

3.2.2 Implementation priorities of proposed procurement procedure

The system development implementation points of each core procedure, serving as the major functional items of this study's procurement trading platform:

1. Supplier network database module: The major functions of this module include online registration for suppliers, platform protection, account and password management, as well as identification and review of suppliers.
2. Online application management module: The major functions of this module include online submission of procurement application for the demanding department, online review, and transformation of a procurement application form into a the procurement form after being approved. This would reduce the repetitious input by the personnel.
3. Online price inquiry management module: This module comprises online price inquiry for each purchasing entity, online quotation submission for the suppliers all over the world and online bargaining.
4. Online bidding management module: This module consists of producing a tender form from the purchasing entity and initiating the online bidding procedure for suppliers
5. Online price comparison management module: The major functions include online price comparison procedure and online review of price comparison forms. The former allows interested suppliers to submit quotations and produces a price comparison automatically from the subsystem. The latter provides the online review for price comparison forms
6. Online delivery date revision management module: The major functions of this module's include: (1) confirmation procedure for purchasing entity and supplier delivery schedule, (2) online revision, adjustment, and confirmation procedure for terms of delivery.
7. Online notification management module: This module aims to provide the online notification procedure which is connected from the internal ERP system in the platform.
8. Online payment status inquiry management module: This module integrates the internal ERP system for supply factories to proceed with payment status inquiry.

4 Design and implementation of Procurement Trading Platform for Shipping Line

4.1 System Functions

Based on the proposed procurement procedure implementation and analysis of the ~~old~~ existing procurement system, a list of core process functions were served as the modular functions of the proposed procurement trading platform.

4.2 System design

The system design was built on the J2EE platform with the Thin Client framework. Users could manipulate the system through the Windows operation system and internet browsers. The system website used SSL encryption to ensure the security of information transmissions. The Oracle database and JSP development tool were implemented on the back end. All users were provided with HTML operational front end.

4.3 Design of Procurement Procedure

4.3.1 Procurement operation procedure

After summarizing and analyzing the procurement procedure of W. Corporation and together with the system functions mentioned above, a new procurement procedure defined in 17 steps, as shown in Fig. 1.

Step1: Entity with goods and materials requirement submits a request on the platform to the warehouse management entity. The warehouse management personnel would look into warehouse inventories.

Step2: If there are inventories satisfying the request, then the entity is notified of taking the needs immediately.

Step3: If there is no inventory, then a procurement application shall be submitted to the procurement platform.

Step4: Based on the review system implemented in the procurement platform, if the application does not pass the review, then the procurement application is sent back.

Step 5: If the procurement application passes the review, then the procurement entity is notified of initiating the price inquiry.

Step 6: Suppliers may submit quotations to the platform for the needed products which they are able to supply.

Step 7: Purchasing entity may haggle and bargain with all suppliers online.

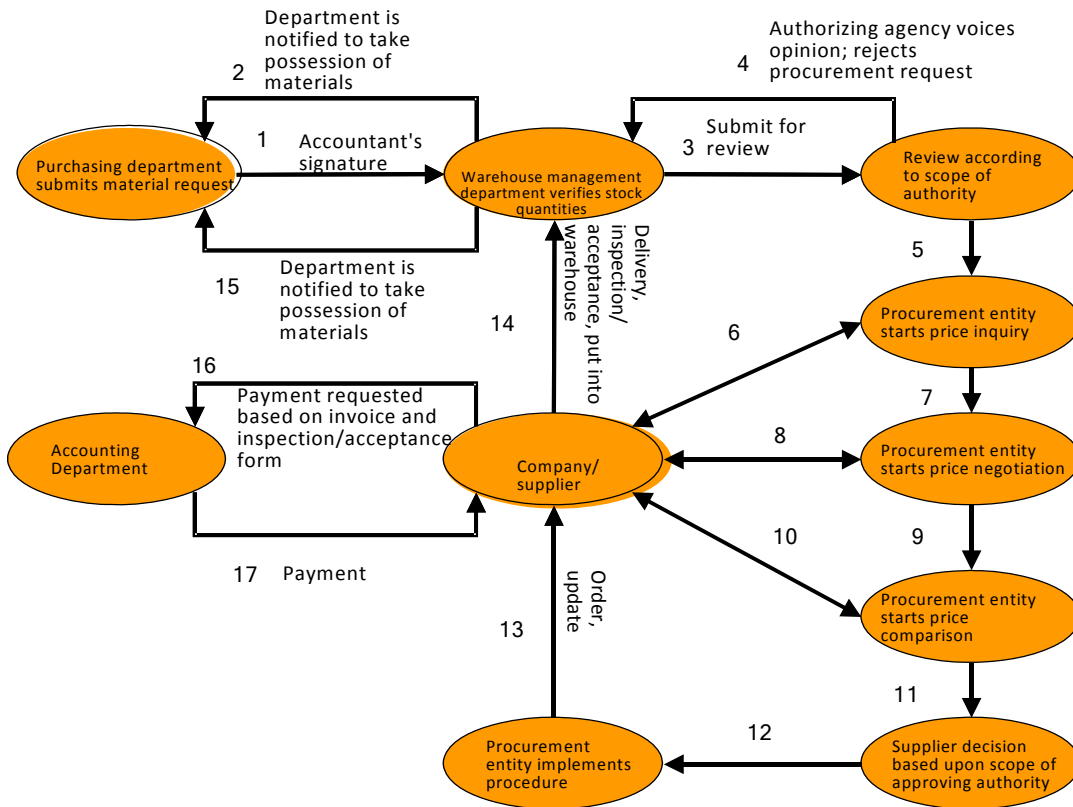


Fig. 1 Complete Procurement Flow Diagram

- Step 8: Suppliers may submit another quotation for the same product based on the price offered by the purchasing entity.
- Step 9: Purchasing entity produces a price comparison form based on the final price of each supplier.
- Step 10: Supplier can know the final price on the platform.
- Step 11: Through the review and approval system in the platform, the top-level manager can make a decision about the supplier.
- Step 12: After the supplier is decided, procurement entity can place the order.
- Step 13: Purchasing entity proceeds with the last stage of negotiation with the bidding winner.
- Step 14: Winning supplier proceeds with inspection, and acceptance procedures based on the terms and quantities of the order.
- Step 15: After the warehouse management personnel the purchasing entity would be notified of taking the purchases.
- Step 16: The winning supplier submits documents to the accounting entity and collects payment after shipments are accepted by

- the purchasing entity.
- Step 17: The accounting entity can disburse payment to the supplier according to the terms of payment and thereby complete the procurement procedure.

4.3.2 Procurement Processing Procedure

For any entity with procurement need, it should submit an application on to the procur have annotation ement platform. The system will first automatically collate if the same procurement need is also requested by any other entities within the procurement database. If so, the system will send a message to the entity that first submitted the application inform it of increasing procurement quantities. Complying with review regulations, the system will automatically send a form to the reviewing manager for proceeding with the procurement price inquiry procedure. The comprehensive procurement application procedure is shown in Fig. 2.

4.3.3 Price inquiry operation processing procedure

After the procurement application is reviewed and approved, it will be turned into a price inquiry form. And an inviting e-mail for quotations will automatically be sent to the suppliers who are capable of filling the products specified on the price inquiry. The flow chart of comprehensive price inquiry procedure is shown in Fig. 3. The manager is responsible for reviewing and approving the factory supplier and the procurement content. The flow chart of comprehensive quotation and price comparison process is shown in Fig. 4.

4.3.4 Price comparison operation processing procedure

Suppliers may submit a price quotation according

to the contents of price inquiry. The procurement personnel may negotiate the price based on the the quotations submitted by the suppliers.

4.3.5 Payment inquiry operation processing procedure

The procurement personnel could produce a price comparison form after the winning supplier has confirmed the delivered shipments and negotiated price. As the workflow accepted by the buyer, the procurement platform will link up the ERP system to enable the supplier to trace the payment status and mode of payment from the platform. The comprehensive payment inquiry processing procedure is shown in Fig. 5.

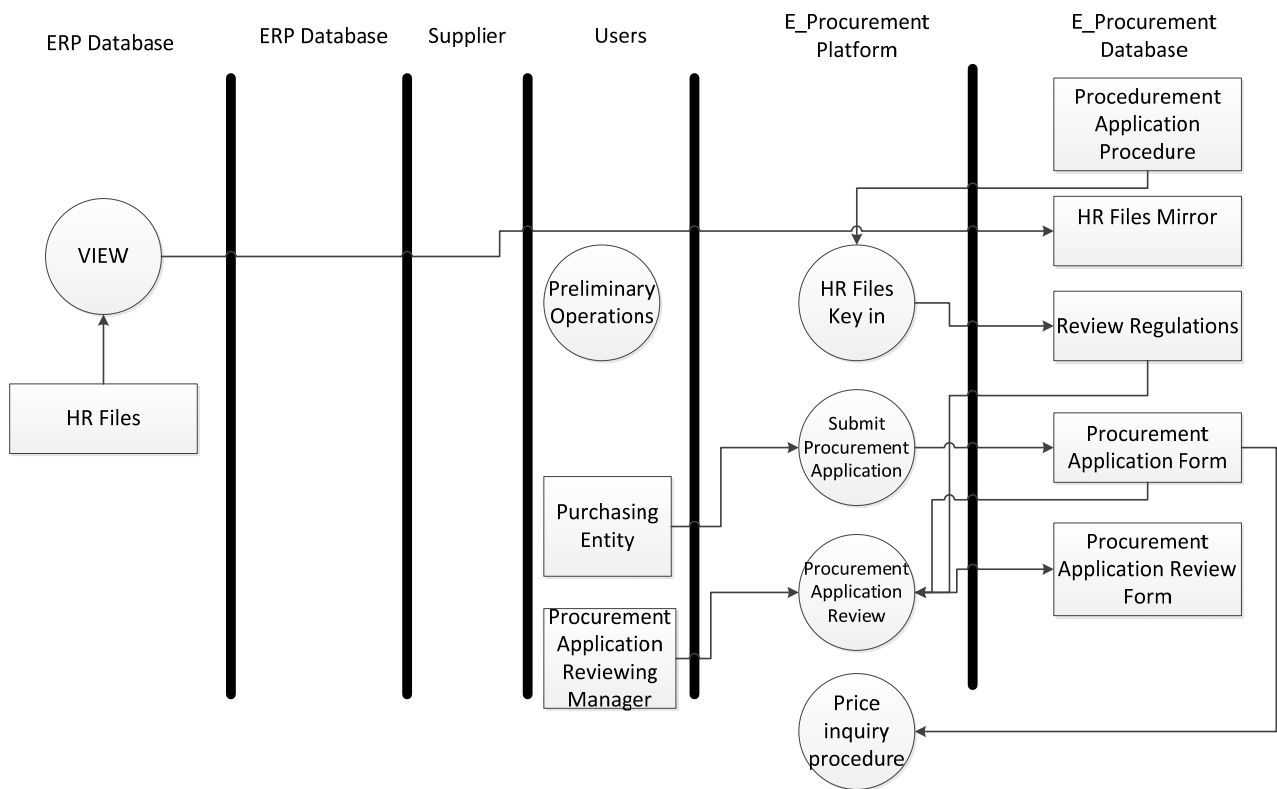


Fig. 2 Flow chart of procurement processing procedure

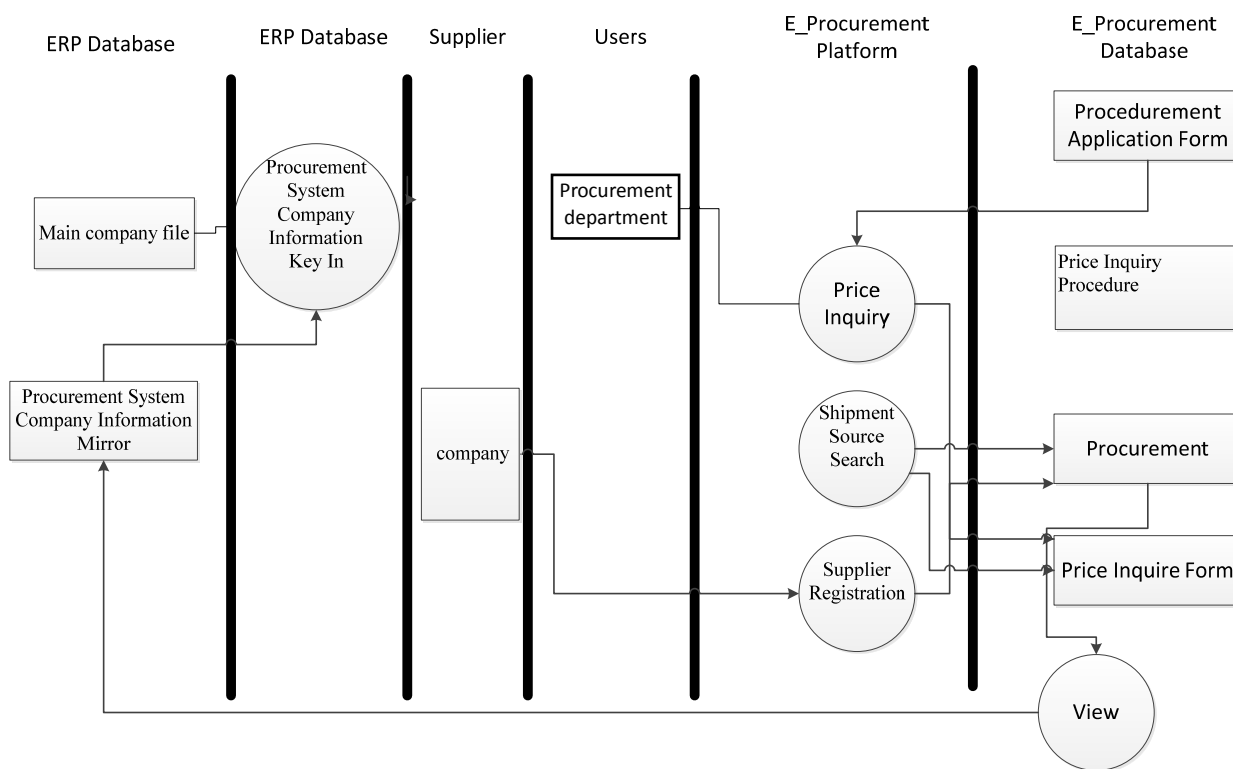


Fig. 3 Flow chart of price Inquiry operation processing procedure.

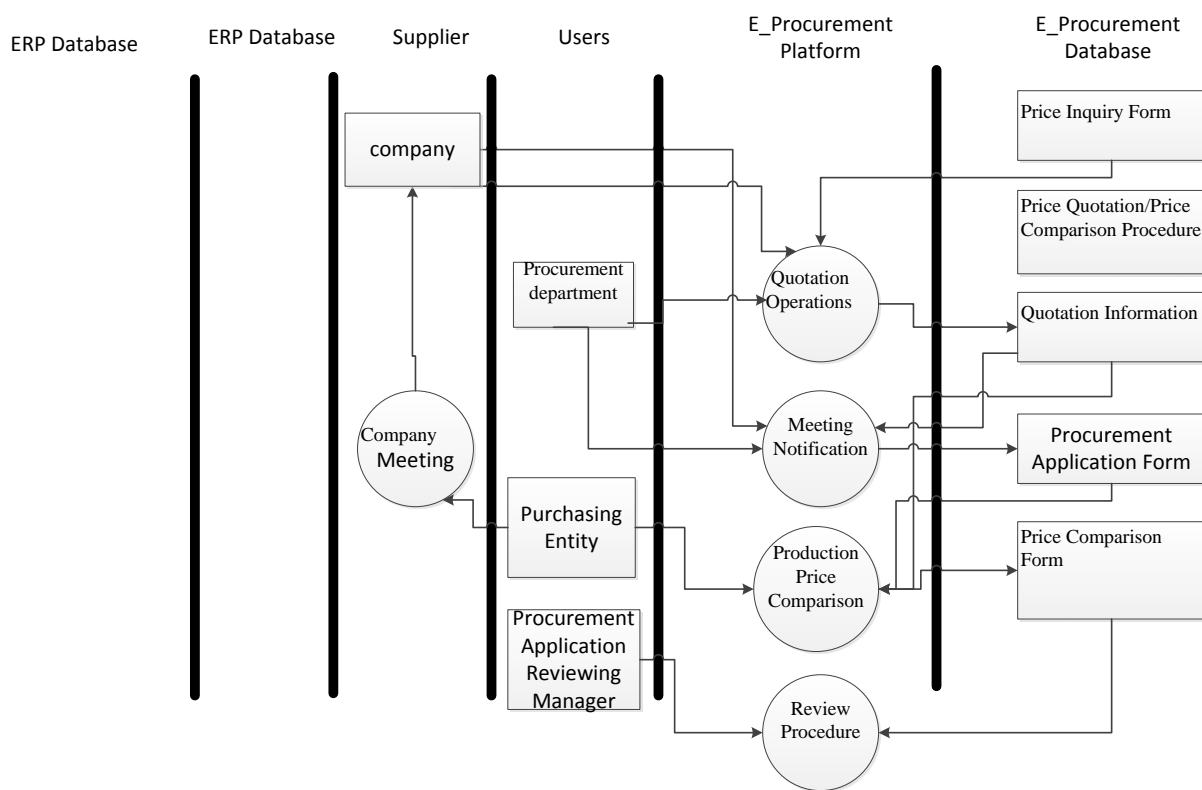


Fig. 4 Price comparison operation processing procedure

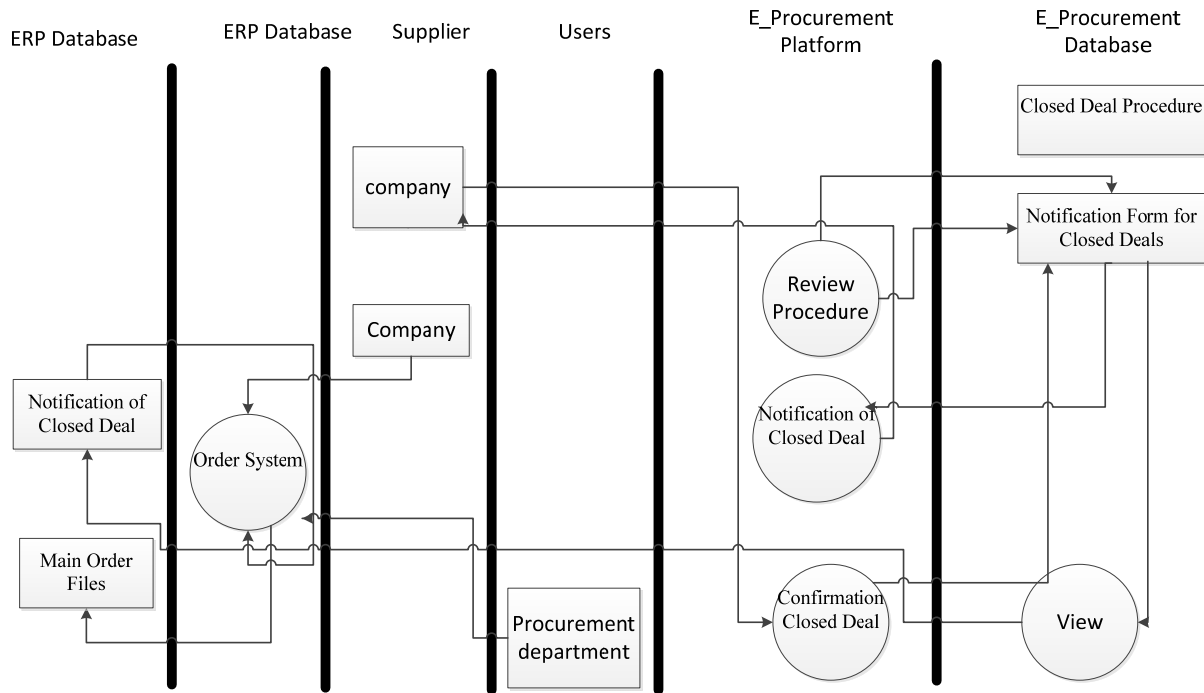


Fig. 5 Payment inquiry operation processing procedure

5 Implementation and Comparative Analysis

5.1 Framework of hardware and software systems

5.1.1 System's environment planning

The study's e-procurement trading platform uses an open J2EE framework to fully satisfy the

5.1.2 Hardware framework

The hardware implementation of the e-procurement trading platform is shown in Fig. 7. This network structure enables suppliers worldwide to quote prices through the Internet, a firewall is used to guarantee the trading security. In

requirement of cross-platform. The core technology for the system includes Java Server Page, HTML, XML, Java Servlet, Java Bean, and Java Script. By making use of the open framework, problems arising from the integration with the ERP system can be avoided. The framework of the system is shown in Fig. 6.

addition, the platform also needs basic supplier information, order information, and payment related information from the company's internal ERP system. Company personnel only requires a web browser to handle all the procedures.

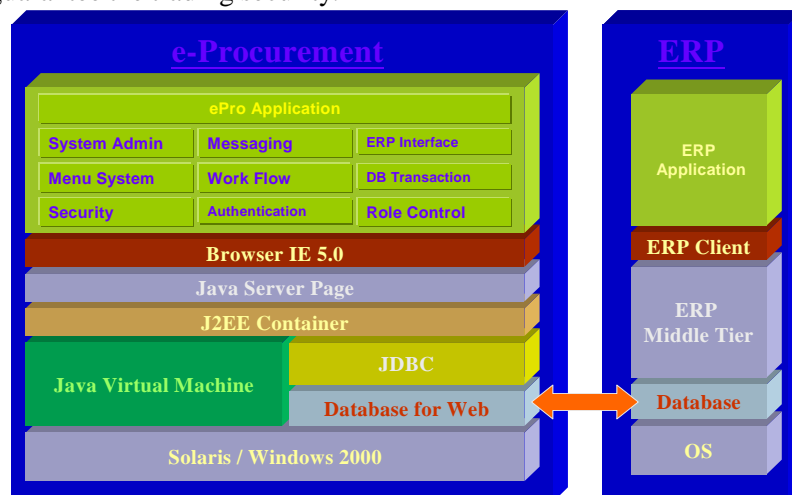


Fig. 6 Framework of web-based e-procurement system platform

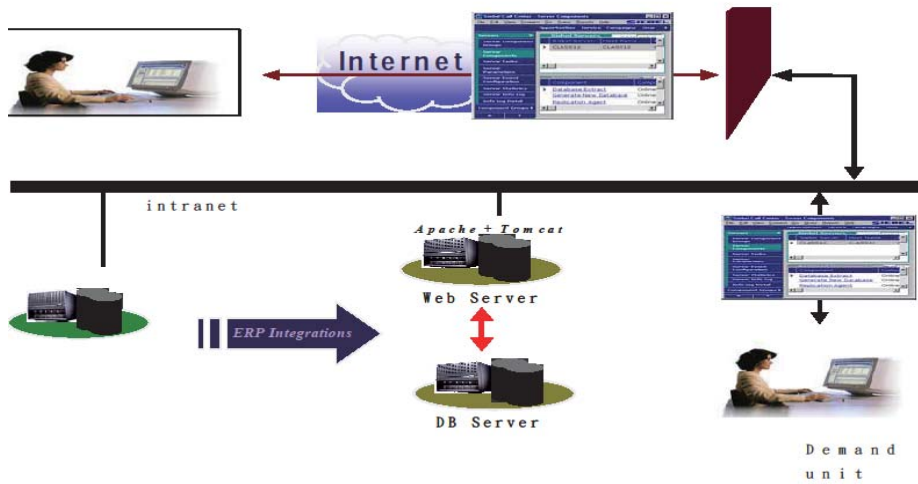


Fig. 7 Hardware framework of the e-procurement platform

5.2 Result Analysis and Benefit Evaluation

5.2.1 Compared analysis

After actually implementing the new e-procurement system for a year, the procurement personnel of W Corporation were interviewed in

the details of the operation-related key performance indicators. The results showed that the procurement procedure and business operation performance had already achieved the following benefits:

1. Benefits in assessment of non-quantitative
Table1 Comparative analysis

	Old procurement	Proposed procurement trading platform
Processing timing and scope	Processing timing is usually limited to the office hours. The procurement behavior is also limited to dealing with local suppliers.	All trading procedure could proceed real time. And the suppliers are no longer limited to local suppliers. This increases the company’s competitiveness.
Manual processing errors	Manual process in the old system is easily prone to mistake.	Instead of manual process, the system processing is automated. All quotations and price inquiries are computerized to reduce the human errors.
Just-in-time Procurement	It is very difficult to follow up the procurement procedure after the procurement requirements have been requested.	Each branch office or business unit may use the platform to access procurement status anytime. The platform can manage the estimated delivery time to enable the entire procurement schedule under control.
Rapid response and supply	As the delivery time from supplier cannot be controlled, company raises the inventory levels and increases the procurement costs.	For the procurement of any spare parts or consumed oil products, supplier can immediately notify its ship docked on the harbor of supplying the order.

2. Benefits in assessment of quantitative

1. The average procurement time was shorten :
The comparison of the average procurement time: old system and mode of procurement: manager would need at least 10 working days to review the order before making a decision. The proposed procurement

trading platform: as the procurement proceeds in the e-procurement platform, an order would only need an average of 2 working days. The procurement time is reduced by 80%. 2. The number of personnel reduced 50%. 3. Annual

telephone and stationery expenditures were 66% down as figure 9. With the traditional procurement method, the procured products procurement overhead. 4. Time allocation of procurement personnel: as figure 8, 10, 11, about choose supplier, search substitute,

may not be bought at lower price. And there are also significant increased manpower and administrative costs. interview, telephone contact, interview, telephone contact, documentation work are all reduce.

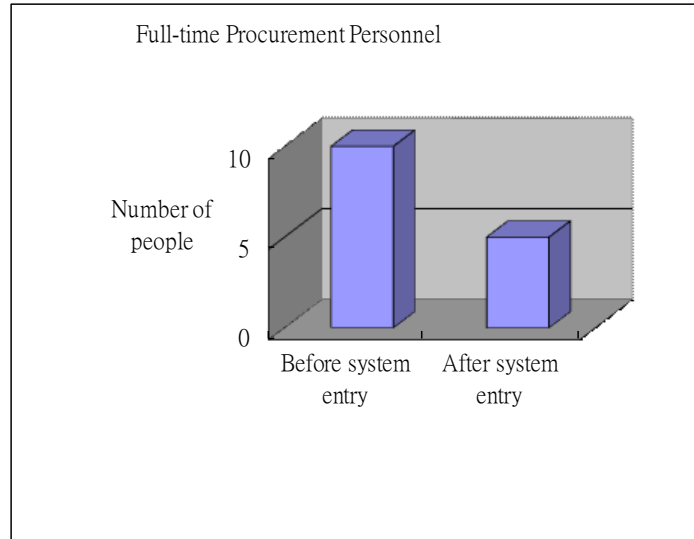


Fig. 8 Number of full-time procurement personnel.

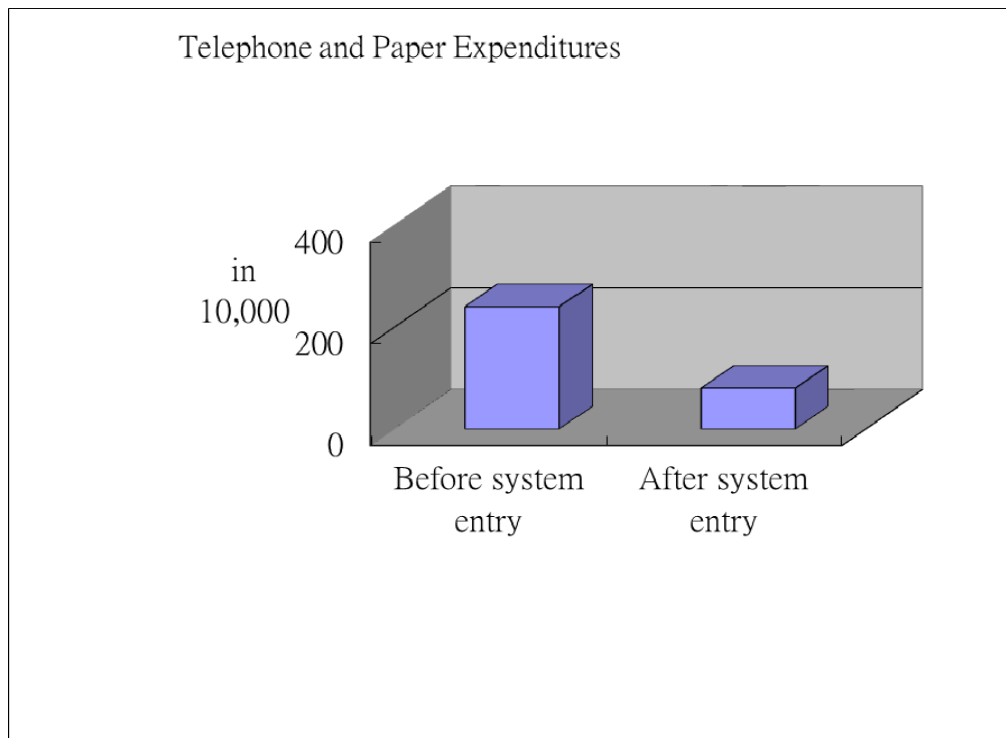


Fig.9 Annual telephone and stationery expenditures before and after system entry.

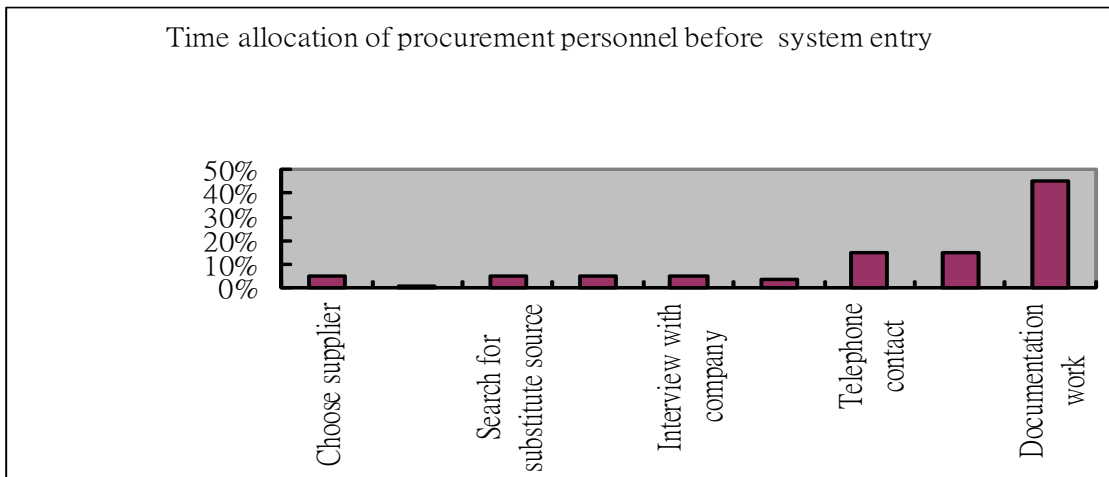


Fig. 10 Time allocation of procurement personnel before system entry

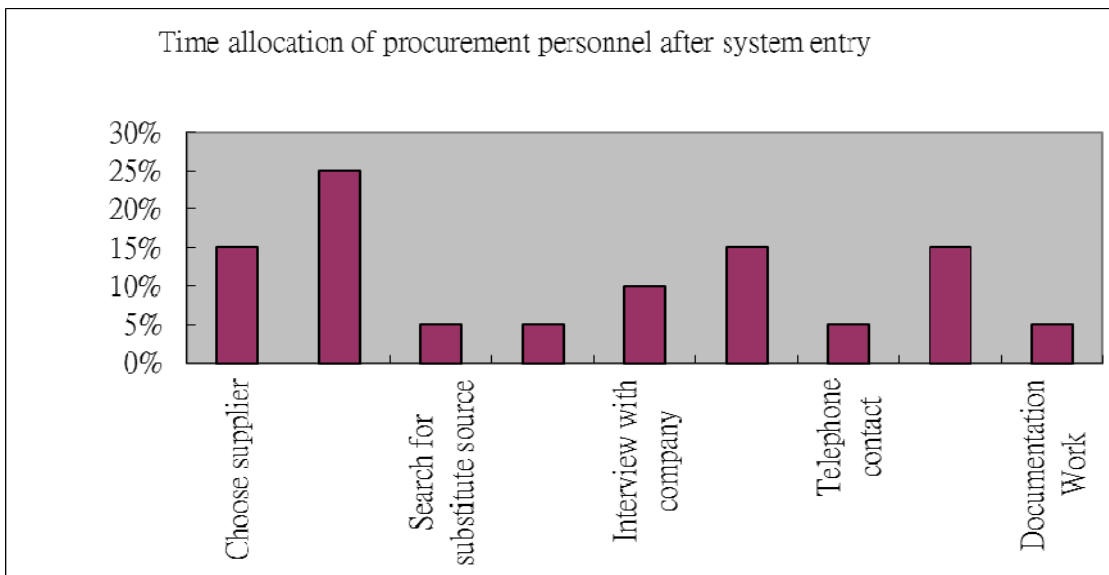


Fig.11 Time Allocation of Procurement Personnel after System Entry

The research results showed the job specifications of the procurement personnel have been changed into strategic work. With this shift in job attribute, not only has it enhanced the performance of procurement personnel, but it also has provided efficiency for decision makers within the company. The implementation of e-procurement system platform contributes to the overall efficiency of the company.

6 Conclusion

Currently, it is still not common for local corporations to make use of electronic procurement system. The main reasons include high setup costs, benefits unexploited by the corporations, rejection from the purchasing entity, and so on. As the emerging technology is applied to rebuild the internal operational procedures of the corporations.

This is considered as a very good way to raise the corporate competitiveness.

This study has the following contributions:

1. Establishing a web-based e-procurement platform: The designed web-based e-procurement platform is able to not only process each procurement case through electronic verification and approval, but also inspect and audit procurement behavior to prevent procurement personnel from indulging in corrupt practices and to improve their performances.-The implementation showed that the average procurement time decreased 80%, the number of full-time procurement personnel went down 50%, annual telephone and stationery expenditures were reduced 66%, the time for document processing of procurement personnel went down 89%, and value analysis time went up 25%.

2. Establishing a good product categorization and coding principles: The product coding principles designed in this research can be applied to all product categorizations and coding. It may also be used for huge quantities of spare parts and oil products in the shipping industry.
3. Establishing a comprehensive procurement model for the shipping industry: The redefined and redesigned procurement system could work for the cross country and cross time zone natures of shipping industry. It has been verified and proven to be feasible.

Acknowledgements

We thank the National Science Council for funding this research (NSC 102-2221-E-163-003).

References

- [1] Ho, Shih-Chiang, "Overhead Costs for Purchases Over the Internet May Exceed 70%," *Aberdeen Group*, 2010.
- [2] Jha, V.: Impact of Cloud Computing on Supply Chain Management. IIM Indore Mgmt Canvas ,2013.
- [3] Toka, A., Aivazidou, E., Antoniou, A., Arvanitopoulos-Darginis, K.: E-Logistics and E-Supply Chain Management: Applications for Evolving Business. IGI Global, Hershey , 2013.
- [4] Nair, P.R., Balasubramaniam, O.A.: IT Enabled Supply Chain Management using Decision Support Systems. *CSI Comm.* 34(2), 2010, PP. 34–40.
- [5] Yuan, Yi-Li, "The Development and Current Status of the Shipping Industry," *Foreign Exchange Monthly*, 1997, PP.25 – 28.
- [6] Wang, Chuan-Shu, "The Effects of World Economic Development Trends and Other International Shipping Industries," *Shipping Monthly*, 2008, PP. 21 – 26.
- [7] Wang, Yi, "Analysis of Taiwan's Shipping Industry," *Cross-Straits Industry and Investment Journal*, 2009, PP. 9 – 13.
- [8] Falagario, M., Sciancalepore, F., Costantino, N., Pietroforte, R.: Using a DEA-cross efficiency approach in public procurement tenders. *European Journal of Operational Research* 218, 2012, PP. 523–529.
- [9] Li, Chuan-Ping, "Corporate Electronification, Plan A: 100% Performance of Online Procurement at IBM," *United Daily News Network*, 2001.
- [10] Liao, Guo-Pao, "Formosa Plastics Saves NT\$41.2Billion on Overhead Costs Through E-Procurement," *Digital Age*, Issue #27, 2001, PP. 23 – 28.
- [11] Manas Ranjan Pani, Amit Agrahari, S. K. De, and G. Sahoo," Critical factors that influence e-procurement implementation success in the public sector", *Management and Labour Studies*, vol. 36, 3: 2011. pp. 225-246.
- [12] Chatterjee, P., Athawale, V.M., Shankar, C.: Materials selection using complex proportional assessment and evaluation of mixed data methods. *Materials and Design* 32, 2011, PP. 851–860.
- [13] Wang, Y.-M., Chin, K.-S., Luo, Y.: Cross-efficiency evaluation based on ideal and anti-ideal decision making units. *Expert Systems with Applications* 38, 2011, PP.10312–10319.
- [14] Amponsah, C.T.: Application of multi-criteria decision making process to determine critical success factors for procurement of capital projects under public-private partnerships. *International Journal of the Analytic Hierarchy Process* 3, 2011, PP. 107–129.
- [15] Guide, V., Harrison, T., Wassenhove, L.V.: The Challenge of Closedloop Supply Chains. *Interfaces: The INFORMS. J. of Oper. Res.* 33(6), 2007. PP. 3–6
- [16] William H. DeLone and Ephraim R. McLean,"Measuring e-Commerce Success: Applying the DeLone & McLean Information Systems Success Model,"*International Journal of Electronic Commerce*, Issue: Volume 9, Number 1, 2004, PP. 31 – 47