E-commerce evolution based on the perspective of network effects: A multi-case study in China

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Abstract—This paper, which is based on network effect theory, focused on the key factors of two-sided network construction and e-commerce ecosystem formation in a big data environment. It takes six e-commerce companies as a research case and suggests how to improve the timing and spacing of service precision and business credit, reduce the experience gap between online and offline commerce, increase the members in e-commerce networks, and ameliorate the form of e-commerce ecosystems. Based on the several propositions, we discuss e-commerce evolution in four stages and propose new perspectives on two-sided network effect improvement in the big data era.

Keywords: big data; e-commerce; two-sided networks; network effects

1 Introductions

With the wide application of a new generation of information technology, such as social networking, cloud computing, and mobile commerce, global data is growing at an unprecedented speed [1]. Nature published a special "Big Data" issue in September 2008, and Science launched its own special issue in February 2011 to explain the importance of big data in scientific research. Meanwhile, the academics of China have also become interested in big data related areas, such as business management, technological innovation, and interdisciplinary research. There are large amounts of data in e-commerce that can be used to segment the market and meet customer needs with customized products and services. In a network situation, customer behavioral data in all channels and all stages of growth can be recorded or collected by enterprises, and accurate and quantifiable marketing strategies can be designed [2].

E-commerce is a two-sided market; the research on two-sided markets usually takes pricing strategy as a starting point; it analyzes the impact of supply and demand characteristics on the profits of platforms, for which an optimal pricing strategy is developed. E-commerce platforms have a two-sided market effect and the interdependence of the two sides play a driving role in development of platforms. Unstructured data, such as relational, location, video data, and images, emerge in large numbers in the big data era and function as the driving resource in the e-commerce model transformation. The existence of a two-sided network effect is based on the demand to resolve big data, and new information technology can facilitate the matching of supply and demand in platforms. Based on the two-sided network theory, research propositions are made in this paper through a case study of six e-commerce businesses; further, the evolution of an e-commerce model is discussed in the four stages of the big data era, and a new perspective on the improvement of the two-sided network effect is developed.

2 Theoretical Review

Network effects are largely influenced by the number of users. Katz and Shapiro (1985) [3] point out that there are direct and indirect network effects. The term direct network effect refers to increases in product value with increases in the number of users, including new users; this increase is known as a demand-side network effect. Indirect network effect refers to the product value derived from the number of complementary products. Indirect network effects will be strong when there are various kinds of complementary products, and the consumption of
core products and the value of other products will increase. In addition, network effect can be divided into local network effects and global network effects. Local network effects are caused by family and friends and global network effects by the installed base. As a consumer’s utility depends on the number of interactions with his or her friends, rather than the size of the overall network [4], in markets with network effects, companies seek to remove features of its original products and sell degraded versions of them at low prices or for free [5].

There are two kinds of users in a two-sided market, and value is created by the interaction between consumers and businesses on the platform [6]. The revenue of participants on the platform depends on the number of participants. Cross-platform network effects should be considered when business strategies are formulated so that these can be rational. Generally, network product markets have the following characteristics in two-sided network effects [7-9]: First, user groups are often very concerned about the scale of the other side of the platform because their needs are interdependent. Second, each member of a group on one side is willing to join the network only when the group members of the other side are expected to join it. Third, the platform sponsor is often quite inclined to a price structure that matches the needs of the two-sides, since the demands of the users on both sides have an asymmetrical interdependence.

Proposition 1: In a two-sided market, the utility of players on one side is dependent on the number of players on the other side.

Proposition 1a: In a two-sided market, the utility of business is dependent on the number of consumers.

Proposition 1b: In a two-sided market, the utility of consumers is dependent on the number of businesses.

3 Study Design

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<th>Table 1 Sample Description</th>
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Based on the network theory, research propositions are made in this paper through the case study of six e-commerce businesses, and a new perspective on the improvement of the two-sided network effect is developed. The case study is the elementary method in management research [10], and it is suitable for observation and research on the series changes of businesses [11]; it coincides with the study of the evolution of e-business models in this paper. The criterion of sample selection in the case study is particularity rather than the generality; four to eight is the appropriate number of cases in a multi-case study [12]. Semi-structured interviews are proposed, based on theory and literature review after the cases are selected. There are four interviewers for each interview, one of whom is the local contact person; one is responsible for questioning and clarification, and the remaining two are responsible for photographing and recording. After the interview, cases were saved in Word format, based on written notes and audio recordings. The findings of interview recording are combined with those of published studies, such as internal reports, journal articles, and speeches in order to ensure the reliability and validity of the collected data.
4 Analysis on the e-commerce revolution

4.1. Services accuracy improved by data mining

With the emergence of new technology, such as blogs, social networks, location based services, and the rise of cloud computing, networking, and other technologies, data is growing and accumulating at an unprecedented rate. There are many kinds of data; the most common are unstructured data for fairly long periods, such as relational data, location data, images, and videos.

The founder of komovie.cn: We know the positions, phone models, general consumption periods, and the consumption capacities of consumers. And we also know the time they enter and come out cinemas, and what kinds of movie they like. All this data can be used to provide precise marketing services.

The Marketing Director of Meituan.com: The two-sided market will appear gradually. On the consumer side, Meituan.com want users to be able to enjoy good services at anytime. On the business side, Meituan.com is establishing a long-term relationship between businesses and consumers.

A large amount of data is generated every day by e-commerce, not only those that serve as records of objective phenomena or numerous unordered values, but also data with special meaning and value. Marketing management combines art and science; the scientific part depends on various data collection methods and marketing databases. Depending on the characteristics of consumption and behavior, modern technologies, methods, and strategies are adopted by enterprises in order to achieve the goal of marketing communication among consumer groups. The two-sides of an e-commerce platform involve consumers and businesses; further, an important issue concerns the precise matching of supply and demand. Information mining by mass businesses to meet consumer needs requires not only various types of data analysis, but convenient channels for information transfer between consumers and businesses.

Proposition 2: The impact of consumer numbers on business utility can be enhanced by improvement of service accuracy in the two dimensions of time and space.

4.2. Transaction risk reduced by business credit rating

Big data means high value, which may result from the mass convergence of data with minimum value and the useful data needed for management decision-making. E-commerce transactions are conducted between suppliers and consumers who do not know each other; information asymmetry is an important factor that affects the development of e-commerce. Credibility identification is particularly vital in foreign trade e-commerce because of asymmetric information.

The Vice president of dhgate.com: Sellers on the management department will review business licenses, registered capital, products, and other information to build up credibility files. Various phenomena of false credit are listed in the “unshine” project, which was set up in 2012; the project asks businesses to conduct self-examinations. If the same complaint is received again, a more severe punishment is applied to the businesses.

The CEO of globalmarket.com: It is hard to distinguish sellers with credit; the credit system (GMC) was launched to solve this problem. A survey is conducted and the result shows that there are 100,000 Chinese enterprises with GMC standards, accounting to 90% of exports in China. Globalmarket.com uses their energy to service valuable customers, including Dell, IKEA, and so on.

Online service providers create better services by the online information that they provide, but they can also use the information to despoil users; thus, the key issue is to establish ethics on the Internet and to ensure that these ethics do not inhibit innovation [13]. Buyers are not only concerned about the number of sellers but also by comments on goods. The more positive comments, the better the products and services provided by sellers; in this way, direct network effects become greater. An online reputation is an important factor that affects e-commerce development; credit conditions should be enhanced in e-commerce transactions between buyers and sellers in order to increase the rate of online trading. More traders will join a platform through active participation when fair credit environments exist on them.

Proposition 3: The impact of business numbers on consumer utility can be enhanced by the improvement of business credit.

4.3. The experience gap minimized by the integration of online and offline commerce

The relationship between online commerce and traditional commerce is the hot issue in e-commerce research [14]. The level of e-commerce development varies by area, as does the e-commerce model and the perspective on the relationship between online and
traditional commerce. Overall, existing research findings can be divided into four perspectives: alternative, promotional, complementary, and independent [15]. With the rapid development of e-commerce, customer migration from stores is unprecedented; the consumer transformation has become a reality. Small bits of data are merged into big data. E-commerce can more easily accumulate and mine data than offline channels and should provide services based on this data processing.

The founder of 500ccc.com: There is a big difference between online and offline in appliance selling. 1:10 is the difference between online and offline in the selling of clothes and 1:100 is the maximum in appliances. Order online and service offline, the one city-one network model can solve the last mile problem of large appliances.

In the e-commerce era, the dual-channel strategy will be the best choice for manufacturers to improve the market competitiveness of enterprises and increase customer demand. The integration of online and offline commerce enhances the ability to penetrate markets and creates a new value transfer mode [16]. The integration of online and offline commerce depends on shortening the experience gap shorten these two sectors. The experience gap will shorten by the improvement of customer experiences and service levels, such as through online bookings, online payments, online counseling, online customization, online complaints, and other service experiences. By shortening the gap between experiences, more consumers will purchase offline products or service online, thus increasing the network effect of the impact of the number of businesses on consumer utility.

Proposition 4: The impact of business numbers on consumer utility can be enhanced by minimizing the experience gap between online and offline commerce.

4.4 Mutualism promoted by the ecosystem of e-commerce

The characteristics and attributes of biological ecosystems are helpful to understand business ecosystems [17]. Every player has its own task in an e-commerce ecosystem, which are intertwined to form a complete network. After several decades of development, the Alibaba Group divided the e-commerce business into three categories and 25 business units; the first is vertical businesses BU, including Taobao, Tmall, and Juhuaasuan; the second is the infrastructure platform, including cloud computing, payments, logistics, and so on; the third category is the sharing platform, which is responsible for information sharing between vertical businesses and the platform. The coordination between vertical business and the platform is achieved through internal open source implementation; the individual needs of vertical businesses and the common needs of the foundation platform can be fully met.

![Alibaba’s ecosystem](image)

Alibaba and third-party service providers settled in the platform carry out their duties for e-commerce services, and a complete ecosystem is created. (1) The social ecosystem: Alibaba acquired the preferred shares of Sina Weibo in 2013; this deal, which marks a milestone in the history of e-commerce, extends to online social networks. Sina Weibo has hundreds of millions of users; information can be quickly spread on the Weibo platform, which is a weak-tie social network; a strong-tie social network, named Laiwang, was also launched by Alibaba. (2) The financial ecosystem: Alibaba uses the credit and behavioral data accumulated by B2B, Taobao, Alipay, and other e-commerce platforms, network models, and videos; a credit investigation mode was introduced to confirm the authenticity of customer information. Customer behavior data is transformed into personal credit evaluation, and then those who are usually unable to obtain loans in the traditional banking channels can achieve small loans.
online. (3) The logistics ecosystem: Cainiao was jointly established by Alibaba and other logistics companies in 2013; an open social storage facilities network was formed all over China through self-build cooperation reconstruction. In addition, Alibaba became a shareholder of amap.com; it opened up location information and user data in order to promote the development of the O2O business. (4) Information services: Alisoft provides personalized software services for SMEs, based on the SaaS model. Alimama built a platform for small websites and e-commerce for advertising cooperation. Aliyun and Yahoo facilitate the obtaining of information for users; thus, consumers are able to search for thousands of products, and search cost is reduced.

![Diagram of the two-sided network effect model of e-commerce](image)

Figure 2. The two-sided network effect model of e-commerce

Proposition 5: The two-sided network effect can be enhanced by the formation of an e-commerce ecosystem.

Proposition 5a: The impact of business numbers on consumer utility can be enhanced by the formation of an e-commerce ecosystem.

Proposition 5b: The impact of business numbers on consumer utility can be enhanced by the formation of an e-commerce ecosystem.

5 Discussion and Prospect

The formation of an e-commerce ecosystem has impacts on business; enterprises specialize in different areas to offer products that reflect their capabilities. Enterprises need communication and collaboration with other enterprise in the system to improve its value. The propositions developed in the case study emphasize the different stages of e-commerce. The discussion conducted on e-commerce evolution is based on four stages.

1) Introduction stage: New technology, such as mobile commerce and location based services, record consumer behavior in the dimensions of time and space. Marketing accuracy can be improved by data mining during this stage in order to attract businesses and consumers and boost sales. Big data is able to provide sufficient space for personalized business applications, based on individual consumer behavior and preferences data, the future enterprise may provide personalized products and services according to different interests and preferences for each consumer.

2) Growing stage: Unexpected advantage is achieved by technology, but only the most fit survive. It is hard to avoid the growing stage as mixed participants join the platform. This is also the transition phase of platform, when it moves from barbaric growth to brand reputation building. Negetive comments are easier to spread than positive ones. Rigorous review mechanisms are sent to the market to avoid adverse selection problems in the market for lemons.

3) Adjustment stage: With the development of e-commerce, online purchases are achieved by PC and mobile commerce. Offline purchases become bottlenecks in the development of e-commerce. The traditional market faces changes in the interaction of online and offline commerce. In this situation, business systems open up. Online and offline system integration become an important issue in order to solve O2O problems.

4) Mature stage: There are contestable assumptions in market theory: freedom in entering, no technogical inferiority of later entrants, and no sunk costs for those who leave. As the barriers to entry in the e-commerce ecosystem are almost zero, many business are involved in the e-commerce ecosystem. The existence of the scope economic effect promotes the opening up of the platform, as, for example, in the open API interface; this encourages third-party developers to create applications and to provide privacy processed data to research institutions and corporations.
### 6 Conclusion

E-commerce is a business model with network effects; thus, how to utilize network effects is the important issue in e-commerce development. Based on network effect theory, a case study was conducted on six e-commerce corporations and two-sided network effects in e-commerce were explored. The proposed propositions included the following: the impact of consumer numbers on business utility can be enhanced by improvement of service accuracy in the two dimensions of time and space. The impact of business numbers on consumer utility can be enhanced by the improvement of business credit and by the minimization of the experience gap between online and offline commerce. The two-sided network effect can be enhanced by the formation of an e-commerce ecosystem. The research model was based on the above propositions, and e-commerce model evolution was discussed during the four stages of big data era.

With the applications of web2.0 and the emergence of big data, there are many areas still worth exploring and improving in research and practice: redundancy in personalized recommendations and visualization in retrieval; fake credit and credit evaluation mechanisms based on network relationships; the emergence of network behaviors and supply chain coordination between online and offline; herd behavior in networks and coordination of the e-commerce ecosystem.

**ACKNOWLEDGMENT**

This work was supported by the Electronic and Information Department of the Chinese Academy of Engineering in 2013 (2013-XX-03)

### 7 References


