

THE IMPACT OF E-BUSINESS ON THE INFORMATION TECHNOLOGY DEPARTMENT

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ABSTRACT

The purpose of this project is to research the impact of e-business on today's information technology department in terms of its requirements under the new global environment settings. First, the different types of ebusiness and their functions will be examined. Second, the requirements of the traditional data processing department in a "brick and mortar" business model environment are presented. Last, the requirements of today's information technology department to support a successful e-business in this information environment era will be studied.

INTRODUCTION

The invention of inexpensive and powerful microcomputers in the late 70s has brought computing capability to the desktop of individuals. Since then, numerous microcomputer hardware and software manufacturers have improved this technology and created the client/server computing that provides the communication foundation between different types of computers. Therefore, these two information technologies, microcomputer and client/server computing, have nested and nourished the birth of the Internet that connects all individual computers, regardless of size and type, to form a single and universal network.

The Internet has become the backbone of the information super highway that allows instantaneous exchange of messages between two computers or information distribution from one computer simultaneously to many computers without any distance limitation and time difference. In addition, the global hypertext publishing of World Wide Web (WWW) has facilitated the creation, manipulation, and organization of a gigantic and universal information library that permits all online information to be stored, accessed and retrieved in a fast and easy-to-use manner.

The combination of the instant information delivery by the Internet and the worldwide online libraries supported by the World Wide Web has created a new transaction method or sales channel named electronic business or e-business for organizations. A well-planned and implemented e-business enables organizations to conduct daily operations and business transactions in a more efficient and effective manner. In some cases, ebusiness is essential to organizations for gaining a competitive edge in this global world. In other cases, e-business is a necessary vehicle used by organizations to survive and stay in business.

The success of an e-business absolutely and completely depends on the support from a competent and flexible information technology department that is somewhat different from the traditional data processing department. This new fact has moved the information technology department from a

negative image as an overhead oriented group to a positive image as a profit-generating center. More importantly, organizations have treated the information technology as a vital tool in their strategic planning to acquire competitive advantages in this information era [4].

The purpose of this project is to research the impact of e-business on today's information technology department in terms of its requirements under the new global environment settings. First, the different types of e-business and their functions will be examined. Second, the requirements of the traditional data processing department in a "brick and mortar" business model environment are presented. Last, the requirements of today's information technology department to support a successful e-business in this information environment era will be studied.

TYPES OF E-BUSINESS

In general, e-business can be characterized as an individual or an organization using electronic network to provide service, product, or information to other individuals and/or other organizations for a profit or a cause. Ebusiness has a set of subcategories either defined by its major purpose or by the types of organizations behind it. The most common and important subcategories that can be found in the literature are e-commerce, e-education, e-government, electronic data interchange (EDI), e-mail and portal [1] [5]. Some of these subcategories do not have a clear-cut boundary or definition. The following is a brief description for each subcategory of e-business.

The e-commerce can be described as using electronic network to conduct business transactions for a profit or a cost reduction. There are three major types of e-commerce models that are currently practiced by business organizations or discussed in the research literature. They include business-to-business model, business-to-customer model, and customer-to-customer model [3].

The business-to-business model is most likely established by the big or medium business organizations that intend to

efficiently manage their supply chain. These organizations set up a private network or use the Internet to connect their material suppliers and/or their retailers as an entity. By doing so, the real time information related to purchasing, manufacture and selling could be exchanged between involved parties for achieving the control of the inventory level to the point of just in time.

The business-to-consumer model is adopted by any value-added business organizations or individuals that would like to have a virtual store front on the Internet to sell their service, product, and information on line. Any individual regardless of his or her location on earth and time of the day can make a purchase as long as he or she has on line access to that particular virtual store. The business organizations or individual can deliver the purchased information and entertainment on line and send the purchased physical commodities through the traditional shipping service.

Customer-to-customer model is created by those business organizations that would like to set up and maintain a virtual store providing an online auction site for the others. The general public can use the site to negotiate the selling and purchasing merchandise among themselves according to the rule established by the business organizations of the site. The business organizations would charge a fix fee or commission to the seller who has made a successful sale using the site.

E-education uses the Internet to delivery the course material by educational institutions or organization. The course syllabus, lecture material, homework assignment, and term projects are posted on a web site. The students with a special access code can view and down load all or part of the information. A chat room or e-mail can be set up between instructor and students for question and answer sessions. An on line test can also be conducted and monitored to evaluate the progress of a student.

E-government is adopted by federal government and state government not only to facilitate internal communication, but also with business organizations and general public using Internet. Government posts new laws and revised regulations on its web site for individuals to access and down load the necessary information. Business organization and private citizen can handle their corporate taxes, individual returns, and welfare using the Internet to interact with their government. Moreover, the government has an electronic procurement system to manage all the purchasing transactions from business organizations. One can view the e-government as a special type of e-commerce that is owned by a government entity instead of a business entity.

Electronic data interchange is the earliest version of business-to-business model of e-commerce that uses an expansive value added private network to coordinate and streamline the ordering process between the organizations and within the organizations during late 1970s and early 1980s. Electronic data interchange allows electronically transmitting

standardized and structured purchasing information between suppliers and customers.

E-mail is an universal electronic mail service system. It enables those individuals and organizations connected to the Internet to instantly send and receive a message and a document to each other within seconds. It also allows information to be simultaneously disseminated to computers of a specific group of individuals who are located in different locations.

Portal is a special type of e-commerce. It provides value added service by containing various links to other interesting web sites for the visitors. It serves as an ease to use gateway or interface for users to offer timely information without the trouble of using an on line search engine. There are two types of portals named vertical portal and horizontal portal (1). The vertical portal concentrates on one subject area where the horizontal portal provides a variety of subject areas. The publisher of the portal makes profit on selling the advertisement space on the portal.

THE REQUIREMENTS AND ENVIRONMENTAL SETTINGS OF THE TRADITIONAL DATA PROCESSING DEPARTMENT

Traditional data processing department has been established by organizations with the objectives to improve the daily operational efficiency and to increase the overall business productivity since the 1950s. The department has been achieving these objectives by constantly creating, maintaining, and revising computer information systems either to replace the existing operations or help the decision making process for different level of management over the last half century.

Those computer information systems built by the traditional data processing department can be classified into four major categories. They are transaction processing systems, management information systems, decision support systems, and expert systems [8]. The transaction processing systems use computers to handle the business transactions among the organization, suppliers, and customers. The management information systems automatically generate routine and exceptional business operation status reports for lower and middle management. The decision support systems utilize different mathematical models to analyze alternatives for strategic management. The expert systems use knowledge base and inference engine to produce solutions for complex problems or business decisions.

The above four different types of computer information systems have the similar requirements and environmental settings needed from the traditional data processing department. These requirements and environmental settings can be roughly grouped into system, end user, staff, schedule, security, and capacity.

System

The computer information systems have been created and implemented to carry out daily accounting transactions and financial analyses. These operations are well defined, established, and structured functions. The traditional data processing department only needs to use the available hardware and software to make the existing procedure a more effective one.

The internal processes and reporting requirements of these computer information systems remain the same over the years since accounting and finance are the basic core functions of any organization. The traditional data processing department does not have to constantly change or overhaul the existing computer information systems. However, the new tax laws and new financial regulations posted by the state and federal governments force the data processing department to conduct some minor adjustments for these computer information systems to produce proper reports for the end users.

The traditional data processing department has not been challenged to use the information technology as an innovative and strategic weapon for the business to reach the organizational vision or goal. Therefore, the traditional data processing department has been treated as an overhead consumption unit and service department under the division of either accounting or finance in an organization.

End User

The computer information systems themselves are all designed to support the internal existing business operations for clerical work or different levels of management decision-making process within an organization. This makes the end users of the computer information systems solely limited to the employees of the organization. The personnel working in the traditional data processing department can identify the end users since they are co-workers in the same organization.

There are less or even no cultural difference and language barriers between the individuals working in the traditional data processing department or other departments in the same organization. Under this circumstance, it is very easy for the personnel in traditional data processing department to communicate with the end users in other departments in order to define the system requirements since they share the same language. Moreover, it is impossible to offend other cultures since the main purpose of the computer information systems is to generate accounting and financial reports.

The traditional data processing department can always put on a series of training courses for the internal end users when there is a complete new system implementation or minor system change. The training material can be designed to fit into the knowledge and background of the internal end users. The traditional data processing department can even revise the course contents according to the feedback from the internal end user.

More importantly, these internal end users are very tolerant to any system bugs, inefficient system, and incomplete system for the following three reasons. First, the traditional data processing department is the sole supplier to create and develop their computer information systems. Second, the end users need to keep a good relationship with the traditional data processing department for future system maintenance work. Third, the internal end users still have the old system as a back up system that they can use to handle the business process without any interruption.

Staff

Typically, a director is the head of the traditional data processing department and reports to the vice president of finance in the organization. The directorship is the highest position a data processing professional can achieve in the organization structure. The other types of individuals working in the traditional data processing department include system operator, system developer, data base administrator, and end user consultant.

The primary function of a system operator deals with running and maintaining the computer information systems. The system developer focuses not only on the analysis, design, and implementation of the new computer information systems, but also review and improve the existing computer information systems. The data base administrator is responsible for the creation and maintenance of a standard database for all the computer information systems usage. The end user consultant provides the assistance and training of the information system usage to the end user. Therefore, all the employees working in the traditional data processing department have the special skills and knowledge of the system hardware, software, database, network, and operation.

Schedule

The traditional data processing department has two well-known problems in terms of systems development. First, it has a huge backlog of developing new computer information systems. Second, it cannot deliver a new computer information system within the predefined time frame and budget limit. The traditional data processing department realizes that they are the sole source to accomplish the computer information systems development work for the entire organization. There is no incentive for the traditional data processing department to meet the deadline since the existing system even with some problems is still working for the function area.

The work load for the computer information systems can be calculated for the entire organization. The operational schedule of the computer information systems can be predefined and effectively managed to fully utilize the system capacity by the traditional data processing department. All the interactive computer information systems are running during the business hours for end users. All the batch processing and report generating computer information systems are scheduled

at night to fully utilize the idle time of main computers. The backup for database and the maintenance of the computer systems are also done at night when the business transaction volume is light.

Security

Security is not a major concern for the traditional data processing department. First, the network security is not a big issue for the traditional data processing department since all the computer information systems are used only by the employees within the organization. Therefore, the traditional data processing department only needs to establish a closed organizational network that no outsider is allowed to connect and access any information.

The second one is related to the data and information security. The traditional data processing department usually develops a normalized database for all the functional area users in the organization. This normalized database can be either centralized in one location, or decentralized in several locations connected to the organizational network. The control of data and information retrieval will be implemented by assigning a proper password to an individual or group for restricted and authorized database access [2]. A security log records any illegal attempt to invade the computer information systems in terms of terminal number, date, time, and action. Proper action will be taken to investigate these violations and to prevent their future occurrence.

Capacity

There are two important issues in terms of the capacity of a computer information system. The first one is the interface needed to communicate with other existing computer information systems. The traditional data processing department can gather the information regarding hardware, software, database, and network for all the existing computer information systems and the end user's requirements as the constraints for designing and implementing the new interfaces. The traditional data processing department can then fully test these interfaces and iron out any problems before its actual operations.

The second one is the capacity of the computer information system to handle the end user's needs. The traditional data processing department can discuss the usage requirement issues in terms of the response time for an interactive system, through put for a batch processing systems, the database specification, and the network speed, etc. with the internal end users. The traditional data processing department can then use the usage requirements to implement a new computer information system with the sufficient capacity to handle the current needs of end users, the future growth, and the seasonal demand of the business in an organization.

E-BUSINESS IMPACT ON TRADITIONAL DATA PROCESSING DEPARTMENT

The most three important characteristics of e-business that do not exist in the conventional brick and mortar are its dynamic, universal, and timeless features. These fierce forces have not only changed the requirements and environmental settings of the traditional data processing department, but also have altered the department's name to information technology department that better reflects its current status. The following is a discussion of the new requirements and environmental settings in terms of system, end user, staff, schedule, security, and capacity for the information technology department to accommodate e-commerce practice.

System

E-business is a new and special type of computer information system that utilizes the communication technology and information technology together to provide inexpensive pervasive computing and electronic services to the entire wide world. It has leveled the playing ground for a small business to compete with the big business through the Internet since the size, space, and location of a business organization become a single point of contact and the presence of a web page.

E-business becomes the necessary strategic computer information system that enables a business to survive and to gain a competitive advantage [7]. In other words, the success of a business is highly tied with the successful implementation of E-business. However, the information technology department has become the backbone in creating and implementing an attractive e-business for an organization. Therefore, an organization depends upon its information technology department to achieve its visions and goals. The information technology department has converted its image from a passive overhead consumption unit to a positive profit-generating unit.

The customer-centric characteristic of e-business has pushed the information technology department to become a dynamic working environment [6]. The information technology department not only continually needs to scout the latest and most suitable communication and information technologies to enhance performance, but also requires constantly updating the existing information with new information in order to attract frequent return visits from customers. Otherwise, customers will definitely seek the other similar e-business web sites for their suppliers since they are only a click away on the Internet.

End User

E-business uses the network to telecommunicate with individuals scattered across the world. This has extended the end users of e-business beyond the internal employees to also encompass the external customers who are connected to the Internet. The information technology department can no longer clearly identify the population of its end users. It becomes impossible to interact with all the potential customers to define the system requirements for the e-business.

An universal language and culture that will be understood by every customer do not exist in the Internet. The customers coming from the same country might not even share the same language and cultural backgrounds. Because these differences, the information technology department must design one user interface that is suitable for every customer. One user interface design of the e-business might be proper for one type of language and cultural background, but it will be improper or even insulting to another type of language and culture background. Moreover, the same user interface might be a lawful design according to the legal regulation of one country, but it becomes a criminal act in another country. In both situations, the business organization of that e-business can potentially face the great danger of a national or international lawsuit.

The user interface constantly needs to update or change its contents in order to provide new information or services to attract potential customer visits. The information technology department cannot offer a training session for the customer to navigate through the new user interface whenever there is a change. If the customer cannot get the information or service that is needed at that particular moment, he or she would go to other similar sites. This results in a loss of a valuable customer and potential sales.

To overcome the lack of customer training, there should be a frequently asked questions page to list the most common questions and answers in the user interface to solve some problems for the visitors. Additionally, there should be a call center established for the customers. The major function of the center is to handle the problems encountered by the customers during the entire transaction process of the e-business. A dark page should also be available to provide sufficient and proper information for the public whenever there is a disaster related to the organization.

The information technology department cannot afford any problems in the user interface since there are many similar web sites that offer the same information and service. The user interface has to be perfect and easy to use for customers at their first time visit. The user interface also must allow customers to access it without any interruption or degraded service. In other words, Internet customers have zero tolerance for any mistake, error, imperfection, unavailability, and inefficiency of the user interface during their navigation for information and service.

Staff

E-business can be classified as an international computer information system with customers coming from every country on the universe. Its user interface has to meet the cultural and legal requirements for every country. Therefore, the information technology department has to hire its employees beyond the individuals with the knowledge of hardware, software, database, and network of computer information systems. It is essential for the information department to assemble a group of employees from different

disciplines in order to design an effective user interface that does not offend any cultural and legal requirements of any country on the earth.

The members of the interdisciplinary group should include psychologists, lawyers, sociologists, artists, and professional writers. Then, psychologists understand the pattern of human behavior and can help to design a better navigation path for the user interface. The lawyers, who have the knowledge of the national and international laws and regulations, can prevent any illegal materials used in the user interface. The sociologists are aware of the customs of different ethnic groups and can assist the user interface to avoid any improper words or phrases to upset any group of individuals. The artists and professional writers can produce an attractive and understandable user interface.

E-business is a new sale and marketing channel in addition to face-to-face, mail, and telephone. The special characteristic of this new sale and marketing channel that is different from the existing three is its capability of mass customization. The mass customization enables a business organization not only to produce its product or service in large quantities for cost saving, but also to allow the product and service to be customized for each individual customer. Therefore, the information technology department needs to work closely with the marketing department to design the contents of the user interface to achieve the objectives of (1) to penetrate the target market, (2) to increase existing sales, (3) to avoid any channel conflicts, and (4) to promote cross product selling.

Today's business organizations require to constantly conduct business process reengineering that examines the organization's structure and business processing to improve its operations. The information technology provided by the information technology department is the major facilitator to achieve the goals of business process reengineering. It becomes the essential for the top management to acquire business knowledge as well as information technology in order to successfully run a business in this information era. This fact has created a new position of chief information officer, who has the ability of establishing strategic usage of the information technology for new business opportunities. The chief information officer holds a position at least the same level as other vice presidents and has a chance to advance for the commander of the entire organization.

Schedule

E-business eliminates the old constraints of the size and location of an organization's capability to enter business. This global open market competition allows the small business organizations or even individuals to provide the same or similar products and services as big business organizations on the Internet. These different types of business organizations competing for the same customers are only a click away from the eyes of every customer. This universal competition characteristic of e-business has forced the information technology department to shorten its computer information

systems development and maintenance time to the new Internet schedule and speed. In other words, the pressure is put on the information technology department to deliver an effective and efficient computer information system on time or even before the deadline.

The information technology department has to change its computer information systems development schedule style from linear to parallel. This implies that the information technology department does not have the luxury to create the next version of a computer information system until it is absolutely unusable by the end users. The sharp global competition forces the information technology department to operate a new computer information system on the Internet and simultaneously design and construct the next version of the system.

The operational schedule for the computer information systems in an e-business environment follows the sun around the world and never ends. It is a one hundred percent proof service level with twenty-four hours a day and seven days a week. There cannot be any down time of the system. Shutting down the system equals cutting off the customer access at that moment. This situation leaves the door open for competitors to gain customers.

The important maintenance jobs or back up functions of the database and the computer information systems have to be performed in a way that does not disturb the access of any customer. This can be done using two identical servers for the same computer information system where one server takes over the entire work load and the other one can perform the back up function and necessary maintenance during the least busy time.

Security

E-business creates a computer information system that is a global open market to every customer connected to the Internet. The organization has to allow its customers to access organizational information through the virtual open market. This situation causes a serious security problem to protect the organizational information, process, and database for the information technology department. Extra security policies, procedures, and systems have to be established by the information technology department in order to exclude hackers and intruders who could severely damage the reputation and assets of the organization.

The network security system used by the information technology department includes firewall, encryption, and authentication. Firewall is implemented to separate the public web server and private network of an organization. It is used to control organizational resource access for both internal end users and external customers. It can be in the form of proxy server, packet filter, application gateway, and circuit-level gateway.

Encryption technology is used to convert a message into a set of secret or unreadable codes in order to ensure the privacy and the confidentiality for the information transmission between two places through the network. It includes two basic encryption and decryption systems using a private key and a public key. A message, that is encrypted using the public key, has to be decrypted using the private key. On the other hand, a message that is encrypted using the private key, has to be decrypted using the public key. The private key takes much longer to be decrypted and is more secure than the public key.

Authentication utilizes the digital signature and works much like the handwritten signature of an individual. The digital signature is a fixed number of digits named digital hash that is computed for the entire message being transmitted. The digital hash is unique for every message and is encrypted with the private key. The receiver can use either his/her private key or the public key of the sender to decrypt the message and the digital hash for assurance. The process of generating, encrypting, and decrypting the digital signature ensures two things. First, the message has not been altered during its transmission. Second, the message is indeed sent by a particular individual or organization since the digital hash is impossible to be forged by others.

Another important issue dealing with the network security is the credit card payment security of the Internet. The information technology department needs to assure e-business customers that their credit card information used in the payment for an on line purchasing is one hundred percent safe and private during the entire transaction process. This can be done using the Secure Electronic Transaction protocol that guarantees the process of the credit card transactions over the Internet is as simple and secure as in the retail business. In addition, the Secure Electronic Transaction protocol will only transmit the minimum information of the transaction to the buyer and seller for the sake of protecting privacy.

Capacity

The capacity of computer information system interfaces must be versatile to meet the needs of both internal end users and external end users. It is easy for the information technology department to design and develop the computer information system interfaces that work well with the existing hardware equipment and software of the internal end users in the organization since it is a set of predefined facts. This is not the case for the external end users since they are the individuals, customers, and organizations scattered in different continents. The information technology department faces the uncertainty issues associated with hardware equipment and software that are (1) the type of client machine and its version, (2) the type of operating system and its version, (3) the type of browser and its version, and (4) the type of network equipment, software, and protocols.

The information technology department has to create a computer information system interface that will handle

different combination of client machine, operating system, browser and network. The information technology department has to avoid any proprietary tools to develop a computer information system whenever it is used by external end users. The information technology department needs to closely follow the standard established by the international organizations. It is necessary for the information technology department to use open architecture for designing the computer information systems that could interact with other external computer information systems without problems in an e-business environment.

The information technology department has to work hand in hand with marketing department and sales department to forecast the usages in analyzing the computer information systems for e-business. The forecasting should include (1) the number of users, (2) the time and date of usage, (3) the pattern of usage, (4) the length of usage, and (5) the future growth, and (6) The seasonal changes.

This predicted usage has to be calculated as the highest possible demand in the future. The information technology department then can utilize this forecast as the basis to carefully determine the optimal requirements of computer, network, program, database, operating system, and interface needed for the computer information system. In this way, there will have a sufficient capacity of the computer information system to process the peak time usage demand without overloading the system and degrading the system performance under any circumstance.

CONCLUSION

The Internet and the World Wide Web have generated the information super highway for business environment. It has given the birth of e-business that eliminates the distance, time, size, and location to connect suppliers and customer forming an international and virtual world. These new surroundings have transformed the traditional data processing department into the information technology department in the "brick and mortar" business model.

The new information technology department can no longer inherit any of the slow, inflexible, proprietary, data processing oriented, and overhead dependent characteristics to deal with its routine business from its predecessor named traditional data processing department. The information technology has to adopt a new approach that is dynamic, flexible, standard, end user oriented, and profit seeking to support the functions of other departments in the organization.

It is essential for an information technology department to utilize the available information technology to improve the over all business productivity. Additionally, it must scout new information technology to gain a strategic and competitive advantage for its organization in the new e-business world.

REFERENCES

- [1] Amor, Daniel, *The E-business (R)evolutio*, Prentice Hall, Inc., 2000.
- [2] Connolly, Thomas, and Carolyn Begg, *Database Systems: A Practical approach to Design, Implementation, and Management*, Addison Wesley, 1999.
- [3] Deitel, H. M., P. J. Deitel, and K. Steinbuhler, *e-Business and e-Commerce for Managers*, Prentice Hall, 2000.
- [4] Gerrard, M., "Challenges in Aligning E-business Strategy and IT Planning", *Gartner Group*, Inc. December 7, 1999.
- [5] Kalakota, Ravi and Andrew B. Whinston, *Electronic Commerce*, Addison Wesley, 1997.
- [6] Radding, Alan, "Pressure Grows for E-Business Infrastructure", *Information Week*, September 25, 2000.
- [7] Schutte, Dave, "Turning E-business Barriers into Strengths", *Information Systems Management*, Fall, 2000.
- [8] Stair, Ralph M. and George W. Reynolds, *Principles of Information Systems*, Course Technology, 2001.