

Chapter 28

MODELING FRAMEWORK FOR E-BUSINESS SYSTEMS

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Abstract: Use of internet technologies has expanded rapidly from the initial profit-oriented commercial systems to wide ranging business systems including administrative, governmental, non-profit oriented businesses, etc., which include intra-organizational and inter-organizational systems (IOS). All these systems are broadly referred as e-Business (e-Biz) Systems in this work. e-Biz systems are developed based on strategic alliances among the participating business systems to exploit the IT(information technology)-driven synergies. Emphasis in the traditional systems development methodologies is on process models, data models, event models, etc. of the business system under study where as in an e-Business system the emphasis is on modeling the strategic alliances between business systems and the integration architecture, and thus necessitating the need to model the strategic dependencies and relationships. Current e-Biz system development tools assume that the changes that are being caused by the technology to business systems' goals and objectives, and nature and scope, are well understood, analyzed and documented ready for implementation by the developer. This assumption is not true. There is a requirement for an e-Biz system modeling methodology which facilitates modeling the strategic relationships, goals and objectives of partners of an e-Business system, and which helps convert the conceptual strategic model to an implementation-oriented model. In this paper, an effort is made to develop such a methodology and demonstrate it using a case study.

Key words: eBusiness, Modeling, inter-organizational systems, system development, methodologies, I*framework

1. E-BUSINESS SYSTEMS

Internet technologies are affecting the way we conduct business in almost all walks of life these days. Over the last decade, several traditional business systems have been reengineered and/or redesigned to exploit the benefits

from Internet technologies. However, the open and global nature of Internet necessitates not only reengineering the existing business processes of a business system, but also redefining the very nature and scope of the business being conducted. The emphasis in profit making has evolved from reducing costs and increasing productivity and process efficiency to increasing the revenues, developing new products/services, expanding the markets, and to making the processes add more value to the system. This change in the nature and scope of business systems has affected and has been effected by the developments in the domain of Information Technology (IT).

Traditional business systems have looked at two types of IT-driven requirements, viz. mandatory requirements necessitated by market-adoption (ex. Automatic Teller Machines in Banking Sector) or statutory legislations (ex. security protocols), and voluntary requirements driven by business process automation decisions. In this traditional perspective, requirements necessitated by the IT-driven strategic alliances with other organizations are not given priority. The emphasis is on development of isolated computer-based business systems to help meet the sectoral market requirements. As the IT applications in the business systems have grown, the computer-based business systems have grown larger, but yet isolated, unwieldy in terms of facilitating synergies through strategic alliances. Development of such large systems has given raise to development methodologies such as Structured Analysis and Design methods. These methods essentially concentrate on modeling the process, data, network and interface aspects of the business systems to help improve the efficiency of the current processes within the broad umbrella of current corporate goals and objectives. The expected life of these systems is considered to be at least about 5 years, with the development effort needed ranging from 1 person year for a small system to over 10 person years for a large system.

Advent of Internet technologies has brought significant changes to the basic paradigm of business systems. With the open and global nature of the Internet, businesses find it easy to interact on both ends of their business chain, viz. suppliers and customer. Several small 'intermediary' businesses have evolved challenging the traditional big businesses. The intermediaries specialize in specific tasks and add more value making them more cost-effective than the traditional systems. These systems are organic and dynamic and respond to the changes in the environment very quickly, thus making the expected life of these computer-based systems short (as short as 3 months in case of some dotcom companies) and necessitating rapid systems development. They attempt to find and exploit a gap in the value chain of inter-organizational systems and develop business systems quickly to fill the gap by providing value added services and information products in

a synergic manner. In this paper, these systems are broadly referred as e-Business (e-Biz) systems.

Evolving e-Business system development tools such as Microsoft's DNA, Sun's Enterprise Javabeans and Java Platform for the Enterprise, IBM's San Francisco, SAP's R/3, etc. assume that the changes that are being caused by the technology to business systems' goals and objectives, and nature and scope, are well understood, analyzed and documented ready for implementation by the developer; however it is not the case as the issues involved are complex and more importantly, dynamic in nature. There is a gap, which needs to be filled by an e-Biz system modeling methodology, which facilitates modeling the strategic alliances and also conversion to a development-oriented model.

2. KEY ISSUES IN E-BUSINESS SYSTEM MODELING

In the study conducted in the 1998 Bled Electronic Commerce Conference on 'Electronic Commerce in the Information Society', a group of 56 academic, business and government leaders from 19 countries on five continents identified organizational change and process improvement/modeling as the top two most important research issues in International Electronic Commerce out of the 174 issues that were raised (Vogel 98). Regarding organizational change, the comments of the group "were oriented around the changes in structure and process that accompany the introduction of the technology", whereas in the case of process improvement/modeling, issues raised included business process modeling, modeling changing value chains (e.g., virtual value chains), business process simulation techniques and new ways of combining parts of the value chain (e.g. through online auctions, etc.), etc.

During the 1960s and 1970s, development of computer-business systems was more programming-oriented. A single person or a small group of persons used to study, analyze, design and develop systems without much documentation. A clear disadvantage felt of this approach was that maintenance cost was exorbitantly high. Many variants of structured analysis and design methods were developed in 1970s and 1980s to help alleviate this problem. Most of the application 'silos' referred earlier are developed using this approach. These approaches tend to spend substantially more time in understanding and documenting the system requirements specifications compared to the earlier programming-oriented approach. This has substantially reduced the maintenance cost, and hence the overall system cost over the system's life. However, an implicit assumption in this approach is that the requirements are going to be stable over a reasonable amount of

time in order to make the initial investment made in requirement elicitation and specification is cost-effective.

E-biz systems, as explained in earlier sections, are dynamic in nature and are expected to respond very quickly to the changes in their user and technology environment. More importantly, user group of an e-Biz system is far more heterogeneous compared to the user groups in traditional systems. Customization of user interfaces and even database structures to suit the individual customers is a hallmark of the contemporary e-Biz systems such as On-line newspapers, Electronic clipping services, etc. Not only the user groups are heterogeneous, but their requirements are dynamic and evolving. In this environment, the structured analysis and design approaches have major disadvantage due to their implicit assumption.

Object-oriented (OO) approach to computer-based business systems development helps in providing continuum in the analysis, design and development process in terms of objects – their structure and behavior, thus facilitating to respond more quickly and effectively to the user requirements changes. However, there is no specific improvement provided in OO approach during the phase of user requirement elicitation and documentation in the e-Biz system modeling. Moreover, the basic premises of e-Biz systems is that they develop IT-driven strategic alliances with other business systems to exploit synergies in tapping the core competencies of competing and cooperating business systems to collapse the supply chains. These alliances are strategic in nature in supporting the core business of the e-Biz system under concern, whereas the operational model of the e-Biz system includes on the operational models of the partner systems also. In other words, while modeling the e-Biz system, it is essential to model the strategic requirements of the system in addition to the operational requirements.

3. E-BIZ SYSTEMS DEVELOPMENT

The system development tools over the last four decades are evolving more in the direction of providing ‘components’ with higher (larger) ‘business granularity’. Some of the developments in the last two years include e-business development environments such as Microsoft’s DNA, Sun’s Enterprise Javabeans and Java Platform for the Enterprise, IBM’s San Francisco, SAP’s R/3, etc. These development tools assume that the changes that are being caused by the technology to business systems’ goals and objectives, and nature and scope, are well understood, analyzed and documented ready for implementation by the developer; however it is not the case as the issues involved are complex and more importantly, dynamic in nature. The approach suggested in the earlier section to model the strategic alliances in an e-Biz system helps to meet this gap.

The component based development (CBD) defines a business system software at five levels of abstraction, i.e. granularity, viz. software language class (i.e. the actual code), distributed component (ex. business function such as validating credit card, etc.), business component (ex. Web-based Order manager, etc.), business component system (BCS) (ex. Web-based flower mart), and federation of business component systems (ex. Flower mart, FedEx, Visa, and HSBC). Though CBD envisages the five levels, it is not necessary that every business system needs all the levels. Major strengths of CBD approach are scalability, ability to build solutions to business systems in new domains efficiently, ability to adapt existing solutions to new problems efficiently and ability to integrate and evolve business system solution sets. As one of the major characteristics of e-Biz systems is to strike new strategic partnerships and evolve into business systems with new products and markets, CBD meets this requirement of integrating and evolving new business system solution sets quickly and efficiently. As CBD is scaleable, it can be applied to smaller as well as larger systems.

The essence of the emerging e-Business models is establishing strategic alliances, driven by information technology (IT), with other businesses to reduce the cost of production of the 'services and products, to increase the market share and revenues, and to improve customer services. Business systems differ in size (mom and pop operations to conglomerates), nature of business (low diversity - possibly single – product to multiple products), range of services offered, extent of external alliances, mode of internal organization, level of automation, etc. CBD approach helps to generate solutions quickly to this wide range of systems using the component libraries. In addition to component libraries, it is envisageable to develop BC libraries and BCS libraries as the e-Biz systems get more standardized. In other words, it is only the strategic alliances which will define the new business systems whereas individual business systems (or component systems) are defined by operational models supported by BC or BCS libraries. In such an environment, system development takes very short time so that the business systems can go on line very quickly to capture the market.

4. CONCEPTUAL MODELING OF E-BIZ SYSTEMS

The current e-Business system development environments are based on the functional requirements of the business system. These functional requirements are, in fact, an outcome of the strategic alliances and the e-Business model adopted by the business enterprise. As explained in the earlier sections, the strategic alliances may and in most cases will affect the corporate goals and objectives of the enterprise. Hence, it is imperative that we model the strategic dependencies and relationships of an enterprise

involved in e-Business systems based on the strategic alliances made in the supply chain and the e-Business model adopted.

There are several efforts in applying conceptual modeling techniques to understand and design business processes. These efforts have modeling formalizations using basic concepts such as entities, activities, assertions, and time. In order to capture the strategic objectives of e-Biz systems such as intentions, dependencies and relationships, a higher order modeling paradigm is required. Yu has proposed I* framework with a specialized ontology with additional concepts to more fully support the types of knowledge and reasoning involved business systems modeling. The framework has been described in terms of requirements engineering, business process reengineering and software process modeling [Yu 1993] [Yu 1994]. This framework argues that organizations consist of actors who perform tasks. Actors depend on one another to perform the tasks. We need to understand not only what and how tasks are performed but also why, the intentions and motivations, in order to model the strategic nature of business process

However, the I*framework emphasizes on the dependencies and tasks performed within a business enterprise whereas e-Biz systems are inter-organizational in nature. It is proposed to extend the framework to capture not only the individual actor goals, but also the organizational goals. In some cases, the collection of the goals of actors within a system may result the overall goals of the system, but not necessarily in all cases. So it is proposed that in addition to the actors of an e-Biz system, the other participating e-Biz systems also are identified as actors with dependencies either on the individual actors of the e-Biz system and/or on the e-Biz system as whole. It is also proposed to define new constructs to capture the collective goals of higher (than actors) order concepts such as the e-Biz system components, subsystems, etc. It is envisaged such an approach helps convert the conceptual model into an implementation-oriented model.

5. CASE STUDY

In this section, we will demonstrate the use of the conceptual modeling techniques to model the strategic alliances in an eBiz system, viz. on-line supermarket store. This case is a typical example for B2C eBiz environment. The aim of this on-line store is to bring a selection of food and groceries products to the shoppers through online to genuinely provide a one-stop shopping solution. This eBiz system taps the benefits of connecting the traditional value chain & supply chain models into a strategic alliance as discussed in the following paragraphs. Corporate level Actor Dependency model of this eBiz system is given in Fig 1.

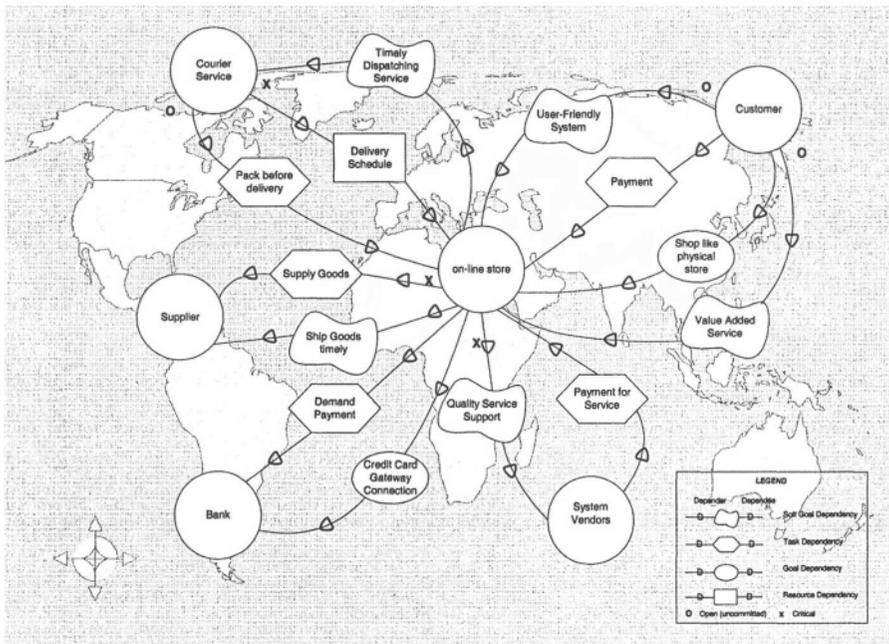


Fig 1: Corporate level Actor Dependency model

Strategic Alliances

Within the value chain and supply chain of the store, there exist opportunities for alliance. In fact, the development of strategic alliances is to support the store’s competitive strategies that would eventually add value in terms of efficient operations and improving customers’ services.

In the upstream activities of supply chain, the store relies on the flow of goods/materials from the suppliers. The online store purchases some groceries such as snack, milk, flour, drinks, toilet tissue, foods bags and etc. from major brands supplies. To avoid disruption of supplies, it has partnered with some local dealers to ensure the constant offering of snack, drinks, candies and etc. Such alliance contributes a lot of advantages to the store such as lower purchase costs, reduced inventory, and enhanced efficiency of logistics as well as increased sales and lower marketing costs. The store also made strategic investment by establishing its own brands selling groceries, toilet tissues, snack, daily consumable products and soft drinks. The benefit is direct sales by disintermediating the middlemen. Besides, the store could build up its own brand loyalty from the customers. On the part of distribution, although the store has established an in-house delivery team, they have outsourced some delivery activities to several transportation companies so as to ensure efficient, reliable and prompt delivery services.

We refer to these intermediaries as Courier Services. The store has also made strategic alliance with a bank to process its payment collection. Customers buying goods from the net may use Credit Card, EPS or Personal Check for payment. The bank handles all the payment collection, electronic payment transfer and Credit Card processing on behalf of the store for its consumers and suppliers, thus, eliminating its tasks in cash management. The store strategically teamed up with canned food manufacturers to demonstrate “Fresh Cooking Ideas” everyday on the net. The cooking ideas are provided free of charge to customers enhancing its value-added services for its shoppers. Based on the value chain description, the components of the eBiz system are described and modeled using the I*framework as following.

Procurement System: Under procurement system, Purchasing Department (PD) is the main actor to be involved. PD would like to have a user-friendly system, which can help to minimize workload and manual procedures, and it depends on the Information System Department (ISD) to furnish such a system based on PD requirements. In addition, it has to interact with Warehouse Department (WD) to exchange information on purchase order information and stocks received information. Suppliers receive payment after an order is shipped.

Payment System: Accounting Department (AD) will settle supplier invoices based on the stock received information provided by PD. In fact, PD obtains stock received information from the WD. ISD’s duties are to develop and maintain a user-friendly information system. In addition, AD critically depends on the accuracy and timeliness of the reports generated by the system for payment. On the other hand, suppliers would like to receive payment timely, which in fact depends on the efficiency and effectiveness of AD. If the system cannot provide timely and accurate payment information, the whole chain of actions will suffer.

Distribution System: In the distribution model, the main actors are Customer, Courier and Warehouse Department (WD). WD requires timely and accurate information from the information system for preparing delivery schedule. On the other hand, Courier requires delivery schedule to arrange trucks to dispatch the goods. In addition, Courier expects all goods are properly packed before loading to the trucks; however, there may be cases that WD does not have enough time to pack all the orders. In this case, Courier will assist WD to pack the goods. The information system plays an important role in this model. The whole value chain critically depends on ISD.

Mercantile System: Customer would like to compare what the virtual store offers with that available in the physical store; therefore, synchronization of the products/services and their prices is an important task when both physical and virtual stores exist. There may be situations that prices or offers cannot be synchronized due to some reasons; however, this

basic rule should not be violated too often. User-friendly operation interface is a key critical successful factor of e-storefront system. It allows novice customers to operate and feel at ease when they are purchasing online. While orders are received online from the web, it transfers the order information to Warehouse Department (WD) for dispatching. WD will then pick and pack the goods for dispatching. The dispatching service is in fact provided by Courier, which is omitted in this model for simplicity.

Revenue System: Customers can pay online via credit card or pay by cheques or cash on delivery. When customers paid the goods online via credit card, the system will interface to the card center to verify the validity of the card and to record the transaction. The bank will then pay to the store after receiving the supporting document (electronically) from the store. The turnaround time should be short to maintain a healthy cash flow. Customers demand user-friendly interface, online refund and payment history records.

eCRM System: Buying online is mainly a personal task. Vendors would not be able to provide direct services to customers who are shopping around. eBiz systems incorporate the concept of eCRM into their web-based functions, i.e. serving the customer electronically. For example, feedback or suggestion loops built into the eStore help to identify customers' preferences and suggestions. In addition, customization can be done by profile administration. Most of the successful eStores, like Amazon.com, require user registration in order to provide personalized services, to identify their needs and to perform Online Analytical Processing (OLAP) to understand and manipulate customers' buying habits / behaviors. In building an eCRM system, industrial practices, customers group preferences, marketing trends and innovative idea are all of great importance.

6. CONCLUSIONS

Strategic alliances are very important in the realm of eBiz systems. Systems development methodologies should incorporate concepts and techniques to conceptualize and model these strategic alliances while developing eBiz systems. This paper illustrates a case of virtual supermarket store and its strategic alliances modeled using the I*framework.

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