ELSEVIER

Information technology and relationship management: a case study of Taiwan's small manufacturing firm

Shu-hsien Liao [a,*], Yea-wen Chem [a], Feng-hao Liu [b], Wei-bang Liao [a]

[a] *Graduate School of Resource Management, National Defense University, Management College, 235 P. O. Box 90046-17 Jon-Ho, Taipei County, Taiwan, R.O.C*
[b] *Graduate School of Information Management, National Defense University, Management College, 235 P. O. Box 90046-15 Jon-Ho, Taipei County, Taiwan, R.O.C*

Abstract

The contribution of small businesses to the main source of employment and income in many countries and areas is a well-known fact. Therefore, the effect of the implementation of electronic functions on small businesses becomes a critical issue not only on the practices but also on academic research. In Taiwan, 90% of business is small business and the number of employees is less than 150. This paper is a case study which investigates several issues. First, the case firm, Li-ja, a Taiwanese small Polyurethane-manufacturing firm, is intending to implement electronic business. What can they do? Second, a specific business model of relationship management has been explored in the case firm and considered as a basis of business solutions for implementing information technology. Third, a web-based system architecture and a relational database management system are designed and constructed in terms of implementing electronic business in the case firm. Fourth, relationship management is the main objective of electronic business and it shows that data functions and on-line prototype systems can support business solutions in the case firm. Finally, system functions are presented as an example of the case study in support of electronic business implementation on the small manufacturing firm. Managerial issues and future work of this paper are discussed.
© 2002 Elsevier Ltd. All rights reserved.

Keywords: Relationship management; Information technology; Small business; Electronic business; Case study

1. Introduction

The rise of the Internet as a business mechanism during the past few years has developed the meaning of electronic commerce. Electronic commerce (EC) describes the manner in which transactions take place over networks. It is the process of electronically buying and selling goods, services, and information mostly on the Internet. This trend of electronic commerce could have significant impact on the world, on government, business, technology, social issues, and people. To a specific business, particularly the small ones, the Internet is expensive because of the lack of resources (Poon and Swatman, 1999; Premkumar et al., 1994; Thong, 2001). Information systems and technology become critical factors for small businesses that participate in the environ-

ment of electronic commerce (Doukidid et al., 1996; Palvia and Palvia, 1999; Sohal, 1999; Kuan and Chau, 2001). This includes everything to do with the application of information and communication technologies (ICT) to conduct business between organizations or to communicate working procedures inside a business (Turban et al., 2000). On the other hand, the implementation of electronic business is the threshold of electronic commerce for small businesses.

The contribution of small businesses to the main source of employment and income in many countries and areas is well documented around the world (Mead and Liedholm, 1998; Dutta and Evrard, 1999). This tells us that small businesses make up the main skeleton of total business activities and no one can ignore their performance and contribution to the whole business structure in comparison with large businesses. Most of the articles about small business agree that successful implementation of electronic business has more advantages than before, such as: generated innovation, created perceived

* Corresponding author. Fax: +886-22-225-0488.
E-mail address: michael@rs590.ndmc.edu.tw (S.-h. Liao).

benefits, saved resources, provided flexibility, increased sales, improved decision-making, increased productivity, obtained competitive positions, and redesigned business procedure, (Massey, 1986; Meredith, 1987; Lincoln and Warberg, 1987; Alexander, 1993; Palvia et al., 1994; Premkumar et al., 1994; Lacovou and Benbasat, 1995; Mead and Liedholm, 1998; Sohal, 1999; Leidner, 1999; Ortiz and Granville, 2000). Therefore, the implementation of electronic functions on small businesses becomes a critical issue not only on the practices but also on academic research. The factors, models, or solutions for implementing electronic functions on small businesses will keep growing and draw more attention in terms of building a new era of electronic commerce.

Most of the owners of small businesses like to implement electronic business in the era of electronic commerce. If the owner or manager of a small business has no knowledge of information and communication technologies, what can he/she do? Due to limited resources, small businesses lack both money and manpower to evaluate what they need and are hardly able to describe what they want. Suggestions from vendors are a possible way to solve the above problem. However, are there particular electronic solutions constructed and offered based on the need of small businesses? Or should they just accept anything that the vender sells without choice? But do small businesses are necessary to get total solutions the same as medium or large businesses for implementing electronic business? Can they afford it? First, without knowing the relative importance of key factors, small businesses may be expending their limited resources and energy on less important factors that have only a limited contribution to information system implementation success (Thong, 2001). Second, vendors may sell them more than they need, wasting resources and causing a burden on the hardware infrastructure (Ortiz and Granville, 2000). As a matter of fact, a one-to-one service seems to be best for small businesses. Electronic solutions can be designed dependeding on helping buyers find what they specifically need and want for their businesses, before they spend resources according to their ability and attributes (Peppers et al., 1999).

In Taiwan, 90% of the businesses are small businesses and the number of employees is less than 150. Small manufacturing firms are the traditional models of small businesses in terms of demonstrating their core competitive advantages of manufacturing products on the global market. They help medium or large businesses to obtain orders, complete products together, help each other, and are flexibility enough to deal with changes from existing imarkets in the form of industrial clusters. This close relationship in the vertical production chain is the reason why Taiwan has kept her growth in the past four decades. In the east, relationships are always tacit, not only on politics, but also on business. From the viewpoints of the west, it is an obstacle and difficulty to do business

with your partner spending a long time on developing the relationship but not securing a deal on the table. Is relationship a foe to electronic business? Partnerships, alliances, and buyer/supplier relationships in general have received much attention during the 1990s (Forker and Stannack, 2000). The partnering approach is characterized by long-term contracts, integrated key processes and generated commitment to cooperative relationships (Burnes and New, 1996). Now, relationship management is a research topic in electronic commerce including customer relationships management (CRM), supplier relationships management (SRM) (Mecbeth, 1994; Heckman, 1999; Gadde and Snehota, 2000; Angeles and Nath, 2000), and adopts information technology to support relationship management in electronic commerce (Roberts and Mackay, 1998; Papazoglou et al., 2000). Therefore, if relationship management is a critical factor in business operation, it is an alternative solution to small businesses considering the implementation of electronic business at the formative stage.

Most of the articles about electronic business implementation in small businesses are focused on using statistical analysis (Palvia and Palvia, 1999; Premkumar and Roberts, 1999; Thong, 2001) and data analysis (Sohal, 1999; Poon and Swatman, 1999; Dutta and Evrard, 1999; Palmer, 2000). A few studies have illustrated the process of system planning and implementation of electronic business in small businesses (Ortiz and Granville, 2000). This paper is a field study and investigates some issues in relationship management in support of electronic business on a small manufacturing firm in Taiwan. There were 5 months in which to conduct this field research. The first stage of study was to stay at the case firm, Li-ja and to watch and document the procedure of business and manufacturing operation. The second stage was to interview managerial level of Li-ja to investigate the critical solutions of relationship management for implementing electronic business. The third stage was to design a relational data table and system procedure to construct data functions and solutions for electronic business. The fourth stage was to implement the relational database management systems and on-line system functions in the manufacturing firm. Finally, system functions are presented as an example of a case study in support of electronic business implementation in the small-size manufacturing firm.

2. Backgrounds of case firm

The case firm, Li-Ja, (founded in 1988), manufactures Polyurethane (PU), has 100 employees, middle stream of petrochemical industry and raw material of textile industry. The production skill of polyurethane was transferred from Japan to Taiwan in the 1950s. Because the global and domestic market for leather handbags, cloth-

ing, and shoes grew rapidly in the 1960s, the PU industry has flourished over the last four decades in Taiwan. For example, in 1994, the global market of PU was 3.8 hundred million yards and 2 hundred million yards were made in Taiwan. It brought approximately 660 hundred million US dollars on production value in that year. However, in the middle of the 1990s, parts of the petrochemical and textile industry firms moved from Taiwan to China. The global and domestic market declined and now the production supply is more than the demand on the market. Now, PU firms in Taiwan are seeing hard times.

Li-ja is a firm responsible for processing the PU semi-product. Before the PU product is completed and delivered to the textile industry, PU has to process Urethane on release paper and use transfer coating method to stick chemical matter on the surface of PU. This process is necessary and important to the whole production procedure of PU. Such a manufacturing process is only provided by four firms in Taiwan and Li-ja is one of them. In the year 2000, Li-ja processed 3000 million yards of PU semi-product and it shared one third of the total domestic market. Therefore, although it is a small manufacturing firm, it plays a critical role in the end products of both petrochemical and textile industries.

The reason for choosing Li-ja for the present case study of electronic business is due to support from the owner and manager of this firm. Like any small business owners, the managerial level of Li-ja has no knowledge of information and communication technologies in electronic business. They don't know what electronic business is and how to do it. They used to ask vendors to evaluate how they should implement electronic business and how much they should pay. The suggestion from vendors are total solutions and will cost them 70,000 US dollars. They are not sure if this is reasonable, but they are strongly motivated to be ready to catch the trend of electronic commerce in the future. However, the major difficulty is the lack of information infrastructure and their personal computers are not suitable to connect to the net. Everything was empty for planning and implementing the functions of electronic business on Li-ja at the beginning stage of this project except courage and support from this small firm.

3. Field work

There are two functional departments of Li-ja, the management department and the manufacture department. The manufacture department is responsible for processing PU materials obtained from upper stream firms and for supplying the semi-product to the lower stream firms for continued processing. It takes twelve steps to finish the processing works, and two working groups share the production work per working day. The

management department conducts the business operations including personnel, financial and accounting, security, and general services.

Initially 5 months were spent in the firm to analyse and evaluate the manufacture and management procedures as the basis for implementation of electronic business. There are two objectives of field work. Firstly, to generalize the standard operational procedure of the manufacturing process to prepare for designing data flow and the structure of the physical database. At this stage, this research re-designs the data table on relational table in terms of developing the relational database. Secondly, to make observations and records on the management department to define the business flow of the case firm, which includes getting orders, obtaining and housing materials, processing materials, finishing the semi-product, and shipping products. At this stage, this research examines the workflow of the case firm in terms of designing a system process as an on-line system and connecting the system with the relational database. In field work, this research finds that the case firm is still at the primitive stage of electronic business. Several low function computers are there for documents/files system processing and there is no internet/intranet service available. Basically, electronic business is just a concept in the case firm.

According to the findings from field work, this paper investigates the research issue on how to design and implement specific business solutions for this small manufacturing firm to fit its operational needs without spending redundant money on system function purchases similar to large/medium business. From the procedure of manufactures and management, it shows that the case firm plays a partnership role between the upper and lower stream production lines. All manufacturing works depend on customer and supplier needs. Besides the manufacturing procedure, Li-ja has to keep its relationship with customers and suppliers in terms of completing the business and manufacture chain. Supplier–case firm–customer is a manufacture loop in the product line, which forms very close relationships among them. Therefore, this paper explores clues to a specific business model in the developing case firm. Relationship management is the basis and source of designing and investigating business solutions as system implementation for implementing business model to the case firm.

4. Relationship management

In Taiwan industry, different manufacturing firms are a part of partnership works in the vertical or horizontal product line. Mostly, the semi-product of upper stream firms is the raw material of the lower stream firms. Every firm is completely independent on the other firms in terms of working together, reducing time and cost, and

maintaining competency. Collaborative work among manufacturing firms is necessary because if any one of them has problems, the other firms will be affected and cause great loss to the final product and the whole industry. Traditionally, this is the characteristic of a high-intensity industry cluster. The PU industry is a kind of high-intensity industry cluster in Taiwan. Different manufacturing firms from different levels finish the final product. Therefore, manufacturing firms have to keep a very close relationship with their upper and lower partnership firms.

Li-ja has a very special relationship with its upper and lower partnership firms (Fig. 1). The semi-product of spunlance nonwoven firm is the upper stream firm of the case firm and semi-product from Li-ja is the material of synthetic leather as the lower stream firm. However, when the synthetic leather firm finishes its work, the semi-product is delivered to the spunlance nonwoven firm to again do the processing work and it becomes an upper stream firm of the case firm. It has finished re-process cycle of the semi-product twice by these firms every time in terms of completing their works and continuing to the next manufacturing process in the product line. In this chain, there is a loop relationship between the spunlance nonwoven firm, the case firm, and the synthetic leather firm. Supplier and customer relationships differ in each stage in which they are engaged in.

In Fig. 1, the case firm, Li-ja, is sometimes the supplier of the synthetic leather firm and the customer of the spunlance nonwoven firm. Normally, the case firm implements supplier relationship management and customer relationship management to its upper and lower stream firms, respectively. However, at other times, Li-ja's role changes to the customer of the spunlance nonwoven firm, and the synthetic leather firm becomes her supplier. This is the relationship among these firms, so and the case firm manages a supplier relationship and customer relationship to its upper and lower stream firms at the same time. When the work order is changed, the role of relationship management is changed too. This paper proposes that this relationship management is a specific business model to the case firm.
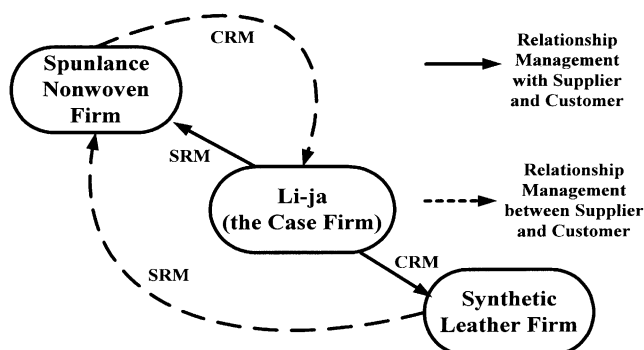

Fig. 1. Relationship management of the case firm.

Mostly, telephone and Fax are the methods used for these firms to manage their relationship with the other firms and obtain the schedule of manufacture from their partners. They are concerned with several things in the manufacturing schedule including: when the order will come next time?; how many complete products are there in the warehouse?; how much raw materials will come to warehouse?; what is the operational ability of the firm?; is the manpower enough to take the order?; what is the market price of material and product?; how to collect the payment for products?; and, how to extend debits and manage cash flow to the other firms? However, there are several reasons to change these situations in the present and the future. First, there is a pull power from the electronic marketplace of the global PU industry that is either to join the e-marketplace or to quit the procurement market. Second, there is a push power from the biggest manufacturing firm of PU industry in Taiwan, which has transferred to electronic business and implemented electronic commerce, to its partnership manufacturing firms. The situation is either to join the e-commerce platform or to quit the PU industry. Third, the manufacturing time and flexibility of the industry are getting more critical than before. Twenty-four hour operations are necessary to the PU industry in terms of making mass production. The communication methods of telephone and Fax are not available at the manufacture and management levels. Fourth, the Taiwan PU industry is a manufacturing cluster and every individual firm has to follow the union of industries and how the other firms co-operate with it. Electronic business and electronic commerce are current developments of large and medium manufacturing firms and it will be a trend which extends to small firms in the near future. Finally, China is a magnetic field that magnetizes a great number of industries moving from Taiwan to China, and the PU industry is one of them. Getting the order in Taiwan and manufacturing in China is an ordinary industrial phenomenon in Taiwan. Electronic business is a necessary condition in terms of handling the command and control of the manufacture moving out and joining the peer where the manufacture chain moves on. Those situations make the manufacture management more complicated and difficult than before to those PU firms.

In this research, the relationship management of the case firm is put, in every step of the manufacturing and business procedures, on line in terms of making the manufacturing situations and management information available to partners, i.e. warehouse situation, manpower situation, machine situation, manufacture operation situation, product failure ratio situation, delay time situation, manufacture real time situation, product process situation, product test situation, order information, product shipment information, material obtaining information, and business flow information transparent. In considering the functions of system implementation, web-based

systems and relational databases are the bases for business solutions implementation. Business and manufacture flow are the main objectives of electronic business implementation. On the other hand, material and financial flow in electronic business are not considered in this research.

5. System architecture and functions

5.1. System architecture

The system architecture is designed and established as in Fig. 2.

5.1.1. System process

The system process is shown in Fig. 2. This system is based on the design of web-based system architecture whose users can be divided into two groups: one is the case firm, Li-ja, and the others are suppliers and customers. With an URL address, users can access the homepage of the case firm, and browse information and the PU industry as a portal site. By means of a password control mechanism, users have access according to their identification and authorization. Product and business information are browsed from business and manufacture databases by users in terms of obtaining the necessary information for decision-making or problem solving.

Besides on-line queries, the system is designed to send mail to suppliers and customers at a fixed period of manufacture to inform them in advance about their schedule of orders and products. In addition, suppliers and customers may provide the information in real-time via this system, enabling this system database to con-

stantly provide the latest information for business and manufacture operation.

5.1.2. Databases

The PU industry database contains basic information regarding PU manufacturing firms, material suppliers and customers, such as market information, product information, case firm introduction, catalog of product, product service and so on. Business and manufacturing databases are designed on spunlance nonwoven order data, synthetic leather product data, and synthetic leather order data that offers system functions for users on-line queries. Any business and manufacturing data is updated constantly. New mail from suppliers and customers are distributed to responsible departments or individuals by day and night working teams. Any queries and questions on-line or by mail are answered as soon as possible. Functions of the relational database are established in twelve data tables (Table 1).

Every data query function is considered as an entity in the database, and data tables are designed on relational data tables. There are twelve query functions and data tables provided by the relational database. In the relational data table, attributes represent necessary data in a specific system function summarized by the management and manufacturing departments. Examples of the relational table of spunlance nonwoven product data and user image are presented in Figs. 3 and 4.

The structure of the relational database in this paper is described in Fig. 5. In the relational database, data integrity and security are maintained by those who are authorized to use, update, and delete.

5.2. System functions

5.2.1. The users

The access, query and display of the data can be operated directly in the relational database. Technically, both the Intranet and Internet use the same technology, such as TCP/IP (Transmission Control Protocol/Internet Protocol), FTP (File Transfer Protocol), HTTP (Hypertext Transfer Protocol), SMTP (Simple Mail Transfer Protocol), IRC (Internet Relay Chat), and NNTP (News Network Transfer Protocol). The system functions linked to ASP (Active Server Pages) for hyperlink can be used in the data query interface to access the relational database or to retrieve the user image via Open Database Connectivity (ODBC). In the Web, users may use browsers to operate, demonstrate, browse and retrieve the data via the Internet, in which system functions are built in the relational database. The users may use ASP hyperlink to look for data in the knowledge repository or to retrieve user image via ODBC.
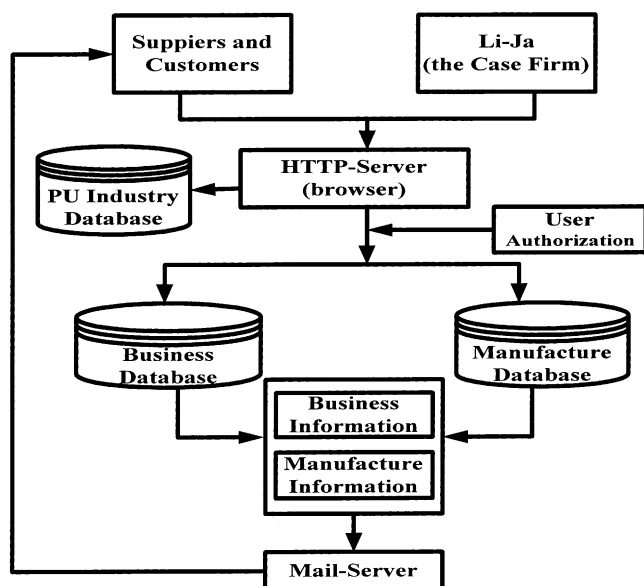

Fig. 2. The system architecture.

Table 1
Data tables on relational database

Data function	Data table
Spunlance Nonwoven Order Data	1. Spunlance nonwoven firms transportation schedule data table
	2. Spunlance nonwoven firms product shipment data table
	3. Spunlance nonwoven firms product data table
	4. Spunlance nonwoven firms return of product data table
Synthetic Leather Product Data	5. Synthetic leather firms leather material data table
	6. Synthetic leather firms transfer coating data table
	7. Synthetic leather firms transfer drying data table
	8. Synthetic leather firms stick chemical data table
	9. Synthetic leather firms product data table
Synthetic Leather Order Data	10. Synthetic leather firms product shipment data table
	11. Synthetic leather firms transportation data table
	12. Synthetic leather firms product delay data table

Fig. 3. The relational table of product–spunlance nonwoven product data.

Fig. 4. User Image of product–spunlance nonwoven product data.

5.2.2. System functions

The prototype system is developed on Windows NT with Personal Web Server 4.0 and Microsoft FrontPage. Relational database is implemented in Access 2000 and browser uses Internet Explorer connecting to web with ASP. Data query is implemented in structure query language (SQL), which is the query language in the relational database. The system functions are supported by relational database management systems illustrated in Fig. 6.
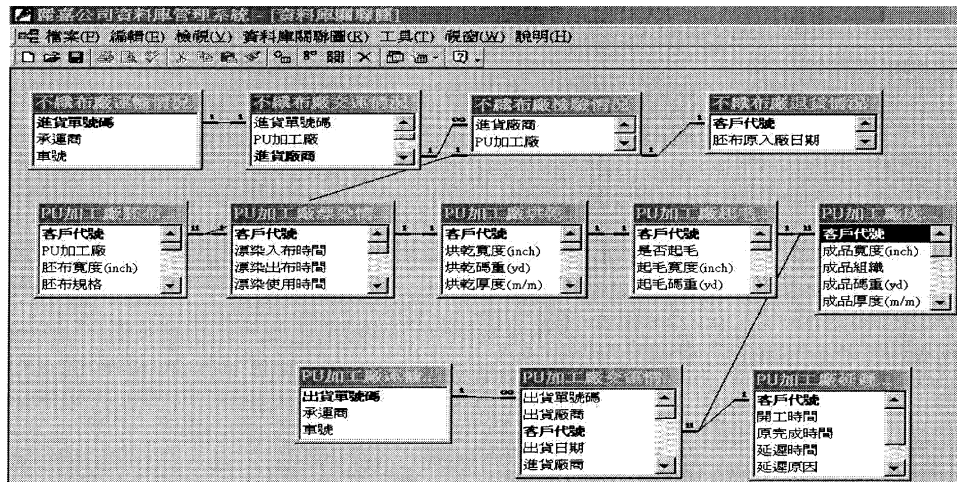
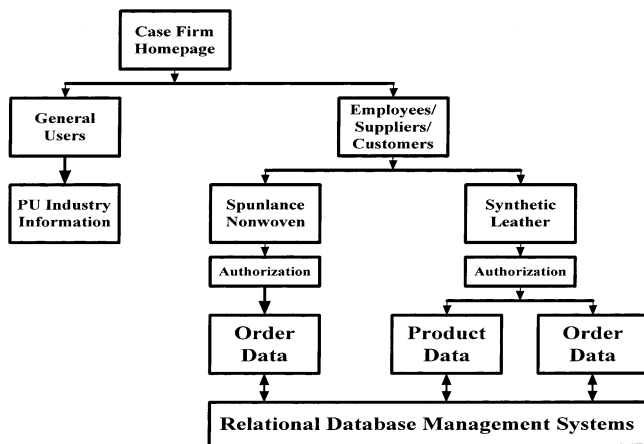Fig. 5.   The structure of relational database.

Fig. 6.   The system functions.

6. System implementation

In this section, the process of the prototype system based on the flow of the system functions is presented. After keying in the web page address, users may enter the portal site of the case firm (Fig. 7).

The PU industry information includes the URL address of upper stream (left-hand-side) and lower stream (right-hand-side) manufacturing firms of the case firm. Users who are interested in the PU industry information can link to their homepage on this portal site (Fig. 8).

6.1. Users' authorization

Users of the system are free to access to the PU industry information or to browse the necessary query information by logging into their ID authorization. Account number and password are designed in the system in terms of indenting ID of users (Fig. 9).

6.2. Database functions selection

Authorized users may access to the database in terms of browsing their query information. Data functions on the database are divided into two selections, order data (upper hyperlink) and product data (lower hyperlink) (Fig. 10).

6.3. Data query

There are 12 relational data tables in the relational database. Once users select database function, they can use SQL to query data on what information they need. For example, if the user selects to inquire the product data of synthetic leather (Fig. 11), he/she can obtain the selected data from synthetic leather data functions (Fig. 12).

6.4. Comments, suggestions, and e-mail

Comments and suggestions from users are considered an important source of relationship management. Someone who is responsible to reply is to solve problems in their working hours (Fig. 13). On the other hand, the case firm gives the necessary information to its suppliers and customers any time using e-mail. For example, a specific product shipment will be delayed by 1 day (Fig. 14).

7. Discussion and future work

7.1. Discussion

7.1.1. Did the solutions work?

Indeed, there are a few problems during the process of IT transfer from the research team to the case firm
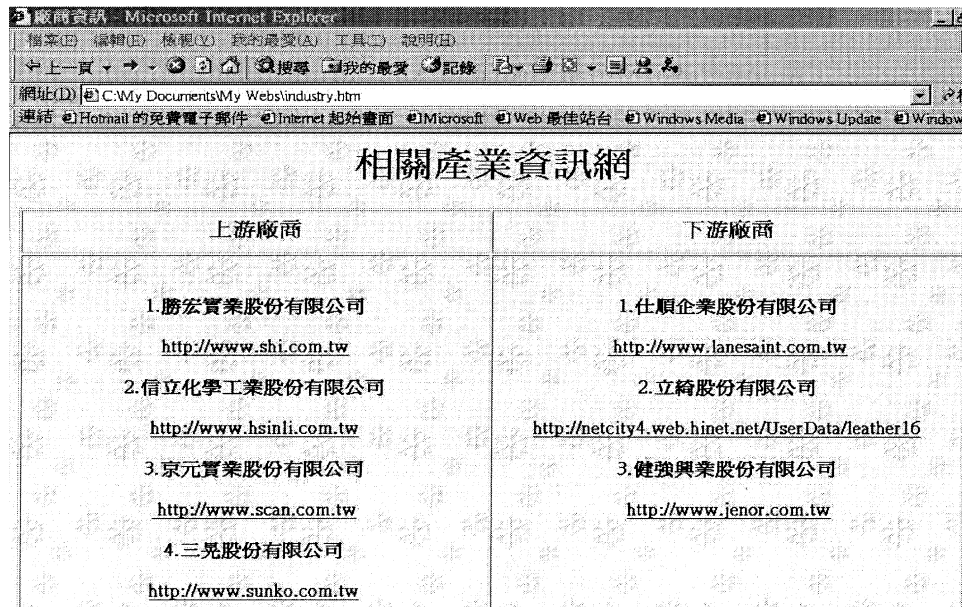
Fig. 7. The system homepage.

Fig. 8. The PU industry information.

because qualified workers are rare and infrastructures are poor when this research project has been finished in the past six months. Since then, in order to implement the proposed system architecture, the prototype system was constantly testing and some new employees were recruited. System solutions are actually work due to the upgrade of hardware/software and personnel.

7.1.2. Is this project helpful to the case firm?

Until now, there is no substantial data or indexes from the case firm to show that this IT and relationship management evolution has resulted in the marking of more profit for the case firm than before. On the other hand, the example of electronic business in the case firm seems not to have switched on a chain reaction to its customers and suppliers. Is that a waste to the case firm to implement electronic business? Not at all! Employer and employees of this company are satisfied with the concept of electronic business in terms of making their works in systematic approach and more efficiently.

7.1.3. What response from the case firm?

A phenomenon happened from the case firm, knowledge inertia, stem from the use of routine problem solving procedures, stagnant knowledge source, and following past experience or knowledge. It may enable or inhibit an organization's or an individual's ability on problem solving including creativity, innovation, and learning (Liao, 2002). At the beginning of system implementation, knowledge inertia of workers actually
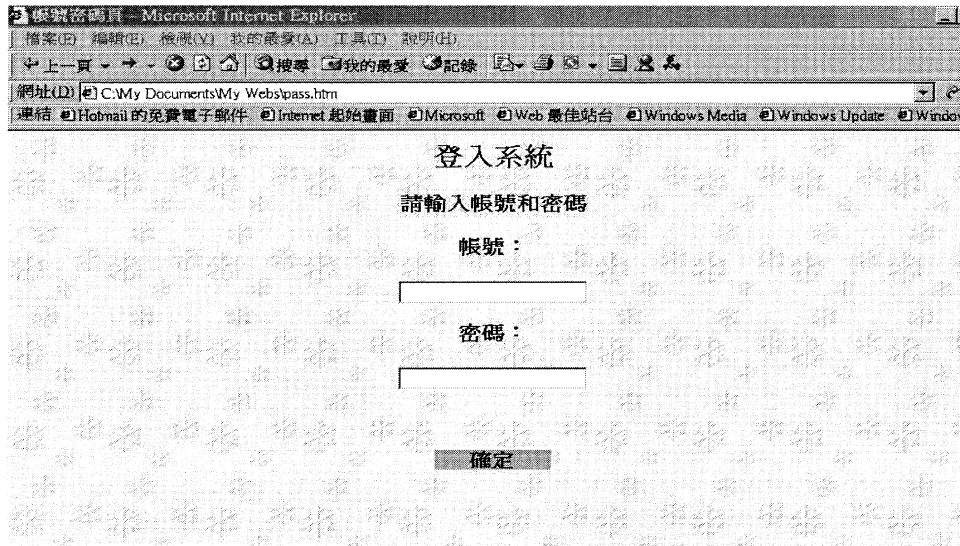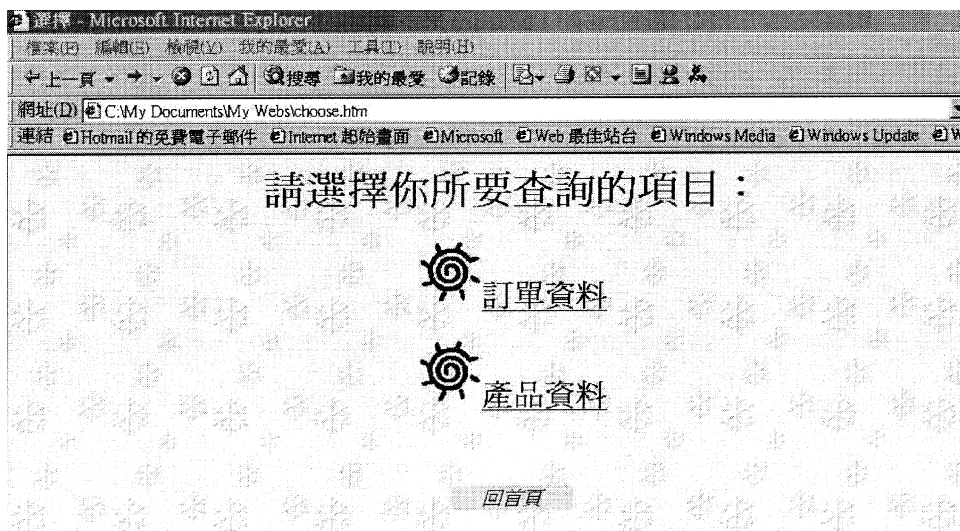
Fig. 9.   Users' authorization.

Fig. 10.   Selection of data functions.

inhibits the process of electronic business. However, with full support from the owner of case firm and more communication to employees, responses from the case firm were getting better and better.

7.1.4. What response from customers/suppliers?

Maybe the case firm is a good example if other firms of customers and suppliers would like to do similar management evolution. But until now, as a matter of fact, they are still watching and waiting for further developments and steps from the other PU firms. This research did not do survey to collect their opinions about their attitude to the result of research project. It does worthy to do this as the future work in the topic of IT and relationship management of the PU industry in Taiwan.

7.1.5. What is notice to small businesses?

This research presents a case study that IT and relationship management can implement in a small manufacturing firm. Actually, this is not a generalized result to other small businesses. Nevertheless, it contributes a concept that specific business model can implement specific business solutions in support of electronic business depending on their needs by implementing information systems and technology.

7.2. Future work

This paper is a primitive research result of the case firm. It needs more time to examine further development of system implementation in the case firm. For example,
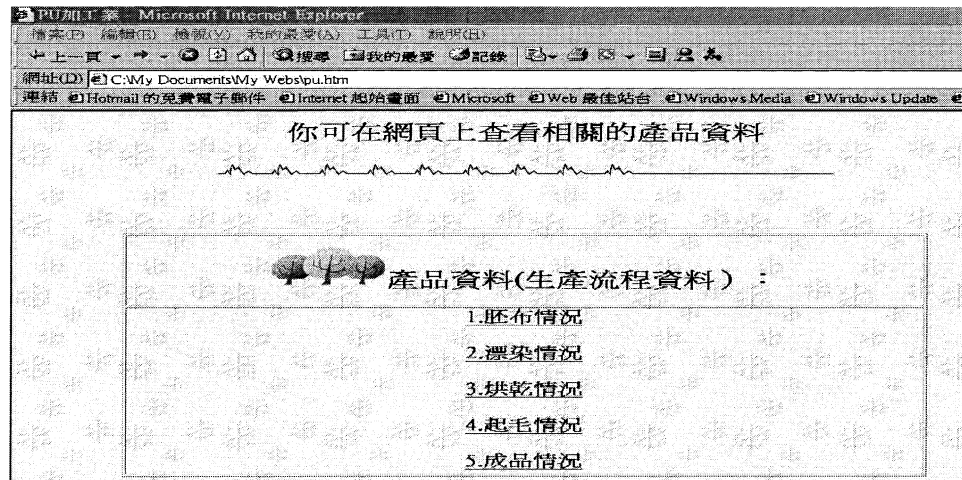
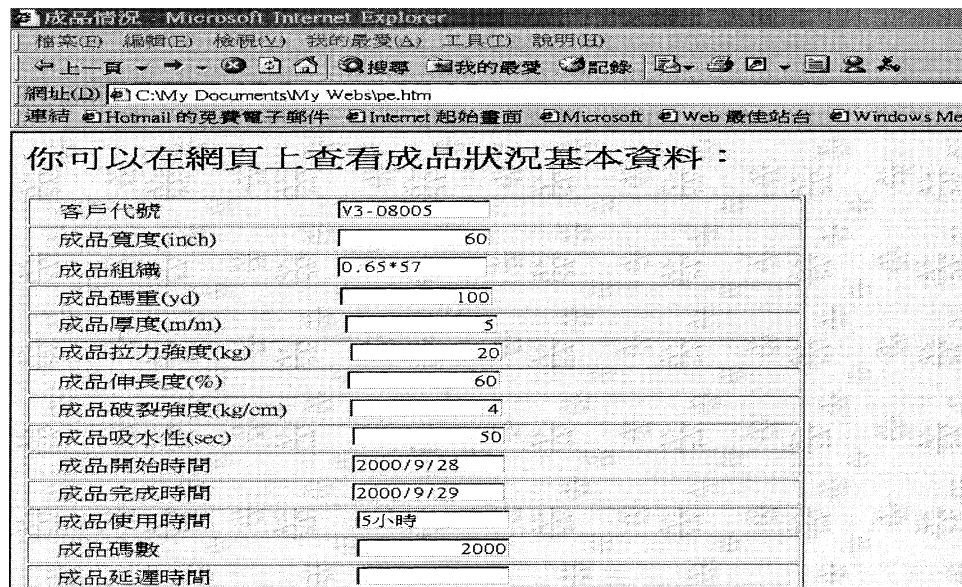Fig. 11.   Data functions of synthetic leather product data.

Fig. 12.   The query results of synthetic leather product data.

would it gives up because other firms will not to construct a common working platform in the future? Would it gives up if there is no enough profit incentive to encourage the employer and employees to maintain the systems? What is the next step to the case firm to figure out its needs of inside and outside environment?

IT techniques in this research are minority. It is hardly to present the merit of research topic in the relationship management. It may, indeed probably should, implement more IT methods and techniques to investigate the research topic on different small businesses.

The essence of small business needs more research works to explore the content in which models or patterns should small businesses implement IT into their organizations in support of electronic business.

8. Conclusion

In the era of knowledge economy, business alliance partners are exceedingly competent as single entities for customers. Such extended corporations reach out with business relationships; they must integrate their business processes and information systems (Papazoglou et al., 2000). Usually, small businesses have a higher threshold than large/medium businesses on electronic business implementation. However, small businesses are now able to enjoy the benefits of information technology (Kuan and Chau, 2001). This trend shows that small businesses are capable of implementing electronic business in terms of joining in the marketplace or electronic
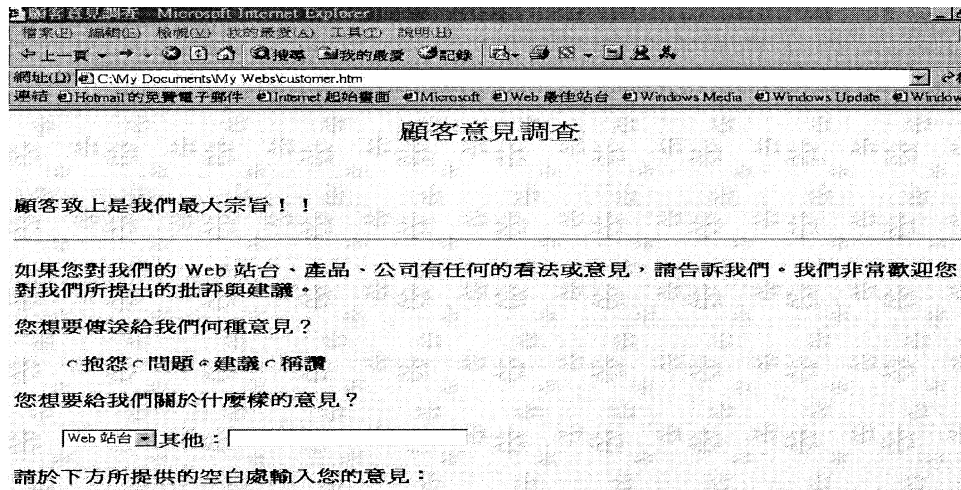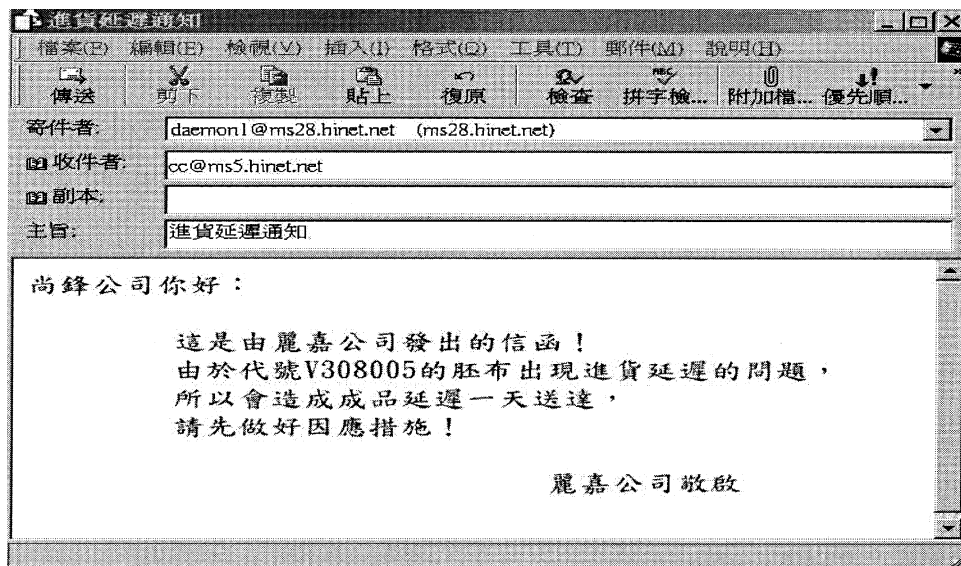
Fig. 13. Comments and suggestions from users.

Fig. 14. The necessary information to suppliers/customers through e-mail.

commerce in the chain of the business or industry to obtain their competitive advantages.

This paper investigates the case of a small manufacturing firm which wanted to implement electronic business positively. Total solutions and infrastructures, similar to large/medium businesses, were too expensive for the case firm. A specific business solution in relation to its business model and relationship management has been explored. This relationship management model is a traditional business model in the manufacturing chain, Taiwan. Upper stream and lower stream firms play roles as suppliers and customers at different stages of the manufacturing chain, and it is a collaborative manufacturing environment that makes the chain work closely and tightly. According to this relationship management, this paper designs and constructs a web-based system and relational database management system in terms of

implementing electronic business in the case firm. Finally, system functions are presented, as an example of the case study, in support of electronic business implementation in the small manufacture firm.

References

Alexander, G.O., 1993. Computing practices in small Arkansas manufacturing firms. Arkansas Business and Economic Review 26, 20–26.

Angeles, R., Nath, R., 2000. An empirical study of EDI trading partner selection criteria in customer–supplier relationships. Information & Management 37, 241–255.

Burnes, B., New, S., 1996. Understanding supply chain improvement. European Journal of Purchasing & Supply Management 2, 21–30.

Doukidid, G.I., Lybereas, P., Galliers, R.D., 1996. Information systems planning in small business: A stages of growth analysis. Journal of Systems Software 33, 189–201.

Dutta, S., Evrard, P., 1999. Information technology and organization within European small enterprise. European Management Journal 17, 239–251.

Forker, L.B., Stannack, P., 2000. Cooperation versus competition: do buyers and suppliers really see eye-to-eye? ournal of Purchasing & Supply Management 6, 31–40.

Gadde, E., Snehota, I., 2000. Making the most of supplier relationships. Industrial Marketing Management 29, 305–316.

Heckman, R., 1999. Organizing and managing supplier relationships in information technology procurement. International Journal of Information Management 19, 141–155.

Kuan, K.K.Y., 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.

Lacovou, C.L., Benbasat, I., 1995. Electronic data interchange and small organizations: adoption and impact of technology. MIS Quarterly 19, 465–485.

Leidner, D.E., 1999. Virtual partnerships in support of electronic commerce: the case of TCIS. Journal of Strategic Information Systems 8, 105–117.

Liao, S.H., 2002. Problem solving and knowledge inertia. Expert Systems with Applications 22, 21–31.

Lincoln, D.J., Warberg, W.B., 1987. The role of microcomputers in small business marketing. Journal of Small Business management 25, 8–17.

Massey, T.K., 1986. Computers in small business: a case of under-utilization. American Journal of Small Business 11, 51–60.

Mead, D.C., Liedholm, C., 1998. The dynamic of micro and small enterprises in developing countries. World Development 26, 61–74.

Mecbeth, D.K., 1994. The role of purchasing in a relationship. European Journal of Purchasing & Supply Management 1, 19–25.

Meredith, J., 1987. The strategic advantages of new manufacturing technologies for small firms. Strategic Management Journal 8, 249–258.

Ortiz, C.M., Granville, L.Z., 2000. Electronic commerce solution for small businesses. Proceedings of the First International Conference on Web Information Systems Engineering 2, 150–156.

Palmer, J.J., 2000. Internet access in Bahrain: business patterns and problems. Technovation 20, 451–458.

Palvia, P.C., Means, D.B., Jackson, W.M., 1994. Determinates of computing in very small businesses. Information & Management 27, 161–174.

Palvia, P.C., Palvia, S.C., 1999. An examination of the IT satisfaction of small-business users. Information & Management 35, 127–137.

Papazoglou, M.O., Ribbers, P., Tsalgatidou, A., 2000. Integrated value chains and their implications from a business and technology standpoint. Decision Support Systems 29, 323–342.

Peppers, D., Rogers, M., Drof, B., 1999. Is your company ready for one-to-one marketing management, Harvard Business Review, 151-160.

Poon, S., Swatman, P.M.C., 1999. An exploratory study of small business Internet commerce issues. Information & Management 35, 9–18.

Premkumar, G., Ramamurthy, K., Nilakanta, S., 1994. Implementation of electronic data interchange: an innovation diffusion perspective. Journal of Management Information Systems 11, 157–186.

Premkumar, G., Roberts, M., 1999. Adoption of new information technologies in rual small business. OMEGA International Journal of Management Sciences 27, 467–484.

Roberts, B., Mackay, M., 1998. IT supporting supplier relationships: the role of electronic commerce. European Journal of Purchasing & Supply Management 4, 175–184.

Sohal, A.S., 1999. Introducing new technology in to a small business: a case study. Technovation 19, 187–193.

Thong, J.Y.L., 2001. Resource constraints and information systems implementation in Singaporean small businesses. OMEGA International Journal of Management Sciences 29, 143–156.

Turban, E., Lee, J., King, D., Chung, H.M., 2000. Electronic Commerce: A Managerial Perspective. Prentice Hall International.
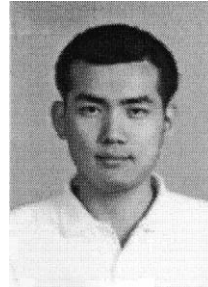
Shu-hsien Liao is an associate professor in the Graduate School of Resources Management, Management College, National Defense University, Taiwan. He received a Ph.D. degree in the Operational Research/System Group of the Business School, University of Warwick, UK, in 1996. His publications have appeared in the European Journal of Operational Research, Expert System With Applications, and Technovation. His current research interests are in decision support systems, case-based reasoning, knowledge management, electronic commerce, database management, and military C4ISR.

Yea-wen Chern is MBA of the Graduate School of Resources Management, Management College, National Defense University, Taiwan. Now, she is working in the private sector in Taiwan.

Feng-Hao Liu has a Ph.D in computer science and is the associate professor of the Graduate School of Defense Information National Defense Management College, has effort to expertise the new type computer network and software engineering in relational practical work and research. He has developed several network knowledge management, information security, software reuse, identification, verify, computer audit technologies published in national, international journals or forums. Several research results awarded by R.O.C. National Science Council, Information Management Associations or National Defense Management College. Leading or attending the promotion and execution of 'R.O.C. Military New Generation Information Integral Planning', 'Joint Logistic system Review', 'Government Information System Purchasing Operation', 'e-Mobile Logistic', 'e-Service Sale-Desk', 'Common Operating Environment' projects. He has been a committee member or consultant for several IDCs, banks, EC organizations, associations, and companies.

Wei-Bang Liao is MBA of the Graduate School of Resources Management, Management College, National Defense University, Taiwan. His research interests are in electronic commerce, IT for business process reengineering, and knowledge management.