central database and all functional areas. The central database collects data from various areas and makes it available for all business activities across functions and business units. ERP streamlines data flows throughout the entire organization and allows managers direct access to real-time operations. Through data integration, ERP eliminates counter-productive processes and cross-functional coordination problems that hinder the integration of the organization.

Information managed by ERP systems can particularly play an active role in international supply chain systems to gain a competitive advantage. Take a simple ERP function as an example. For a multinational company, when a sales person enters an order from the

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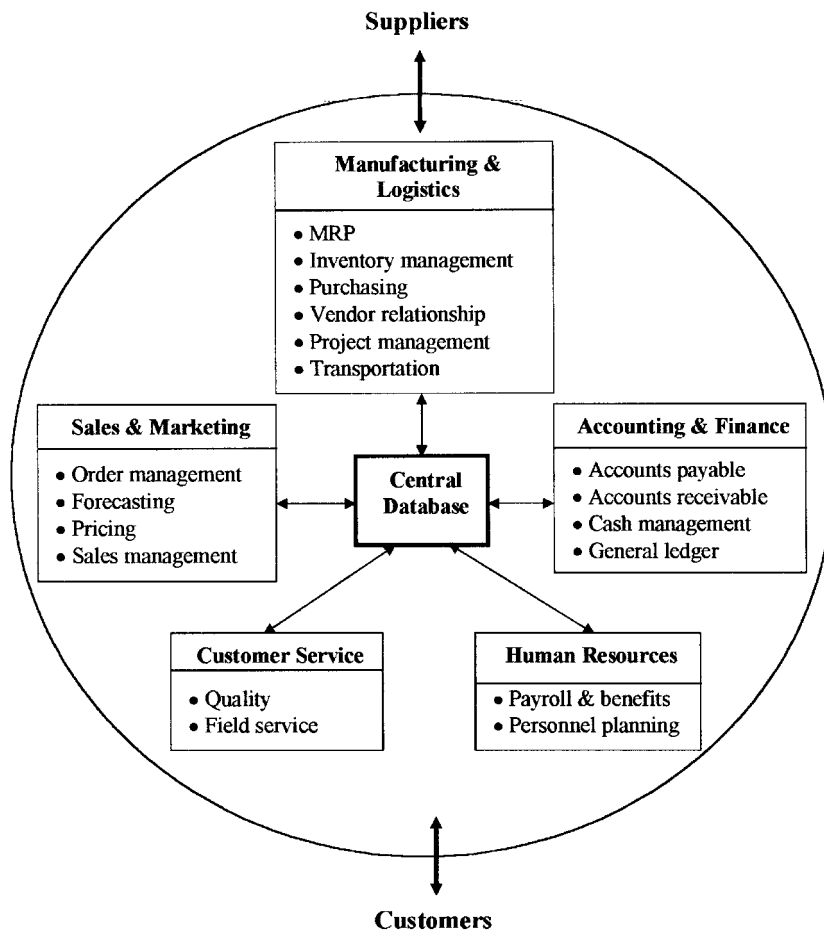


Figure 1. An Overview of ERP systems.

customer in any location in the world, the transaction data can permeate the entire supply chain's (including suppliers') information system. The system updates the inventory of parts and supplies automatically, changing the production schedules of overseas facilities and also the balance sheets at headquarters. Thus, the employees of different departments in various countries quickly have the information needed to complete the processing of their jobs. Feedback is fast and efficient. From this information the sales person can inform the customer of updated delivery dates and the managers can receive accurate inventory status immediately. The ERP facilitates the enterprise-wide integration of information by tying suppliers, distributors, and customers all over the world together without geographical restrictions. To summarize, an ERP system provides multinational organizations with extensive information and coordination of supply chain functions.

ERP emerged as a complete business software system that enables an organization to share common data and activities throughout the entire enterprise. It arrived at a time when process improvement and accuracy of information became critical strategic issues. The emphasis of supply chain management and the advancement of information technology created a need for enterprise-wide integration. In the past few years, ERP has become a

'must have' system for almost every European firm to improve competitiveness (Everdingen *et al.*, 2000). Mabert *et al.* (2000) surveyed 479 US manufacturing firms and found that over 60% of companies had installed or planned to install a packaged ERP system. The popularity of ERP systems is also evidenced by its projected sales exceeding \$30 billion in 2002, an increase of 300% since the late 1990s.

While companies worldwide have made substantial investments in the installation of ERP systems, implementation has proven to be unexpectedly difficult, and the final benefits have been uncertain. Several researchers have concluded that failures are usually the result of business problems instead of technical difficulties (Davenport, 1998; Kumar & Hillegersberg, 2000; Markus *et al.*, 2000). The technical aspect of installing ERP systems is undoubtedly critical, but the management aspect of ERP systems could have an even greater impact on the success of the system or use. After all, ERP is about 'the way of doing business', which is largely the result of a firm's strategy and culture. Therefore, 'misfits', the gap between the functionality offered by ERP systems and that required by the adopting company, would arise from country-specific or company-specific requirements (Soh *et al.*, 2000). These misfits can be related to data format, operating procedures, and output format, which force companies to make package and/or organizational adaptation during the implementation process. Studies indicate that no ERP implementation can succeed without resolving those misfits (Hong & Kim, 2002; Soh *et al.*, 2000). Actually, firms can lose their source of competitive advantage by adopting ERP systems that do not fit their business strategies (Davenport, 1998).

In practice, the magnitude and impact of such misfits will be even stronger when ERP is implemented across nations because of national differences. Factors such as culture, language, management style, politics, regulations, customs, etc create national differences and thus affect 'the way of doing business' (Hofstede, 1983; Simchi-Levi *et al.*, 2000; Trompenaars & Hampden-Turner, 1998). No universal ERP system can be implemented in different countries successfully without resolving misfits resulting from national differences. As an example, the business models, including the operating processes underlying most ERP software packages, reflect European and US industry practices. Such operating processes are likely to be different in Asian countries, having evolved in a different cultural, economic, and regulatory environment. Multinational ERP implementation involving international facilities must first resolve national differences. Based on this premise, the purpose of this study is to investigate the effects of national differences on ERP implementation. Understanding such effects will enable companies to be more proactive in planning for multinational ERP implementation.

The next section reviews relevant literature, followed by the presentation of research questions. The research method is then discussed. The methodology involves case studies and is used to explore issues pertaining to implementing ERP in multiple nations. The findings from case studies are provided, and the research propositions are reviewed and revised. Finally, managerial implications and potential research issues are presented.

National differences and ERP implementation

Substantial ERP research has been published over the last few years. These studies have covered a wide range of various research issues pertaining to ERP systems. Some of these works identified technical issues pertaining to architecture, data standards, configuration, and hardware and software integration (e.g. Jordan & Krumwiede, 1999; Markus & Tanis, 2000; Olinger, 1998). Several researchers investigated the effect of critical factors (e.g. top management support, sufficient training, proper project management, communication, etc)

on the success of ERP implementation (Bingi *et al.*, 1999; Kumar & Hillegersberg, 2000; Holland & Light, 1999; Hong & Kim, 2002; Verville & Halington, 2002; Willcocks & Sykes, 2000). Others studied tactical issues such as process and organizational adaptation, measurement of benefits, and resistance to change (Laughlin, 1999; Motwani *et al.*, 2002; Swan *et al.*, 1999).

In contrast, a relatively small group of researchers were more concerned with strategic and cultural issues involving the alignment of ERP implementation with products and processes (Al-Mashari & Zairi, 2000; Bowersox *et al.*, 1998; Davenport, 1998; Hammer & Stanton, 1999; Jacobs & Whybark, 2000; Markus *et al.*, 2000; Soh *et al.*, 2000). Al-Mashari & Zairi (2000) and Hammer & Stanton (1999) related ERP with re-engineering, since ERP provides information that flows horizontally across all functions of the business. Both studies argued that firms should use ERP as an integrative mechanism to create a new style of management. Davenport (1998), Bowersox *et al.* (1998), and Jacobs & Whybark (2000) asserted that ERP was not only a software package but also 'a way of doing business'. Davenport attributed many failures of ERP implementation to the lack of alignment with business needs. There is no single 'best process' to do business as ERP systems assume; therefore, the customization of ERP systems is necessary. He further cautioned that firms could lose their source of advantage by adopting processes that are indistinguishable from competitors. Bowersox *et al.* (1998) also supported the need for addressing issues of operational rigidity in order to maintain existing unique value-adding practices. They called for more effort toward integration of supply chain systems using ERP systems.

Jacobs & Whybark (2000) expressed their concerns with multi-site ERP implementation. Using the furniture industry as a reference, they illustrated how ERP implementation could lead to disaster unless there were considerations for corporate culture, production methods, and customer demand. Markus *et al.* (2000) also recognized the complexities of multi-site ERP implementation. When organizations are geographically dispersed, implementing ERP systems involves unique technical and managerial challenges. They suggested that multi-site implementation starts at the strategic level before proceeding to the technical level. Both Jacobs & Whybark (2000), and Markus *et al.* (2000) raised issues pertaining to implementing ERP at multiple facilities, but neither specifically discussed the issue of multinational implementation and national differences. Finally Soh *et al.* (2000) studied the ERP implementation practices in a hospital in Singapore and cautioned about potential cultural incongruence in implementing ERP in Asia. Potential misfits could arise from areas including data format, operational procedures (e.g. billing and collection), and output format. Resolving such incompatibilities has resulted in extra implementation time and expense.

Overall, research in this area emphasizes the business and cultural implications of ERP implementation, which should be more important than the technical challenge of the implementation. However, research has not made sufficient effort to address multinational ERP implementation from the perspective of national differences in culture, government regulations, language, management style, customs, etc. International management research has successfully linked the cross-national differences to various operations management decisions, such as supply chain management, total quality management, manufacturing planning and control (see, for example, Pagell & Sheu, 2001; Sheu & Wacker, 2001; Whybark, 1997). Considering that ERP systems overlap and/or interact substantially with these management decisions, national differences are likely to play a major role in multinational ERP implementation practices. Accordingly, we develop a research proposition—national differences influence ERP implementation similar to how they affect other related management decisions. As Fig. 2 shows, the impact of national differences on those

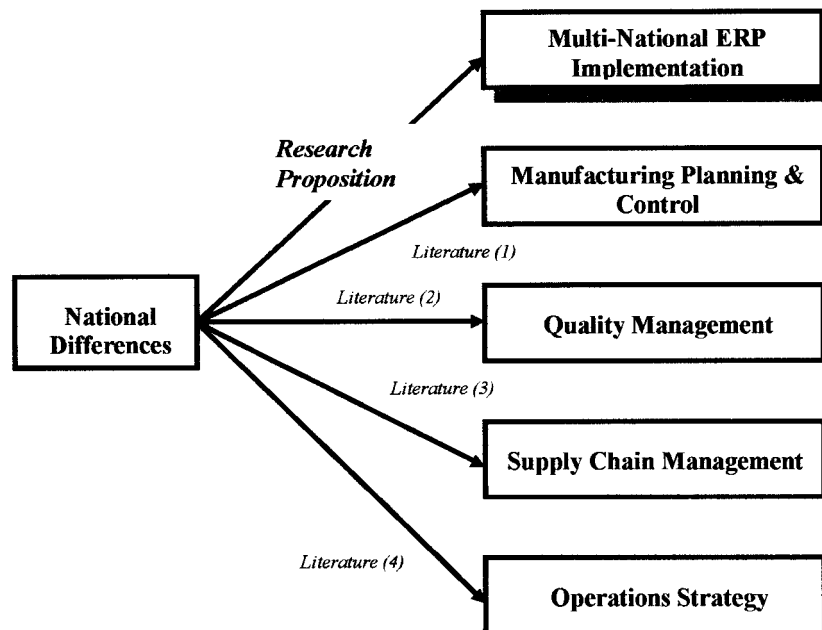


Figure 2. National differences and management decisions.

Selected supporting literature:

Literature (1): Ardishvili & Hill (1993); Sheu & Wacker (2001); Chikan & Whybark (1990).

Literature (2): Adam *et al.* (1997); Ettl (1997); Flynn (1992); Yen *et al.* (2002).

Literature (3): Pagell & Sheu (2001); Munson & Rosenblatt (1997); Helper & Sako (1995); Carter & Narasimhan (1996); Simchi-Levi *et al.* (2000).

Literature (4): Badri *et al.* (2000); Klassen and Angell (1998).

management decisions has been extensively studied, but we have not found any literature addressing the issue of ERP implementations across nations. Without resolving national differences, organizations are unlikely to apply ERP successfully in integrating the international supply chain systems. Specifically, we are interested in the following research questions.

- (1) Which aspect of multi-national ERP implementation is affected by national differences? How and why is it affected?
- (2) What factors of national differences affect multi-national ERP implementation practices? How and why do they affect the implementation?

Research design

Case study method

This study is exploratory in nature, since past research has not addressed the issue of multinational ERP implementation. There are many 'how' and 'why' questions to be answered with regard to this issue. We believe that through direct observation and systematic interviewing, the case study methodology is most valuable for exploring and understanding the relationship between national differences and ERP implementation. While case study research has been frequently criticized for its lack of rigour, we have closely followed

suggestions from previous studies (e.g. Eisenhardt, 1989; Yin, 1994; Miles & Huberman, 1994; Meredith, 1998; Stuart *et al.*, 2002; Voss *et al.*, 2002) to ensure the validity of this study.

This case research involves the integration of data gained from organizations of similar nature that have implemented ERP. We identified four manufacturing companies in the United States and Taiwan for the purpose of on-site interviews, observation, and data collection. Table 1 summarizes the company profiles consisting of industry, products, production method, time after ERP implementation, ERP software, facilities locations, etc. In general, all companies have the following characteristics:

- (1) they are all multinational corporations with facilities located in more than one country;
- (2) they all have a clear and long-term vision; and
- (3) they have implemented ERP for two years or longer.

Methodologically each company is treated as an individual 'case'. Therefore, this research involves a multiple-case study methodology that searches for patterns in multinational ERP practices. Three of the four facilities interviewed are located in Taiwan, although their headquarters may be located in another country, and the fourth plant is in the United States. Three companies have implemented ERP systems across nations, while another is in the process of its overseas implementation. We collected information regarding the 'cross-national' ERP implementation based on archival documentation and interviews with managers who were involved in overseas ERP implementation. Three companies are from the high-tech industry, and the remaining one is from the personal care industry. The average annual sales volume of these companies ranges from US\$0.6 billion to US\$4 billion. With various production methods, national cultures and differing industries, the selected companies offer a good mixture of scenarios for the purpose of this study.

Data collection

Data collection for this study utilized structured interviews in a field setting to ensure that the same data were collected at all sites. A case study protocol was designed and used to guide the structured interview and data collection (Yin, 1994). The protocol was reviewed and pre-tested by a group of researchers and senior managers. A pilot study, conducted to review the research proposition, improved the conceptual understanding of the research issues. Based on the results of the pilot study, the protocol was revised to include multi-site ERP implementation questions. The interviewees also made several suggestions to enhance the interview skills.

On-site interviews and observations were conducted after the pilot case study was concluded. Prior to each interview, the protocol questions were shared with the interviewees for the purpose of preparing and gathering necessary information. The respondents were also informed of the purposes of the study. In all cases, we met with at least two interviewees from one of the following areas: IT managers, ERP project team leaders, plant managers or functional managers. At least two researchers participated in the interviews in order to reduce confirmation bias. The first researcher wrote up notes from the visit, and the second researcher verified these notes. Disagreements were handled through the use of follow up telephone calls. Sources of data collection included interviews, direct observation, documentation and archival records. While most of the data were qualitative in nature, quantitative data were also collected to verify the findings. The use of multiple sources of evidence enhanced both the reliability and validity of this study (Voss *et al.*, 2002; Yin, 1994).

Table 1. *Company profile*

	NCQ	CareM	NoteF	MoniP
Industry	Computer	Consumer personal care products	Computer	Computer
Products	Notebook, motherboard	Cosmetics, personal care, home cleaning	Notebook/PC	Monitor
Production method	Make-to-order (MTO)	Make-to-stock (MTS)	Make-to-order (MTO)	MTO & MTS
Facilities locations	Taiwan*, China	USA* (production), Taiwan (telemarketing)	Taiwan*, USA, China, Czech Rep.	Netherlands*, Taiwan
Languages used	Mandarin	English, Mandarin	Mandarin, English, Czech	Dutch, Mandarin
Facilities visited	Taiwan	USA	Taiwan	Taiwan
Time after implementation	3 years	2 years	4 years	3 years
ERP software	SAP	J. D. Edwards	Magic (Taiwan, China); varies in other areas	SAP
Why ERP?	Requested by customers	Self initiated	Requested by customers	Requested by headquarters
Position in supply chain systems	Manufacturer	Manufacturer & sales	Manufacturer	Manufacturer
Annual Sales	~US\$ 4.0 billions	~US\$ 0.6 billions	~US\$ 1.5 billions	~US\$ 2.2 billions

*Corporate headquarters

Table 2. *Research validity tests*

Test	Approach/Tactic Used
(1) Construct validity Develop sufficient set of operational measures to reduce subjective judgement.	(a) Reviewed multiple sources of evidence so that the findings were based on the convergence of both qualitative and quantitative information. (b) Established a chain of evidence with sufficient citations to relevant portions of the case study database. (c) Asked participants and informants to review draft case study reports.
(2) External validity Ensure generalization of the findings.	Applied multiple-case replication. Each company was selected and studied so that it either predicted similar results or produced contrasting results.
(3) Reliability Demonstrate that repetition of the data collection procedures will result in the same conclusions.	(a) Used case study protocol to document the procedures (b) Created a case study database including case study notes, documents and narratives for future reviews and analysis.

*All tests were conducted based on Yin's (1994) guidelines.

Data analysis and results

Data analysis was performed based on original research propositions regarding the effects of national differences on ERP implementation. Following a 'pattern-matching' strategy (Yin, 1994), patterns between national differences and ERP implementation practices were identified for each individual case. To ensure the quality of research design and our findings, we carefully conducted several validity tests indicated as necessary by previous studies (Voss *et al.*, 2002; Yin, 1994). Table 2 reviews the tactics this study applied to ensure the quality of our case study method. The rest of this section reviews the information collected in relation to the background of the four firms and analyses the effects of various national difference variables on implementation practices.

Background information: competitive strategy and infrastructural decisions

Table 3 summarizes the background information of the four visited companies, including their competitive strategies and infrastructure. Competitive strategy refers to the manner in which firms will achieve and maintain their competitive advantage in the market place. The literature in operations management has suggested that it is competitive strategy that

Table 3. *Competitive strategy and infrastructure*

	CompQ	CareM	NoteF	MoniP
Competitive strategy	Customization and volume flexibility	Quality consistency	On-time and fast delivery	On-time and fast delivery
Production method	Make-to-order (MTO)	Make-to-stock (MTS)	Make-to-order (MTO)	MTO and MTS
Production volume	Small	Large	Med/Large	Med
Product variety	Wide	Narrow/Med	Med	Med
Labour skills	High	Low	Med	Med
Production schedule	Instable	Stable	Instable	Instable
No. of suppliers	Large	Small	Large	Med

guides the choice of various infrastructural decisions (Hill, 2000). Verifying the theoretical relationship between competitive strategy and various infrastructural decisions would provide the construct validity of this case study (Yin, 1994).

Company NCQ is a notebook manufacturer for several large US computer companies such as Dell, Hewlett Packard, IBM and Gateway. As an original equipment manufacturer, it faces frequent order changes in volume, delivery and product specifications. The company has an excellent R&D department, able to respond quickly to various customization orders. With a well-established supplier network, it effectively uses outsourcing and overtime to adapt to changes of production volume and delivery. It had an on-time delivery rate of 90%, which increased to 95% after implementing ERP systems, even with constant order changes. The emphasis of customization and volume flexibilities is associated with the make-to-order production method, small production volume, a wide range of product varieties, high labour skills, unstable production schedules, and a large number of suppliers.

CareM competes on the dimension of quality consistency. It is known for high quality personal care and cosmetics products. It has three manufacturing facilities located in the US and has more than ten overseas telemarketing offices. While all three manufacturing facilities have implemented ERP systems, several overseas telemarketing offices such as Japan, Taiwan and Korea are currently implementing the systems. The make-to-stock production method is associated with large production volume, high set up time, stable production schedules, a small number of suppliers, lower labour skills, and functional organizations.

Both NoteF and MoniP emphasize the dimensions of speedy and on-time delivery. NoteF manufactures notebook computers. Its product design and sales functions are located in Taiwan, and key components such as CPU and motherboard are manufactured in China. Depending on customer location, the final assembly is performed in either US or Czech plants in order to speed up delivery. The headquarters of MoniP is in the Netherlands, while the manufacturing in Taiwan is entirely responsible for orders from nearby Asian countries to achieve speedy delivery. As expected, most infrastructural decisions in both companies are different from that of the two former groups of companies due to the differences in competitive strategy.

National differences and implementation practices

We have identified the following categories of national differences that affected ERP implementation practices across nations.

(1) Culture and language

In all companies we visited, language difference affects the implementation practices in both technical and managerial aspects. Technically, it was confusing for companies in Taiwan and China to enter employee names in ERP systems in the Western format as first, middle and last name. Soh *et al.* (2000) also made the same observation about this technical problem in Singapore. Another technical problem found is that some ERP packages only support one single bite language (e.g. English) and one double bite language (e.g. Japanese or Mandarin). Therefore, if English is in the ERP system, then only one double bite language can be used at a time. This technical limitation forced the data entry into the ERP system using primarily English, and all overseas facilities must know English based on the system. The use of English increased employee resistance to ERP implementation.

While technical problems were relatively easier to resolve, communication barriers resulting from language differences were far more difficult to overcome. In this study, the facilities that NCQ has are located in either Taiwan or China, while NoteF and MoniP have

facilities throughout the Netherlands, US and the Czech Republic. The headquarters of NCQ is located in Taiwan; thus, there is little difficulty communicating with facilities in China because of language and cultural similarities. Consequently, the headquarters played a major role in overseeing and managing the implementation project in all individual facilities. Specifically, the headquarters selected common ERP software and sent a project team to all facilities to assist their ERP implementation. After installation of the ERP system, each facility then assumed responsibility for maintaining the system. Overall, it was easy for NCQ to centralize its ERP implementation decisions without getting undue resistance from overseas facilities.

In contrast, since the headquarters of NoteF (located in Taiwan) and MoniP (located in the Netherlands) do not speak the same languages as their overseas facilities, communication becomes very challenging. As a result, many implementation decisions, including the selection of ERP software and other implementation practices, were largely decentralized to local facilities. Each site purchased, installed and maintained its own ERP software without consulting the other. Information sharing between facilities and headquarters is currently limited to financial and accounting information.

The difficulties of centralizing ERP implementation were due not only to language and communication barriers but also the cultural difference. Operating processes in Taiwanese organizations are likely to be different from their US facilities, each having evolved in a different cultural and regulatory environment. For instance, it is very common for Taiwanese companies to schedule production and purchase materials without a formal contract but simply based on a telephone conversation with customers. As expected, resistance to adopt the same operating processes was very high at overseas facilities. For instance, the US facilities of NoteF refused to adopt the same ERP software packages and configurations the headquarters requested, claiming that this software was inconsistent with its current operating processes. Several US employees threatened to resign if they were forced to adjust their culture to the business practices of NoteF.

In contrast, CareM did not encounter a great deal of resistance from its local facilities in the US. The headquarters was able to centralize all implementation decisions. However, since it began to implement ERP systems in its overseas telemarketing offices, managers have observed increasing resistance from the overseas offices.

(2) Government/corporate politics

We discovered a unique variable affecting the ERP implementation involving both Taiwan and China, namely their current diplomatic relationship. These two governments have imposed strict regulations on transporting goods, exchanging information, and transferring money between each other. Without formal diplomatic relationships, many business operations between these two countries are currently conducted in a way that packaged ERP software does not permit. For example, if a Taiwanese company wants to invest in a firm in China, it needs to first set up a third company in a third country, which would then transfer all investment/funds from the Taiwanese headquarters to the branch company in China via this third company. These political issues forced companies to make substantial efforts to modify ERP software according to their use.

Another example of how the political factor affects ERP implementation was found at the corporate level. Political concerns at this level seem to be attributable to current low information sharing between facilities in all companies. All companies expressed concerns over sharing too much information, fearing that individual facilities would compare and argue for getting better or equal treatment (in terms of materials, customer orders or any form of resource support) than other facilities. If so, the corporate headquarters would have

more difficulties allocating resources to the whole organization considering the global benefits. As a result, companies have purposely limited information sharing between facilities, resulting in diminished benefits of ERP systems.

(3) *Management style*

We refer to management style as the attitude toward setting a priority for implementing an ERP system. This style directly affects the approach and duration of implementation. The amount of time the three Taiwanese firms (NCQ, MoniP and NoteF) took to complete the implementation was approximately eight months. The length was significantly shorter than that of CareM, a US firm that took almost 23 months. Mabert *et al.* (2000) found that most US firms took more than 13 months to implement their ERP systems. We confirmed this observation of shorter implementation duration in Taiwan by interviewing several Taiwanese industry practitioners. There are several possible factors contributing to shorter implementation time in Taiwanese companies. First, managers in the three Taiwanese companies were highly pressured from severe international competition, and they were extremely committed to implementing an ERP system to increase their competitiveness in the global marketplace. The pressure also came from their US customers such as Dell, Compaq, IBM, Hewlett Packard, etc.

Other than the pressure factor, management personality is another possible factor affecting the implementation duration. Yen *et al.* (2002) asserted that managers in Taiwan have the personality type that takes extra care about technical details and are more determined to complete short-term projects. In NCQ, the ERP project was lead by the CEOs, and all project members were completely removed from their primary responsibilities in order to dedicate themselves to the project. Additionally, all three Taiwanese firms took a 'big bang' approach and implemented all ERP modules at one time. In contrast, CareM, like many US firms, was more careful with pre-implementation preparation. Its management tend to adopt the attitude of 'playing by the rules', 'following the manual' and making no compromise with all required preparation during the implementation. As a result, CareM took the 'phase by module' approach in its ERP implementation. While the effectiveness of these two management styles remain to be studied, firms in Taiwan apparently completed the implementation in less time. Note that all three Taiwanese firms are larger than CareM in terms of the sales volume and number of employees. The size of the firm did not affect the implementation duration.

(4) *Government regulations*

We found that tax policies dramatically increased the complexities of multinational ERP implementation due to more complicated operating procedures. Different tax rates produced extra work in entering sales orders from different countries into the ERP system. Furthermore, tax rate differentials encouraged companies to develop complex business procedures for saving tax expenses. For instance, NoteF invested in a company located in a country (e.g. British Virgin Islands) where the tax rate is lower than that of Taiwan. NoteF then resold its sales orders to this company at a price low enough to avoid paying income taxes. The invested company then found a country with low production cost (e.g. China), which resulted in high profit but low income taxes. This tax-saving approach created unique operating procedures and caused complicated accounting procedures in order to deal with transactions between the three regions. Naturally, a substantial amount of adaptation was necessary for NCQ to customize ERP packages for its use.

In addition to tax policies, the process of importing/exporting materials and goods is also different from country to country. Countries that have mutual tariff preferential

treatments would have a different set of custom forms, import/export tax rates, and custom clearing procedures than those countries that do not. No ERP package handles these variations, and the resolution of such 'misfits' requires substantial modification in ERP packages. Both NCQ and NoteF had to rewrite the ERP software source code to ensure a fit with their businesses, an effort unfortunately never anticipated.

While CareM has not started its ERP implementation in Taiwan, its managers have indicated that they fear their ERP implementation efforts in Taiwan will be thwarted because of cross-cultural miscommunication related to labour laws. Taiwanese managers have already conveyed to corporate management their concern for job security once an ERP system is implemented. They based this fear on observation of the way many US companies released employees from their positions and/or the company without concern for employee welfare once the systems that required fewer labour hours than prior systems were implemented.

(5) *Time zone*

Depending on the specific geographical locations, there can be as many as 14 hours of time difference between two nations in this study. In the case of company NoteF, the headquarters finishes its operations at 5 p.m. on Monday in Taiwan, while it is still 3 a.m. in the Texas branch office. This time difference could affect international trade operations from the aspect of exchange rates for currency. Even though many of the European countries have joined the European Union, some (such as Denmark) do not use the euro. Denmark's reluctance requires extra consideration for exchange rates. This example is amplified when considering involvement with the rest of the world across many different time zones. Anticipated rates used to calculate transactions can be greatly different than expected once the 'next day' rate is provided for the transaction.

(6) *Labour skills*

Levels of labour skill vary from country to country. For example, most employees in Taiwan have at least a technical college degree, while the majority of workers in China are high school graduates. When NCQ implemented an ERP system in its Chinese facilities, it discovered that the same training programme took twice as much time to complete than at its headquarters in Taiwan. The headquarters had to send a project team to the Chinese facilities to help during the entire implementation period. Labour skills affected the length and content of the training programme during the implementation. In the case of NCQ, lower labour skills were attributed to longer implementation duration in its Chinese facilities. We found that the lack of IT knowledge and skills in Chinese facilities also made NCQ centralize its implementation decisions.

Discussion

Overall, our findings confirm the research proposition in Fig. 2—national differences affect multinational ERP implementation practices. We identified six specific categories of national differences and their impacts on several areas of implementation. We found that failing to anticipate such impacts increased the budget and duration for the implementation of an ERP project. Figure 3 displays the specific relationships between the six categories and various practice items.

Differences in language, culture, politics, government regulations, and time zone created misfits of data format, organizational requirements, and output format. Some of those misfits were neither anticipated nor planned for prior to the implementation. Companies were forced to resolve those misfits during the adaptation process. NoteF and NCQ had to develop in-

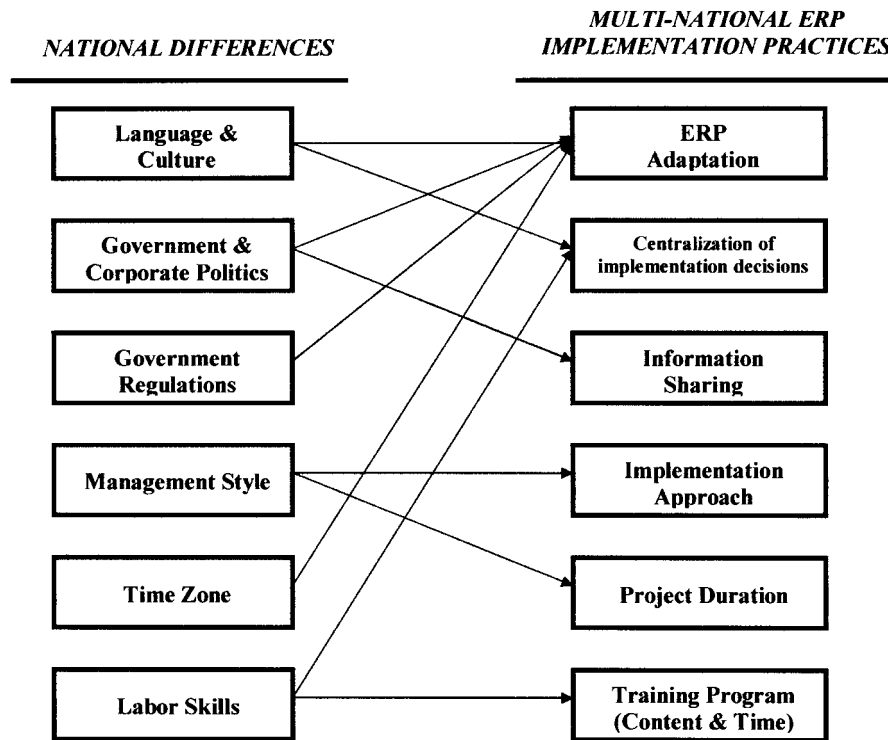


Figure 3. National differences and multinational ERP implementation practices.

house modules to accommodate some of their complicated tax-saving operating procedures that involved three countries.

Severe misfits appear to be those implementation practices that have significant managerial implications. These misfits presented far more challenging problems to multinational ERP implementation. For instance, language and cultural differences discouraged and frustrated management efforts toward coordinating the implementation between facilities in different countries. As a result, the headquarters had to decentralize the purchasing, installation and maintenance of ERP packages at each of its local facilities. Note that language and cultural differences also generated a high level of resistance from overseas facilities, which indirectly pushed for 'decentralized' practices. CareM did not experience this problem from its domestic implementation. Nevertheless, its managers were extremely cautious with the language and cultural differences in its current ERP implementation efforts in the Japan and Taiwan offices.

It is rather ironic that all three Taiwanese companies had the vision of improving multinational information sharing and communication prior to the ERP implementation. Currently, it is unclear how decentralized implementation will affect the original goal of information integration. Regardless of the results of this practice, any organization that implements ERP across countries needs to be aware of the influence of the language and cultural differences.

Management style was defined as a manager's commitment to implementing an ERP project, which influenced implementation duration and approach. We found managers in

three Taiwanese firms were more committed to completing short-term projects such as ERP implementation (less than one year) than US firms who took a longer time span. The sources of high commitment are from either the management personality type observed by Yen *et al.* (2002) or due to the pressure from international competition and customers. Generally, Taiwanese managers were also more aggressive by choosing a big-bang approach as opposed to the modular approach in the US, which further reduced the project duration.

How well companies were able to anticipate and resolve national differences affected the project budget and duration. Company NoteF clearly learned an expensive lesson by having a 40% overrun on its original budget to complete the implementation. Three of the four companies did not consult and negotiate with ERP software vendors prior to the implementation to obtain additional help or to reduce expenses. CareM did work with its vendor in the early stages of implementation to reduce cost and risk in its US companies. The company, however, feels it has learned enough to implement ERP in other countries without the need for further assistance from the ERP vendor. This could become a costly mistake for this company based on our research findings. Failing to recognize the impact of national differences on multinational ERP implementation was proven costly by the other three companies.

Conclusions

Many companies around the world are following the trend toward making large investments in implementing ERP systems. In the meantime, many of these companies do not conduct a formal analysis or planning effort prior to implementation (Mabert *et al.*, 2000). Even when a formal analysis was undertaken, it was mostly limited to traditional ROI and payback methods. The lack of proper planning would definitely harm the multinational ERP implementation even more due to across-nation differences. The literature has seldom addressed the issue of multinational ERP implementation, even though there is a strong need to do so in industry. For instance, during our visit to CareM, its CEO specifically emphasized national differences as the biggest concern to successful multinational implementation. Considering that ERP is the backbone of supply chain management, multinational ERP implementation becomes necessary to ensure the success of supply chain management.

This exploratory study investigated the relationships between national differences and multinational ERP implementation. The results of this study reveal the following.

- (1) National differences affect multinational ERP implementation with regard to the type and amount of ERP adaptation, centralization of implementation decisions, information sharing, project duration, project approach and training programme.
- (2) The categories of national difference that affect implementation practices are language, culture, politics, regulations, and management style.
- (3) Realizing the potential effects of national differences on multinational ERP implementation practices is necessary to enable managers to be more proactive in planning and implementation.

The above findings and the specific relationships presented in Fig. 3 are important to both managers and researchers. From a management point of view, there is a need to recognize each unique national context when adopting an ERP system in different countries. Early identification of the relationship between ERP implementation and relevant national difference variables provides a more accurate basis to budget for contingency implementation funds and allows adequate planning for related implementation practices. The potential

effects of national differences can also be carefully thought through and these effects are likely to be less reactive.

For future multinational ERP research we suggest revising and testing the relationships displayed in Fig. 3. This study examined only four multinational companies from two industries, high tech and personal care products. Although the effects of national differences on ERP implementation are clearly confirmed, other countries and industries need to be examined in the future to revise the model in Figure 3. Another natural extension of this study is investigating what and how strategies can be applied to resolve misfits in the multinational ERP environment. Knowing the effectiveness of various resolution strategies in dealing with national differences should help multinationals manage their international supply chain systems more effectively.

To ensure the quality of this case study, we carefully followed previous prescriptions in case study research. For example, we selected theoretically useful cases, used multiple investigators and respondents, conducted reliability and validity tests, collected multiple source of evidence, and systematically searched for cross-case patterns. However, in order to generalize the findings, more case data need to be collected. Finally, due to logistical issues, in the companies we studied, we did not interview their overseas locations. Even though we collected necessary information and interviewed those managers who participated in their overseas ERP implementation projects, there may still be possible bias. Regardless of these potential shortcomings, this exploratory study raises several issues that should be considered in future ERP and supply chain management research.

Acknowledgement

The authors wish to thank Mr C.T. Yang for his valuable suggestions and assistance in preparing this paper.

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