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New Information and Communication Technologies' Application Process and Pattern of Commerce

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Abstract. With EDI, Internet, e-commerce and other key technologies, the application process can be divided into three stages: data processing stage represented by EDI, rapid popularization stage brought by Internet and diversified stage with e-commerce. The commercial activities in China has widely used information to strengthen competition to a certain degree. Enterprises of different industries, types and scale vary greatly in application of ICTs. From the perspective of application method, the current situation of application of ICTs by commercial enterprises in China is characterized by high network application and popularization rate, emerging of e-commerce enterprises and wide application of information system software. The e-commerce development in China obviously centralizes in Beijing-Tianjin-Hebei Region, Jiangsu-Zhejiang-Shanghai Region and Pearl River Delta as well as Shandong Peninsula and Cheng-Yu area to a certain degree.

Introduction

Technical progress brings profound changes of social method. With the rapid development and popularization of new information and communication technologies (ICTs), the operating environment of business changes greatly. Especially, the information consumers can obtain increases dramatically and the demand becoming more diversified and personalized, thus intensifying competition and updating [1]. In the age, which is of increasingly dramatic competition, rapidly changing and more and more unpredictable, "having a better understanding of customers than competitors and changing such understanding into action more rapidly" has become the key to enterprise development [2]. Under the environment of rapid progress and wide application of ICTs, commercial enterprise must make good use of ICTs in order to survive and develop. The application of information in commercial activities is of obvious stages and such application is gradually diversified.

ICTs application process of Commerce

The application of ICTs in commercial activities is a process begins with zero, from large enterprises spreading to middle and small ones, from single development to diversified and continuous updating. With EDI, Internet, e-commerce and other key technologies, the application process can be divided into three stages: data processing stage represented by EDI, rapid popularization stage brought by Internet development and diversified development stage with e-commerce as the core.

Data processing stage represented by EDI

The communication technology develops earlier than computer technology and the computer in early stages can only be of numerical processing and used in military calculation, scientific calculation, engineering calculation and other field. Therefore, the application of computer still has not yet been in business field when the telephone and telex is widely used.

In 1950-60s, the data processing technology represented by file management technology and database technology emerges, which is a leap in the computer application technology. The breakthrough of data processing technology leads to the emerging of small commercial computer and the combination of computer and communication technology preliminary enters into various social fields. In the commercial field, the computer technology is tried to be used to solve the information processing problems in business management, involving the data processing at the aspects of enterprise finance, sales, purchasing, so as to improve working efficiency. The ICTs in this stage is collectively called as "electronic data processing system" (EDPs), which is mainly of standalone operation method.

The development of computer communication network promotes the rapid development of electronic data interchange system (EDIs). America first proposed and implemented EDI in 1960, established a research institute in 1968 in order to research and improve the electronic data interchange method between enterprises, set up the first EDI standard in 1975 and published 5 national EDI Standards in 1983, which increased to 245 standards by 1995. Then Britain, German, Netherlands, Italy and some other countries have successively issued their own EDI Standard and the big enterprise in such countries began to use EDI in commercial activities. China prepared its own EDI development plan in early 1990.

Working principle of EDI: in sending terminal, documents prepared by manual or tables transmitted by other business application are accepted by EDI, then mapped into flat files readable by EDI and converted into EDI standard data format, and finally sent out. In receiving terminal, the standard data is received by EDI and re-converted into flat files, then mapped into document and other tables readable to other business applications. By interchanging standard information between computers, the output of one application can be the input of the other application, thus eliminating the delay and error of paper transaction, reducing manpower, material resource and management expense, increasing the information accessibility and beneficial to more effective auditing.

In this stage, due to the expensive expense of using public information network and massive integration with each trade partner if one enterprise wants to engage in commercial activities with EDI, a lot of capital should be input from network design, installation to management design and hardware, software and personnel problems, therefore, the commercial activities with EDI can only be limited to big companies or their inside.

In addition to EDI, the application model of ICTs in this stage in commercial activities also includes computer inventory tracking, bar code, ERC (electronic cash register), OPS (business automation information management technology and equipment), wireless scanning gun and other data processing application.

Wal-Mart is the first retailer that widely uses ICTs. In this aspect, Wal-Mart has made active investments: it is the first to use computer inventory tracking (1969), bar code (1980), EDI (1985), wireless scanning gun (1988) etc. These investments significantly reduce the costs of Wal-Mart and improve its capital productivity and labor productivity.

Rapid popularization stage brought by Internet development

The network technology application has been widely used in various information systems since 1960s. However, due to the technical limitations of traditional network, there are still some problems in the network interconnection and resource sharing. The Internet emerging in 1990s breaks this kind of situation, making ICTs enter network processing era. The ICTs application of network processing ear is mainly characterized by network interconnection, high sharing of resources, change of space-time concepts and "disappearance" of physical distance. At the same time, the expense of using ICTs decreases continuously, thus the medium and small-sized enterprises are affordable and willing to pay the technology which can save costs and bring benefits. Then EDI and other data processing technologies are gradually used to transform the enterprise process and improve the management efficiency.

Meanwhile, the progress of ICTs makes computers improve from traditional data processing to knowledge processing and intelligent processing. Some large enterprises extend the application of

ICTs into enterprise management, in which the most representative applications include enterprise resource planning system (ERP) and customer relation management etc., thus improving the resource management efficiency and improving the business process.

The rapid popularization of Internet also makes enterprises realize the real-time contact with customers and downstream enterprises and timely and effective acquisition of information. The ICTs is used in many aspects of supply chain management, in which the more representative applications include build to order (BTO) and supply chain management (SCM), thus greatly reducing the transaction cost of enterprises.

Taking Wal-Mart as an example, Wal-Mart uses Internet and SCM system to connect over 6000 suppliers, over 50 distribution centers and its own information system, thus realizing rapid-response supply chain management. It takes two days for the distribution center from receiving orders of stores to purchasing from manufacturers and receiving orders by stores; the supplier can be access to Wal-Mart's distribution system and data center through the system, directly get the dynamics of commodity circulation that it supplied and Wal-Mart's inventory allocation status from POS, and conduct sales prediction, production arrangement, goods supply and delivery based on this, thus bringing great benefits for both suppliers and sellers. Wal-Mart realizes global centralizes purchasing through the system, thus greatly reducing the purchasing cost.

The popularization and application of ICTs in business greatly improve the operation efficiency of enterprises and make the contact between upstream and downstream enterprises smoother, thus bringing great impacts on the operation management and transaction activities of enterprises and completing the "electronization" of enterprises. The Internet makes the spatial scope of enterprise contact not limited to small areas, but expand to wider areas and more easily go global. Partial enterprises begin to construct enterprise website to conduct network propaganda and marketing tentatively, so as to lay a foundation for future development of e-commerce.

Diversified development stage with e-commerce

With the development of WWW, hypertext and multimedia technology based on Internet, people can not communicate text information, but interchange voice, images and other hypermedia. Meanwhile, the cost of using ICTs decreases and the computer and network are further popularized, thus making commercial based on network have a qualitative leap --e-commerce. Before e-commerce, the ICTs application is devoted to improving the operation efficiency of business, which is a kind of "qualitative" accumulation; however, e-commerce changes the operation models of commercial activities essentially, makes its core activities, transaction method, change essentially and makes "non-face-to-face commodity delivery" possible, which is a kind of "quantitative" leap.

The merchants constitute resource management layer ,application service, web layer and human-computer interaction layer. The data warehouse is showed to customers on human-computer interaction layer finally by collection in application service layer and conversion in web layer. Customers select their necessary commodities by visiting the website via browser and then fill in the order. The merchants confirm the customers via orders and inform them about the charging method and also inform its application system to organize commodity supply programs. Then customers connect to Internet and conduct capital transfer by electronic settlement and bank. The bank informs the buyer and seller about the capital transfer results by e-mail (or other methods). The manufacturer organizes goods and delivers them to customers. Besides, the dealer, tax and certification authorities can also connect to Internet to interact with merchants. E-commerce integrates information flow, product flow, capital flow and logistics and is the transaction process of the whole trade.

The development of e-commerce based on Internet does not only expand the business of big enterprises all over the world, but also make e-commerce not the patent of big enterprises and small enterprises are able to engage in e-commerce activities, thus greatly expanding the application scope of e-commerce and bringing new vigor in the development and wide application of e-commerce. More and more enterprises select e-commerce for trading and network marketing and network advertising also become one of the marketing channels of enterprises. After network advertising

experiences expensive enterprise brand advertising in business portal age, there is more and more medium and small-sized enterprise advertising represented by search engine [3].

With the popularization of ICTs and decrease of expense, the diversified application of ICTs by enterprises is more practical and feasible. The information system software of any kind is not the patent of big enterprises, many medium and small-sized enterprises gradually use SCM, CRM, supplier relation management (SRM), e-logistics, system integration, data warehouse, collaborative commerce and data integration to further improve the enterprise management efficiency, coordinate supply chain and improve the relation between upstream and downstream enterprises. Using ICTs to conduct network contact and acquire real-time information has become the basic application method of enterprises.

From the above, the ICTs application in business shows a diversified development trend with e-commerce as the core. With ERP, SCM and CRM as information framework, the business information system supports purchasing, contract management, warehousing, order management, marketing, sales, support services and other commercial activities and connects suppliers, dealers, retailers, distributer, after-sale service and other activity subjects by e-commerce. The specific ICTs application also includes EDIs, network marketing, network advertising, e-logistics, system integration, data warehouse, collaborative commerce and data integration. These application methods can be divided into 3 categories: network application, e-commerce and information system software .

ICTs application method of Commerce

From early electronic data processing to rapid popularization brought by Internet as well as modern diversified development with e-commerce, ICTs application in commercial activities has experienced over 60-years update. The mature ICTs application methods in business include network application, e-commerce and information system software, in which each has many specific models.

There is no obvious boundary between various application methods. In specific commercial activities, each application method is not substantive, but associated with and depends on each other.

Network application method

Network application method means commercial activities adopt information network with Internet as the core to conduct internal and external contact and information acquisition. The main models include EDI, E-mail, internet, intranet, instantaneous communication software, mobile network etc. their purpose is to improve the efficiency of internal and external contact, information acquisition and information release and expand its scope of influence.

E-commerce method

E-commerce method means commercial activities using network trading platform, network marketing and advertising for commodity transaction and marketing. The trading platform mainly includes B2B, B2C, C2C, while marketing model includes network marketing and advertising.

Commodity transaction. It mainly includes B2B (business to business) and B2C (business to customer). The B2B model is mainly the retailer-oriented distribution of dealers and customer-oriented sales of retailers. Comparatively, B2C model needs stronger background information system support and pointed response system. B2B and B2C e-commerce websites differ greatly in industrial distribution. According to the data of 2011 industrial e-commerce website investigation report in China[4] (see Fig 1 for details), among B2B websites, the integrated industry website ranked first in various industrial e-commerce websites, accounting for 25.42% and the mechanical, building material and agriculture industry ranked top 3, accounting for 12.43%, 10.82% and 7.52% respectively. However, according to 2011 CINIC investigation report, for Chinese B2C network shopping users, the online shipping commodities in 2010 were mainly clothing, books, digital products, virtual cards and cosmetics, which differed greatly from B2B website.

Marketing. It includes network marketing and advertising etc.. Network marketing mainly includes propaganda activity and market research of enterprises with network; and network advertising means commodity exhibition and guide media by suing network and other new media.

Information system software method

Information system software method means the various IT software for enterprises to acquire, collect and manage the various internal resources and data, such as basic financial management software, personnel management software and office automation, which are widely used in medium and small-sized enterprises in China; and systematic and complicated ERP and SCM, which have been gradually used in medium enterprises in China. Especially, with the further decrease of costs by using ICTs and continuous popularization of ICTs, the medium and small-sized enterprises in China can basically afford to use enterprise management software system to conduct internal management and process optimization.

The use of IT software by enterprises for resource management and supply chain management of internal system can realize the real-time monitoring of raw materials, production process, inventory, sales and other links, so as to help enterprises realize flexible production method and save time and costs. In the supply chain management, some enterprises bring the upstream suppliers into the enterprise information system to be convenient for its timely purchasing and to transfer the inventory to suppliers to a greatest extent, such as Wal-Mart. Some enterprises bring upstream distributor and franchisees into the enterprise information system to be convenient for the ordering of upstream manufacturers and to make them timely get the product sales status, and also into ordering and production plan, such as Su-Ning.

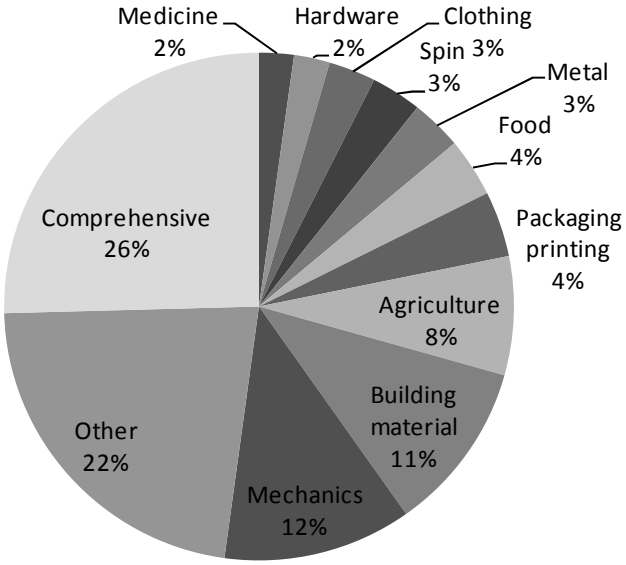

Fig. 1 The distribution of China's 2010 industry e-commerce website

ICTs application pattern of Commerce in China

Spatial agglomeration of e-commerce development in China

The development of ICTs is the microscopic background of ICTs application in commercial in China also brings definite vigor in commercial development. In mid-1980, POS, bar code and other technologies were sued, thus opening the trial application of information in commercial in China. In 1982, “China EDI Development Strategy and Standardization” Forum drafted “Opinions on Overall Planning of China EDI Development Strategy” and the business in China entered data processing application stage. In late 1990s, the digital management system integration combining modern communication, network, data management technology and logistics management. ICTs with fiber-optic communication, LAN, WAN and Internet as the carriers was gradually used in commercial and information system software application with allocation, purchasing, warehousing and sales of commodities also gradually became key strategy and core competition in most enterprises. In early 21st century, ERP, SCM and CRM were continuously used in commercial enterprises and

e-commerce started. Now, the ICTs application in business in China has entered diversified development stage with e-commerce.

Regional difference of e-commerce development in China

The difference of informatization level also affects the regional difference of e-commerce development in China. According to the division data of administrative regions in China, 354 prefecture-level cities in mainland China are selected as analysis objects, excluding Taiwan, Hong Kong and Macao. The commodity quantity on Taobao (http://www.taobao.com) in various municipal administrative regions were counted by the author on August 20, 2013 14:00-16:00.

Fig 2 shows the city with the largest commodity quantity on Taobao was Beijing, which was 208,287,200. Top 10 cities included Shanghai, Beijing, Tianjin (municipalities cities), Guangzhou, Hangzhou, Wuhan, Nanjing, Chengdu, Fuzhou (provincial cities), Shenzhen.

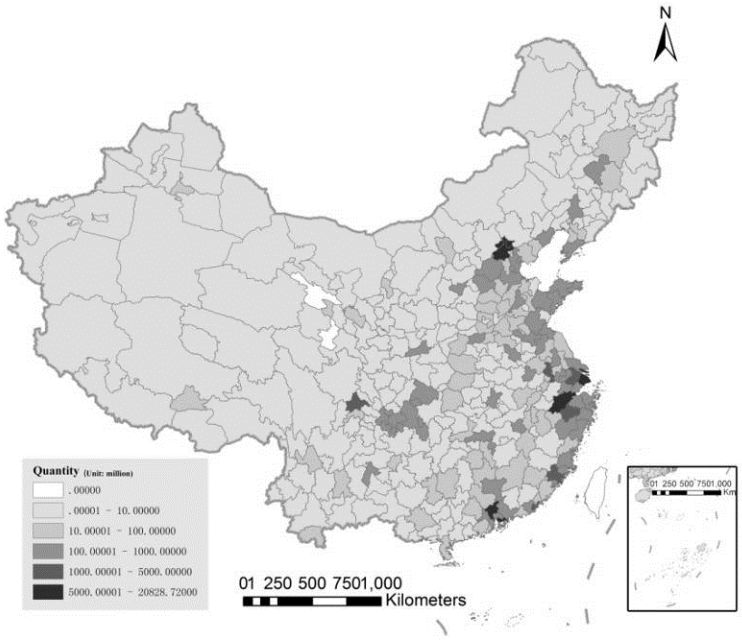

Fig. 2. Commodity quantity on Taobao of prefecture-level cities in mainland China

From the correlation analysis of commodity quantity on Taobao in 354 cities and permanent resident population in city, registered population in city and registered population in municipal district, GDP in city and GDP in municipal district, the correlation coefficient of city commodity quantity on Taobao with permanent resident population was 0.52, that with registered population in municipal district was 0.56 and that with registered population in city was 0.37. The correlation coefficient of city commodity quantity on Taobao with local GDP was high, especially with GDP in municipal district, which was up to 0.94, indicating that the development of regional C2C e-commerce was of significantly positive correlation to the economic development level.

Analysis on spatial cluster of e-commerce development in China

The e-commerce development in China obviously centralizes in Beijing-Tianjin-Hebei, Pearl River Delta as well as Shandong Peninsula and Cheng-Yu area. Moran's I index, which is the global index measuring the spatial autocorrelation, reflects similarity level of the attribute values of spatially adjacent region units. By calculating Moran's I index, the geographical distribution status of certain index can be measured and the spatial cluster of e-commerce development in China can be analyzed.

If X_i is the observed value of location (region) i, Moran's I index of the variable can be calculated by the following formula [5,6]:

$$I_i = \frac{(x_i - \bar{x})}{S^2} \sum_j w_{ij}(x_j - \bar{x}) \tag{1}$$

In Eq. 1, $S^2 = \frac{1}{n}\sum_i (x_j - \bar{x})^2$, $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$

Where, Xi is the observed value of region i, Xj is the observed value of region j; is the mean observed value of all regions; Wij is the spatial weights matrix. The spatial adjacent value is 1, the non-adjacent value is 0.

Moran scatter diagram is a 2D graphic visualizing the linear link between variable x and its mean spatial weights Wx with (x, Wx) as the coordinates. The 4 quadrants of Moran scatter diagram correspond to the 4 local spatial link forms between region units and its adjacent units: in which the first quadrant (High-High) means the high-level area is surrounded by other high-level areas; the second quadrant (Low-High) means the low-level area is surrounded by other high-level areas; the third quadrant (Low-Low) means the low-level area is surrounded by other low-level areas; and the fourth quadrant (High-Low) means the high-level area is surrounded by other low-level areas. Compared with Moran's I index, the advantage is that it can further specifically distinguish the spatial link form, High-High, Low-Low, High-Low or Low-High, of region unit and its adjacent unit.

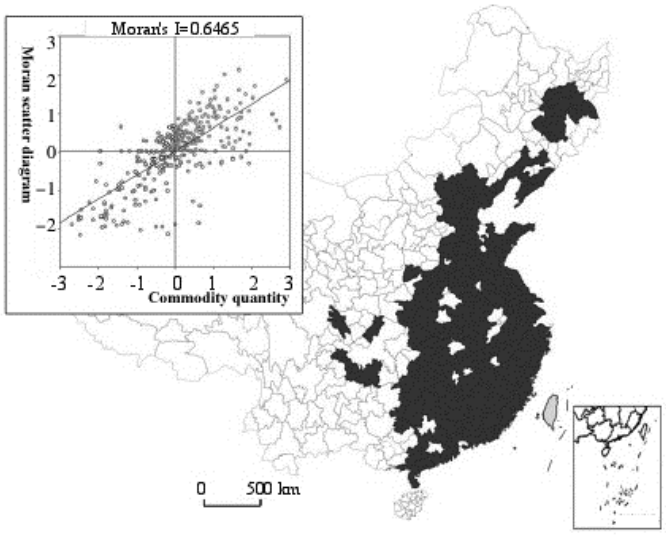

Fig. 3 Moran scatter diagram of Taobao distribution & Brushing map of the first quadrant

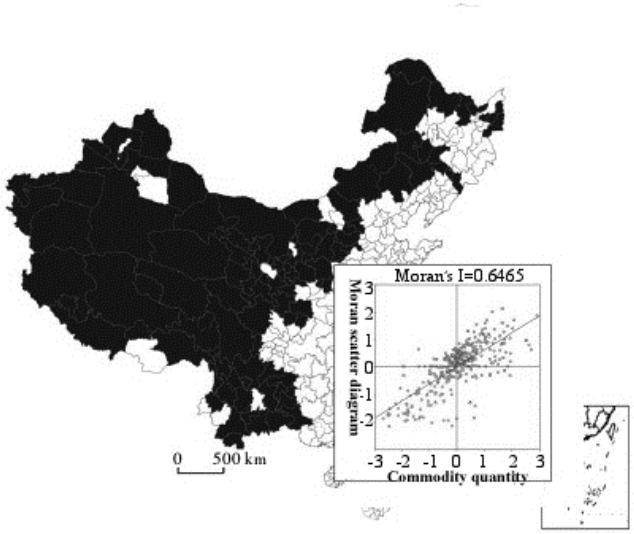

Fig. 4 Moran scatter diagram of Taobao distribution & Brushing map of the third quadrant (Gross distribution)

To eliminate the heteroscedasticity of data, the data is of logarithm transformation. The Moran's I index of Taobao store quantity in 354 cities is 0.6465, indicating that the C2C e-commerce development of various regions in China is of significant and positive spatial autocorrelation and each

region is of high spatial cluster of similar value, that is, high-level areas are inclined to be adjacent to high-level areas and low-level areas are inclined to be adjacent to low-level areas.
In Fig. 3 and Fig. 4: The left corner is Moran scatter diagram, in which the slope of black oblique lines means the size of Moran's I index. When the points in the first quadrant are brushed, areas that they represent will highlight. It can be seen from the diagram that these areas centralize in East China, partial Middle China, Beijing-Tianjin, Bohai Rim and Changchun-Harbin Region. If the points in the third quadrant are brushed, the low-low centralizes areas correspondingly highlighted on map centralizes in northwest, southwest, northeast border.

Similarly, if the points in the fourth quadrant are brushed, the areas highlighted on map are Chengdu, Yibin, Mianyang, Leshan, Nanchong, Chongqing, Xi'an, Xianyang, Baoji, Lanzhou, Taiyuan, Urumqi, Hohhot, Baotou, Kunming, Guiyang, Nanning, Liuzhou, Yinchuan, Haikou, Sanya, Qiqihar, Daqing and Wuhu, which are outstanding cities. However, due to the low development level of its surrounding areas, these areas are distributed in high-low quadrant.

Furthermore, in Moran scatter diagram, the points under the oblique line, which are farthest from the vertical distance of oblique line are selected because the influence of points, which are farther from the vertical distance of oblique line, on slope of fitting straight line is bigger. These points are Beijing, Xi'an, Chongqing, Chengdu, Lanzhou, Nanning, Urumqi, Wuhan, Kunming, Haikou respectively. The Moran's I index is 0.7046, which increases significantly compared with the previous 0.6465. The significant improvement of Moran's I indicates that these areas impose great impacts on the global results and the e-commerce level in many other regions of West China is low.

Conclusion

The application of ICTs in commercial is a processfrom large enterprises spreading to middle and small-sized ones, from single development to diversified and continuous updating. With EDI, Internet, e-commerce and other technologies, the application progress contains three stages: data processing stage represented by EDI, rapid popularization stage brought by Internet and diversified development stage with e-commerce. The mature ICTs application methods include network application, e-commerce and information system software.

The commercial in China has widely used information. Enterprises of different industries, types and scale vary greatly in application of ICTs. From the perspective of application method, the current situation of application of ICTs by commercial enterprises in China is characterized by high network application and popularization rate, emerging of e-commerce enterprises and wide application of information system software. The e-commerce development in China obviously centralizes in Beijing-Tianjin-Hebei Region, Jiangsu-Zhejiang-Shanghai Region and Pearl River Delta as well as Shandong Peninsula and Cheng-Yu area to a certain degree.

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