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Pre-sale Mechanism Based on Customer Behavior under E-commerce Environment

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Abstract: Focusing on online pre-sale research, this study utilizes principle of economics to explain the reasons for the existence of pre-sale mechanism and study the impact of customer's time preference factor and social preference factor on online pre-sale mechanism. The simulation of online pre-sale mechanism based on Anylogic software is made and the correctness and feasibility of the system is verified.

Key words: Customer behavior, pre-sale mechanism, system dynamics, multi-agent modeling, e-commerce

INTRODUCTION

As the Internet develops and people's ideas change, online shopping has become a new fashion. With the change of overall online shopping environment, shopping way becomes more diverse, network security continues to improve and more and more Chinese netizens prefer online shopping. In particular, the clothing commodities comprise a significant proportion of online shopping. With the improvement of living standards, many trendsetter and young women are more willing to wear individualized clothing, but traditional supermarkets have been unable to meet their needs, so these people turn to the network for getting more new fashions and styles with lower prices. In recent years, a new sales model-pre-sale emerges from online shopping platform. Some customers pre-order the specific styles from sellers in order to get the latest fashion at the lowest price, obtaining a price discount through paying deposit. Certainly, these sellers have accumulated a good reputation and manufacturing experience as well as great sales performance.

STUDY ON CUSTOMER BEHAVIOR UNDER E-COMMERCE ENVIRONMENT

In online shopping, customers usually conducts certain strategic behaviors, e.g., the behaviors of customers are strategic and they will initiatively choose the decision scheme that can maximize their benefits. The study focuses on customer psychology, customer loyalty, customer satisfaction, recognition, information search and the like.

Perception psychology of customers: Wu (2010) presented a systematic explanation on perceived control's impact on customer satisfaction. Wang (2011). established an mechanism model regarding customer value's impact

on customer's after-shopping behavior intention with consideration of customer value hierarchy model. Chen (2003) pointed out that, only with in-depth understanding of customer's purchase desire and decision-making information, can sellers cater for customer needs and guide market consumption strategy in product development and marketing. Gao (2003) explored consumer's perceived risks and risk reducing behaviors. Wang *et al.* (2011) analyzed consumer psychology and consumer behaviors under e-commerce. Shao (2010) summarized 14 factors affecting customer's decision making in online shopping from three aspects.

Customer loyalty: Hong and Cho (2011) studied the impact of customer trust in online shopping and they believed customer trust in intermediaries directly affect customer loyalty and purchase intention. Studies have shown that increasing customer loyalty can provide enterprises with more economic and service benefits. Tokmana *et al.* (2007) presented the enterprises a experience model to win back lost customers and the important role of value factors, social capital and importance of services in customer loyalty development. Koufaris *et al.* (2004) discussed what online enterprises should do to develop the loyalty of first-time shopping customers and that enterprise reputation and personalized product would affect customer loyalty. Liu *et al.* (2010) believed it would be an effective way to maintain customer loyalty for network business to reduce customer's perceived risks, enhance customer engagement and establish a good relationship quality. Kang (2010) discussed how to improve customer loyalty in e-commerce environment and found using database to improve customer analysis system, personalized services and network experimental marketing are favorable strategies for cultivating customer loyalty. Niu (2010) studied the measures to increase customer

loyalty such as providing personalized services, enhancing the degree of standardization and enhancing customer trust in network. Li (2011) comprehensively defined and analyzed the factors affecting customer loyalty from three aspects, e.g., functional value, procedural values and social values and thereby built customer loyalty evaluation system based on customer value.

Customer satisfaction: Thirumalai and Sinha (2011) divided online shopping personalization into two sub-stage, e.g., individualization of decision making and individualization of transaction. The product recommendation in individualization of decision making helps to improve customer satisfaction and to reach a purchase intention; the convenience and interaction of individualization of transaction helps to improve customer satisfaction. Chang and Chen (2008) proposed the integrated theoretical framework of the relationship between user interface quality, satisfaction, switching costs and loyalty. Lin *et al.* (2011) conducted a questionnaire survey among 390 college students with online shopping experience in Taiwan. Liu *et al.* (2008) studied the fuzzy model of customer satisfaction indicators (Kim and Juhn, 1997).

Business reputation: Reputation activity is kind of consumer-driven information exchange activity and the spread of reputation is free from the intervention of sellers. In network environment, scholars make reputation research mainly in two aspects, e.g., the development and impact of reputation and the effectiveness of network comments. Li (2010) pointed out that network reputation directly affects customer's purchase intention; as a double-edged sword, it should be utilized under guidance. Bi and Hu (2010) studied the reputation of existing network as per the categories such as meaning of network reputation, transmission motivation, transmission information, transmission effects, transmission management and individual differences of consumers. Jian *et al.* (2010) found the factors impacting reputation: community isophil, relationship between consumer and the website, website perceived quality and network reputation search preference. Sha *et al.* (2011) conducted a reach from three aspects, e.g., influence of reputation, active search for reputation and perceived risk and proposed that the active search for reputation information is the key factor for variables to influence reputation. Huang *et al.* (2010) conducted research by dividing existing studies into reputation spread overview, reputation spread object, reputation spread subject, reputation spread process and reputation spread research

methodology. The research of Li and Wang (2011) showed that the network reputation distribution platform established by a third party plays a more important role in the consumer's purchase decision and the negative network information has a decisive influence on consumer's judgment on products and such influence will not vary with differences of publishing platforms (Hilletoft *et al.*, 2010).

ANALYSIS OF ONLINE PRE-SALE MODEL UNDER E-COMMERCE ENVIRONMENT

Pre-sale refers to selling goods to consumers prior to the completion of the goods. Generally, the use right and ownership of goods are transferred to the buyer over a certain period of time after the payment is made. Simply put, payment is made before the transfer of goods; meanwhile, the goods do not exist when the payment is made. Tsao (2009) believed that it is a common phenomenon to provide pre-sale discount so as to attract customers and reduce the uncertainty of demand.

Putrescibility of goods is one of the reasons for pre-sale. The unused capacity after sales does not have residual value and sellers need to improve profits in the form of pre-sale while providing price discount to pre-order customers.

The pre-sale goods are superior in style, price and quality and this is why many consumers choose to buy in this way.

Reasons to buy: The reason for customers to buy pre-sale goods is that they favor the goods and trust the seller and therefore they are willing to pay for a long wait. When customers pay the deposit, they have an estimate of waiting time and they will pay only when they feel the delivery time is acceptable. At the same time, customers will also have an estimate of the quality of the goods and they will search for reliable sellers to purchase pre-sale products. How to determine whether the seller is trustworthy? A pleasant buying experience in the shop, or high reputation of the shop, recommendation of friends and so forth will help to determine the seller is trustworthy.

Conditions of purchase: Customers will have an expectation of value before they decide to buy pre-sale goods, namely, how much the goods is worth in the minds of customers and this value does not represent the true value of goods or the market price. With the supplementation of product information, the expectation of the customers remain changing. When the customers believe the expected value of goods is higher than the

actual value, they will choose to buy pre-sale goods and pay the deposit. Otherwise they will not buy. Assuming the seller's policy offer customers to an unconditional money back guarantee, namely, the customers can get refund without paying any fee. We assume that the deposit for the product is B and the actual price of the product is P and the product value in the minds of customers is V , its distillation function is $(G(\bullet) = 1-G(\cdot))$ and density function is $g(\cdot)$; customer demand for the product is random variable D , whose distillation function is $F(\cdot)$ ($F(\bullet) = 1-F(\cdot)$) and density function is $f(\cdot)$.

The condition for customers to buy goods is that he expected value of the goods is greater than the actual value, that is, its expected utility $EU = V - p > 0$, so, the proportion of customers purchasing the pre-sale goods shall be $P\{v > p\} = G(p)$.

STUDY ON ONLINE PRE-SALE MECHANISM MODEL BASED ON DIFFERENT CUSTOMER BEHAVIOR FACTORS

The mechanism studied in this study is different from the traditional "pre-sale of uncompleted flats", which is widely applied in network. Under this model, buyers and sellers are not big enterprises, their economic strength is limited, the amount of deposit is small, waiting time is long, transaction relies on network, buyer cannot see the physical goods when they pay deposit or pay the full amount, so there is great uncertainty.

In addition, this new pre-sale mechanism is different from the traditional pre-sale, this study mainly studies on two main factors, e.g., time preference factor and social preference factor and discusses their effect mechanism and its impact on customer behaviors.

Online pre-sale mechanism based on customer's time preference factor: Customer's buying behaviors are not always rational and the irrational factors, such as reputation and sense of fairness, will affect the behaviors of customers. Time preference directly affects pre-sale model. Many customers give up pre-sale goods because they don't wait too long rather than because of quality, communication or other issues. Different person has different definition of the length of time, for instance, for the same pre-sale goods, some customers can wait 20 days, but some may give up waiting within 10 days. After paying deposit, time preference-based customers will be willing to pay more time cost for getting expected goods, which has a positive effect on pre-sale.

In the two types of the customers, the staid customers tend to wait and most likely to purchase the goods finally, while rational customers are less likely to

buy the goods. Assuming the extent of time preference-based customers is α , namely, the proportion of staid customers is α and the proportion of rational customers is $1-\alpha$. If the number of customers who paid deposit is B , the number of staid customers is αB and that of rational customers is $(1-\alpha) B$. If the depth of each customer's time preference is φ , $\varphi \geq 0$, for staid customers, φ is greater than 0 and less than expected value in the minds of customers (EV); the greater φ , the deeper the time preference of customers and the stronger the desire for insisting on the purchase. The above two features are listed in Table 1.

Online pre-sale mechanism based on social preference of consumers: Firstly the delivered information is assumed as qualified one, in that people that have purchased persuade people that have not to prepay deposit. Of course information from society can be good or bad, but this study only studies the influence of qualified information in order to simplify the model, of which the spreading scope is limited and only the touched people will disseminate.

On the platform of internet shopping, consumer have different understanding to certain kind of presold product. And some consumers would like to ask other purchasers for advice as well as research information of the product assessment. The understand of those clients to the information of commodity are relatively overall and they also are greatly affected by other clients with the social preference. While others, who would not initiatively learn feedback from consumer that have purchased the product, have their own judgment and will not be influenced by others, thus they have a little social preference. In this study, consumer with social preference are called follower-type customers, while the others without are called rational customer.

Follower-type customers are very common to see in internet shopping in reality because the social preference has great influence on consumers. Internet is a platform with huge information and most consumers will consider advice from various sides before purchasing. They will focus not only on description information from sellers, but also more on the feedback information and so does the pre-sale model. People need spend a lot more time and attention when they purchase the pre-sale product, because they have to wait for a long time to finally get the product after they prepay deposit. As a result, this part of consumers will be very cautious before they prepay, in that they will focus more on the credit standing of sellers,

Table 1: Customer types and characteristics

Customer type	Proportion	Number	Time preference level
staid customers	α	αB	$0 < \varphi, < EV$
rational customers	$(1-\alpha)$	$(1-\alpha) B$	$\varphi = 0$

Table 2: Consumer type and features

Consumer type	Proportion	Amount	Time preference span
Follower-type customer	β	βS	$0 < \omega < EV$
Rational customer	$1-\beta$	$(1-\beta)S$	$\omega = 0$

assessment on the net shop from other purchasers and even the net purchasing level of other purchases. That is the reason why the influence of social preference should be studied when the pre-sale model is studied.

It is assumed that consumers in market are classified into two groups, one that are easily influenced by social preference and one that are not. The former group is called follower-type customer while the latter one is called rational customer. The follower-type customers account β proportion in market while the rational ones accounts $1-\beta$. And if the amount of consumers is assumed to be S , that of follower-type customer is $S\beta$ while that of rational customer is $S(1-\beta)$. β is called the range of social preference which means the influencing range of social preference on consumers in market. And the bigger β is, the more proportion of consumers influenced by social preference in market will be. Moreover, It is assumed that ω presents the influencing depth of social preference and $\omega \geq 0$. As for follower-type customers, ω is bigger than 0 but smaller than EV which means the expected value of pre-sale product in the mind of consumers and the bigger ω is, the deeper of the influence of social preference on consumers and the greater consumer will be influenced by people who have purchased the product when they make decisions (Table 2).

SIMULATION RESEARCH WITH ANYLOGIC

Anylogic simulation software has a great advantage on constructing mixed model in that it has various model libraries and its simple modeling method improves its flexibility. On the foundation of basic Anylogic model, the time preference and social preference will be introduced, a series of controllable variable will be set and the model parameter will be adjusted in order to analyze the simulation result. The simulation method can be used to explain the influence of time preference and social preference.

Multi-Agent modeling: Firstly, Multi-Agent modeling will be constructed, the state diagram will be used to describe the decision behavior of consumers and the time preference and social preference will be introduced. Then the system dynamics model of supply chain will be constructed to complete the link of the two. At last, the diagrams will be added to for data analysis. Fig. 1 is consumer decision behavior diagram, in which state

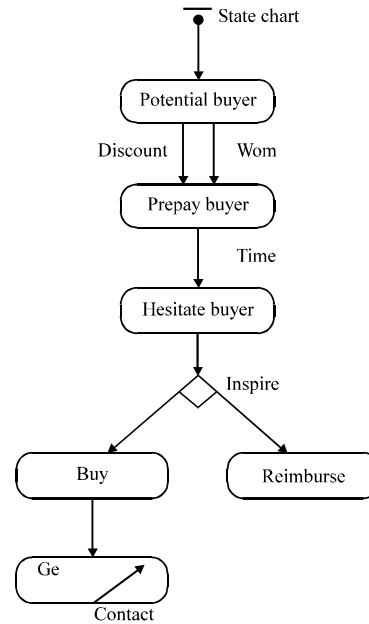


Fig. 1: Consumer decision behavior

diagram with various color present different state of consumers, including PotentialBuyer, PrepayBuyer, Hesitate Buyer, Buy, Reimburse and Get.

The states of consumers are constant changing and the changing reason is presented as “contact”. The contact drives the contact among the different states of consumers and the two states connected by contact can be same, which is called inner-contact, or they can be different. In Anylogic, the icon presents contact, the starting point of it is the origin state and the targeting point is the target state. And it is the contact that makes Agent so changeable.

There are lots of potential consumers on internet. And the pre-sale model will be used for some products; however, consumers have to prepay deposit, with a certain time of waiting, to finally get the product. Under the influence of product advertising and other consumers (social preference), the potential consumers decide whether to prepay deposit, ones that decide to prepay deposit are prepaybuyer, others who give up prepayment are still potentialBuyer. Because influence from advertisement or social preference is constant, potential buyers will prepay deposit at any time.

Prepaybuyer will not get the product immediately and he or she will have to wait for a certain time, during which the time preference makes the sedate consumers keep waiting while it makes rational customers to HesitateBuyer. HesitateBuyers will make two different choices, which is, part of consumers give up waiting



Fig. 2: Inner contact

while the others keep waiting. The choices will be made on the basis of the inspiring policy that sellers choose starts to play the role. If the inspiring policy is attractive enough, consumer would like to keep waiting and at that time prepaybuyers are divided into buy group and reimburse one. The buy customers will undoubtedly get the product and become buy group, while reimburse customers will ask for reimburse and give up purchasing (Macal and North, 2006).

In order to complete the model in a better way, some parameters and variables are set in the study. In anylogic, parameters are used to define some features of the modeling target, while variables are used to store simulation structure or describe the dynamic features when modeling. Variables present some state of the model, which can constantly change followed the simulation time, while parameters present the static feature of the target, which will remain unchangeable in simulation. In this modeling period, parameter which is used to record some feature of the model will only change before the model works and variables is used to record the changing condition of data in model (Martinez-Moyano *et al.*, 2007).

The social preference of consumers in this study is simulated by inner contact, with the principle that consumer in Get state will deliver a “Buy” message at certain rate, which can be received by customers in certain scope and customers after receiving “Buy” message will be influenced among which the follower-type customers will be more easily to prepay deposit. And Fig. 2 is the setting of inner contact.

Consumers states involved in this model are various and the change of consumer states is frequent, which means the change of state is an important matter. In Agent, a simple variable BuyerState is introduces which record the change of consumers’ state and deliver the message into the dynamic change of consumers. Once consumers enter into a new state, a new figure will be given to BuyerState. And in the dynamic setting of the

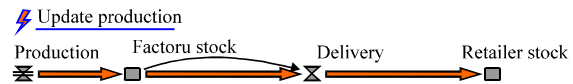


Fig. 3: The system dynamics model

circle (the two dimension diagram of consumer), circle colors are changed according to the change of variables figures and different colors represent various states. And because the reasons for potential buyers to those who prepay deposit will be different, discount or social preference (Wom) are also colored respectively differently.

Supply chain system dynamics model: In the basic mixed model, supply chain is formed with manufacturers and retailers and the former will not directly contact with final buyers and the manufacturer will produce according to the order from retailer without overstocking. And this model increases the complexity of supply chain in that the upper-reaches manufacturers also participates in market with market information and produce according to the amount of buyers who prepay deposit (Pourdehnad *et al.*, 2002)

A new module accident “UpdateProduction” is also introduced in this model, which will control the producing frequency and output of manufacturers. And each time the trigger of the weekly triggering pattern will examine the amount of PrepayBuyer in Agent (Person) and according to which decides the producing amount. Figure 3 presents the complete system dynamics model (Schieritz and Grossler, 2003).

When the stock of retailer is bigger than 1, consumers in Buy state are able to get the product and turns to Get buyers, otherwise, they will turn to Prepay Buyers; meanwhile, once a product is sold, the stock of retailer will decrease accordingly. And that realizes the information exchange between Agent model and system dynamics model. Figure 4 presents the adjustment of Agent model.

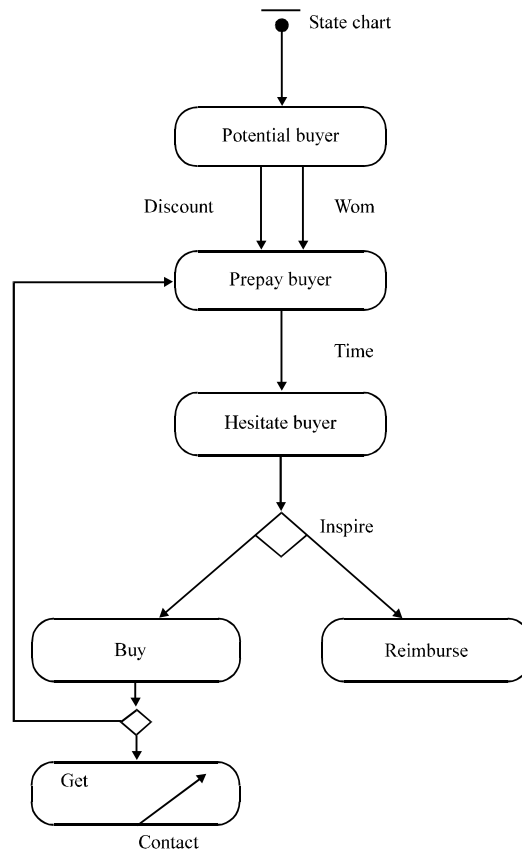


Fig. 4: The adjusted Agent model

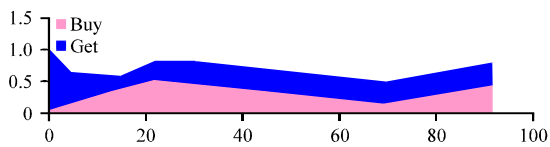


Fig. 5: Time pile table

Data analysis: Simulation model is constructed to analyze the simulation structure of the model and use it to explain the problems in reality. As a result, after the model is used to correctly illustrate the current situation, the strong statistic function of Anylogic is used to explain date (Nilsson and Darley 2006).

Figure 5 records the amount of Buy consumers and Get consumers, in that the amount of consumers deciding to buy and those giving up buying.

In Fig. 6, the first diagram records the amount change situation of Potential Buyer, From Discount, From Wom and Prepay Buyer, while the second one records that of Prepay Buyer, Retail Buyer, Buy, Reimburse.

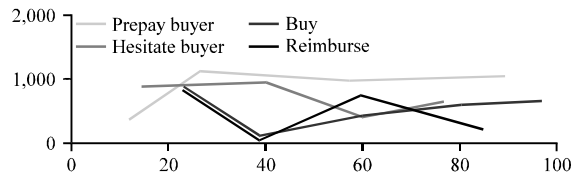
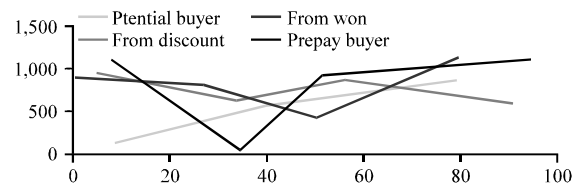


Fig. 6: Time line diagram

CONCLUSION

The study studies the theory of new type online pre-sale mechanism and the related simulation. In recent years, the application of pre-sale mechanism is increasingly common, from real estate industry to

electronic business. However, the research of online pre-sale system is at a starting point with huge development in future.

Anylogic simulation software is used in this study and the system dynamics and modeling method based on Agent are connected to construct a new mixed model. This model simulated the influence of time preference and social preference to consumer behavior and supply chain, In future, the test method and improving method should be changed on the foundation of current simulation test, involving increasing compared parameters, adopting parameter testing method integrated with improving test method and changing parameters to compare model, so that more compression data will be gotten, which will be used to improved analysis later.

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