9 July 2011

A Dynamic System Of E-Service Failure, Recovery And Trust

Wei-Lun Chang
Tamkang University, wlchang@mail.tku.edu.tw

Hui-Chi Chang
Tamkang University, girl110579@hotmail.com

ISBN: [978-1-86435-644-1]; Full paper

A Dynamic System of E-Service Failure, Recovery, and Trust

Wei-Lun Chang, Department of Business Administration, Tamkang University, Taipei, Taiwan, R.O.C., wlchang@mail.tku.edu.tw

Hui-Chi Chang, Department of Business Administration, Tamkang University, Taipei, Taiwan, R.O.C., girl110579@hotmail.com

Abstract

Researchers have highlighted the mediating role of trust in electronic circumstances. However, relatively few studies examine the links between e-trust and e-service recovery. This study explores e-service recovery in terms of trust issue. This study utilizes the system dynamics approach to build an e-recovery framework and subsequently conduct simulations to evaluate recovery performance. The results of this study reveal that trust is indispensable to a successful recovery, which can boost long term firm profitability. Perceived prior service quality also positively affects prior recovery e-trust when failures occur. Customers with low perceived quality will have higher e-trust and generate more profit for firms than other customers after recovery. Service severity negatively affects customer prior e-trust. Interestingly, customers who have experienced high failure severity but ultimately have their problems solved will have greater e-trust and generate more profit for the firm than those with low service severity after recovery. Customer participation is critical to recovery performance. The more customers contribute in recovery process, the higher post e-trust they will create. This study helps explain how e-trust plays a pivotal role in dynamic system e-service recovery.

Keywords: System Dynamics, E-Service Failure, E-Service Recovery, E-Trust

1 INTRODUCTION

In this modern society, the speed and convenience of Internet contributes greatly to the development and growth of e-commerce. A competitive e-commerce environment and low switching costs have resulted in a high customer churn rate on the Internet. Research published by The Wise Marketer (2005) indicates that "an average annual churn rate for many Internet Service Providers is 25%." To increase their revenue and profit, firms often provide online services (e-services) as a critical ingredient to increase the customer retention rate. Reichheld and Sasser (1990) claimed that increasing the customer retention rate by just 5% can boost profit by 25% to 85%. Hence, it is crucial to gain customer trust for companies based on online service applications. Trust is a fundamental element in establishing and maintaining long-term relationships (Rousseau et al., 1998). The lack of on-line interpersonal interaction and the absence of touch in online exchanges have strengthened the high significance of e-trust (Reichheld & Schefter, 2000). Trust is the critical component driving customer satisfaction, loyalty, and purchase intention in online services (Ribbink et al., 2004; Gefen and Straub, 2004; Kim et al., 2008; Liao and Wu, 2009; Kim et al., 2009; Chiu et al., 2010). Hence, trustworthiness is a major determinant in customer intention, and its importance cannot be overemphasized.

Firms inevitably experience service failure. For example, B2B online news announced that "Amazon Has Suffered a Temporary Web Service Failure" during the Christmas season, which caused troubles for consumers who were buying presents (2010). A similar headline in The Epoch Times (2011) reported that "Bank of America Website Down, Leaving Customers Unhappy." In this case, a broken website was too slow to load, which made customers unable to navigate and stopped their online banking. Such failures definitely decrease customer trust in service providers and increase their dissatisfaction. Kolter (1997) showed that the cost of acquiring and serving new customers is five times greater than the cost of retaining and satisfying current customers. That is, the more customers a firm loses, the more it must spend. Thus, service recovery is a significant issue for firms. The "recovery paradox" literature indicates that customers who have experienced service failure but ultimately have their problems solved will become much more loyal than those who do not encounter failures. Liao and Wu (2009) revealed that e-trust is a key mediator in the process of service recovery. E-trust can be influenced by an outstanding recovery performance and subsequently enhance customer loyalty. High service recovery can positively affect customer satisfaction, purchase intention, and positive word of mouth (Miller, 2000; Maxham, 2001; Seawright et al., 2009; Sousa and Voss, 2009). Hence, trust issue is a noteworthy topic in e-services.

Although many studies examine traditional service recovery, relatively few discuss service recovery in e-commerce The two critical distinctions between traditional services and e-services include reduced human interaction and the mediating role of technology (Holloway and Beatty, 2003). Consequently, the recovery difficulties and the factors influencing the recovery process online differ from those in offline circumstances. Researchers have highlighted the significant mediating role of trustworthiness in the recovery process (Liao and Wu, 2009). However, most researchers used quantitative methods to analyze the linear relationship between variables and service recovery. The current study uses a system dynamics approach to discover the causal relationships between trust and a number of variables in an e-service recovery process. Sterman (2000) showed that "system dynamics is a perspective and set of conceptual tools that enable us to understand the structure and dynamics of complex systems." This approach can explicitly observe how things influence each other under complex systems over time, allowing firms to create more effective service recovery strategies.

This study utilizes a system dynamics approach to build a e-service recovery framework of trust. The proposed framework can help firms discover how to regain customer trust after service failure, examine their process of service recovery, and to think in a broader way. This study attempts to explore the following research questions: (1) Will e-service recovery help enhance the trust of customers who experience service failure? (2) What are the major factors influencing e-service recovery in terms of trust? The remainder of this paper is organized as follows. Section 2 reviews related research, including service recovery and trust. Section 3 describes the research method and proposes an e-service recovery framework of trust based on previous studies. Section 4 presents the

analytical results in detail. Finally, Section 5 provides the conclusion, implications, and suggestions for further research.

2 LITERATURE

2.1 Service recovery

Service failures occur when service performance cannot meet customer expectations during the delivery process. Service failures decrease customer satisfaction, and reduce their trust and commitment to firms. Customers are prone to engage in negative word of mouth after unpleasant service experiences (Weun, 2004). Failure severity also has a negative effect on customer loyalty (Wang et al. 2010). Nevertheless, previous studies reveal that customers who air their complaints with service failures offer firms a second chance to serve them and rectify their problems (also called service recovery). If customers are satisfied with the final recovery performance, they will be even happier than before. An anonymous antecedent emphasized that "a good recovery can turn angry, frustrated customers into loyal ones." High service recovery efforts can significantly increase customer post-failure levels of satisfaction and loyalty, boost their purchase intention, and strengthen their motivation to spread positive word of mouth (Miller, 2000; Maxham, 2001; Seawright et al., 2009; Sousa and Voss, 2009).

Although researchers have instigated this topic for a decade, a gap still remains for service recovery issue. However, it is not possible to compare online service recovery with offline circumstances because of the nature of service. The two major differences between online and offline services are reduced human interaction and the mediating role of technology (Holloway and Beatty, 2003), which lead to different types of online failures. There are generally four types of problems in self-service technologies, including e-services: (1) technology failures (e.g., web site is temporarily broken), (2) process failures (e.g. customers fail to receive the products ordered online), (3) poor design (e.g., it is difficult for customers to navigate web pages), and (4) customer-driven failure (e.g., customers fail to login due to a missing password) (Meuter et al. 2000, p. 56). Existing research on online service focuses on process failures, and tends to neglect the other three types of failures. To some degree, service recovery related to technology, poor design, and customer-driven failures have something in common: customer efforts are the key factor determining ultimate recovery performance when self-service technologies fail. Dong et al. (2007) conducted an empirical study based on the scenario of Internet setup and online course registration. Their results demonstrate that customers who are involved in the service recovery process involving self-service technology appear to be more satisfied with the service recovery than those who are not. That is, the greater the customer effort, the higher the recovery performance will be. Conversely, e-trust is a key factor in establishing and maintaining the relationship between customers and service providers. E-trust consists of e-service quality such as web site design (Tamimi and Sebastianelli, 2007), which directly affect customer satisfaction and loyalty (Liao and Wu, 2009). DeWitt et al. (2008) indicated that "trust has important mediating roles during the service recovery process" (p.269). A great deal of research has been conducted on service recovery. What seems to be lacking, however, is an analysis of trust in service recovery situations.

2.2 E-trust

Though the issue of trust has been universally studied for many years, the definition of e-trust (online trust) in an electronic commerce environment remains ambiguous. Bart al et. (2005) stated that "online trust includes consumer perception of how the site would deliver on expectation, how believable the site's information is, and the level of confidence in site" (p.134). Due to the distinction of service content, online trust differs from offline trust. In traditional circumstances, customers can based their trust on what they have seen, including the visible service delivery process and their interaction with front-line staff. In contrast, the reduced interpersonal interaction in online services increases the significance of technology's mediating role between customers and service providers. This also results in the diverse factors of online trust, most of which relevant to the technological factors such as web site characteristics, visual design, and perceived security.

E-trust is critical for creating loyalty when customers perceive a high level of risk (Anderson and Srinivasan, 2003). Empirical research in e-services reveals that e-trust positively and directly affects customer satisfaction (Kim et al., 2008; Liao and Wu, 2009; Kim and Swinney, 2009). Trustworthiness is also critical to driving customer loyalty (Ribbink et al., 2004; Kim et al., 2009; Liao and Wu, 2009). Trust is crucial to the relationships among perceived value, customer satisfaction, and commitment (Kim et al.2008; Sanchez-Franco, 2009). Trust is a key element in customer purchase intention (Gefan and Straub, 2004; Chiu et al., 2010). Consequently, e-trust plays a pivotal role in e-service and directly affects the long-term relationship between customers and service providers.

Although many studies investigate e-trust, most of them focus on transaction trust (e.g., online shopping) or trust based on web site characteristics, and largely neglect system-based trust (Grabner-Krauter and Kalusha, 2003). Most researchers studied different contexts of trust, and indicated that trust can decrease the level of perceived risk on the Internet (Chiu et al., 2004). Conversely, service failures can affect trust. Weun et al. (2004) explicitly pointed out that failure severity has a significant influence on trust. Their research reveals that customers who experience service failure are upset, diminish their trust on firms, and are prone to engage in negative word of mouth. Thus, service recovery becomes imperative and essential for firms wishing to enhance their trustworthiness. Trustworthiness plays a critical role in mediating service recovery process (DeWitt et al. 2008). In summary, e-trust is indispensable to successful service recovery. Hence, this study focuses on trust in e-service recovery.

3 RESEARCH METHOD

3.1 System Dynamics

System Dynamics, founded by Jay W. Forrester, is an approach to deal with “internal feedback loops” and “time delays” that affect the behaviors among complex systems over time (Sterman, 2000). This approach can help researchers gain insight into the dynamic changes existing in every human activity and improve awareness of the complex phenomena in the real world. System dynamics can simulate entire and considerable perspectives and long-term solutions because it effectively deals with the dynamic changes, feedback information, and time delays in complex problems.

System dynamics consists of causal relationships and utilizes feedback systems as the basis of causal feedback loops. Additionally, researchers can define the problems in use of causal relationships. Subsequently, complex problems can be presented in a concise and systematic way to help managers to obtain a grip on problems. This study addresses two different causal loops. One is a positive feedback loop, also called a reinforcing loop, containing even negative relationships; it will lead to positive results (Fig. 1 (a)). Conversely, a negative feedback loop and a balancing loop, including odd negative relationships, will result in negative effects (Fig. 1 (b)). A system consists of several positive and negative causal loops. Therefore, there may be different changes in patterns, including stability, growth, or decline. No matter how a system changes, it is possible to make an accurate judgment as long as key factors to problems can be grasped. Furthermore, the system dynamics method features the existence of time delays, where the influence between two variables cannot appear immediately, but will be produced after a period of time.

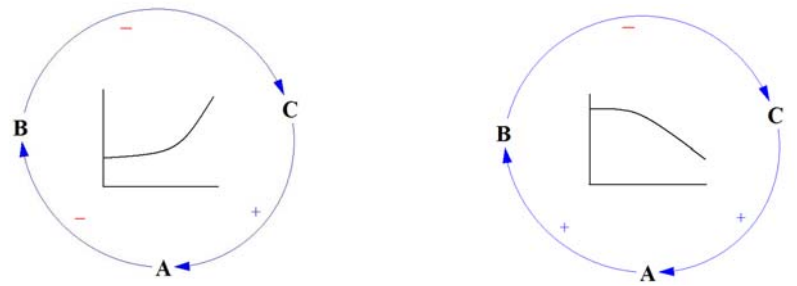


Figure 1. (a) Positive feedback loop (b) Negative feedback loop

This study utilizes a system dynamics approach for several reasons. First, the service recovery process is very complicated. Michel et al. (2009) addressed three key successes to recovery: (1) "Customer recovery," studied by marketing researchers, focuses on customer psychological recovery such as fairly treatment, quick apology, etc. (2) "Process recovery," discussed by operation researchers, focuses on delivery process such as how to utilize technology to appease customers after service failures. (3) "Employee recovery," emphasized in management literature, focuses on how to help employee to recover customers. However, most studies examine the recovery issue by breaking it into subprocesses and adopt mathematical methods to reveal the linear relationships between variables, which lack systematical thinking and fails to broaden perspectives. Since the system dynamics approach can overcome the limitation of linear thinking, it can help reveal the causal relationships among complex recovery process. A causal loop diagram makes it possible to conduct computer simulations and evaluate the performance of a recovery strategy. Thus, this study utilizes a system dynamics method to model an e-service recovery framework, and subsequently evaluates the recovery performance by employing "Vensim" software.

3.2 Modeling Process

The first step in modeling a complex process in a system is to discover the casual relationships among variables. This study attempts to design the process of e-service recovery based on previous research. Miller (2000) divided the service recovery process into three phases, including pre-recovery, immediate recovery, and follow-up recovery phases. The failure severity, customer loyalty, perceived pre-service quality, and company guarantees all affect customer expectations of service recovery in the pre-recovery phase. The role of customer expectation is critical to the success of service recovery. If firms have a superior understanding of customer expectations, they can easily implement an effective recovery strategy or exceed customer expectations. Next, there are four key elements to a successful recovery in the immediate recovery phase: the types of recovery activity (psychological and tangible efforts) and the delivery of service recovery (speed of recovery and front line empowerment). When failures occur, firms must quickly respond to customers, endeavor to appease them, and treat them fairly. Finally, follow up recovery, which involves an apology or a tangible token, can strengthen the effectiveness of recovery and subsequently lead to the success of maintaining long-term customer loyalty and satisfaction.

Miller's recovery framework is a unified framework for related situations owing to the survey conducted by a variety of companies in "either online or offline services." However, e-service recovery is unlike that in traditional circumstances, especially in terms of technology and the reduced human interaction (Holloway and Beatty, 2003). Thus, this study considers some critical e-recovery factors from other empirical studies in e-services recovery (Dong et al., 2007). This study also attempts to place the significant role of e-trust on e-recovery process in consideration of the online trust framework built by Urban et al. (2009). The results of Glen's research show that customers will increase their trust based on the perceived internet quality (e.g., privacy security) and subsequently behave either in psychology (e.g., become loyal) or physiology (e.g., purchase or use services), This can result in firms' success and boost their profits. These observations can be applied to e-service recovery. That is, customers will accumulate their prior trust based on their perceived on-line quality before service failure. When failures happen and diminish customer trust, service providers must begin to deliver recovery and reestablish customer trust. As long as the recovery performance can satisfy customers, it can increase their trust and enable them be loyal users. The following section explicitly describes the causal loop diagram of "e-service recovery on e-trust."

3.3 Causal Loop Diagram

Figure 2 demonstrates the proposed causal loop diagram. When service failure occurs, it decreases the customer e-trust accumulated by prior perceived service quality. The more e-trust customers possess, the higher service recovery they will expect. Meanwhile, service failure will make them voice complaints or spread negative word of mouth. Once a firm receives customer complaints, it should respond to the situation quickly using technology and devote serious efforts to service recovery.

Simultaneously, customers encountering e-service failures may also participate in the recovery process. Hence, the more efforts customers contribute, the higher recovery quality they will perceive. If the perceived recovery quality exceeds customer expectations, customer will be satisfied with the service recovery. The higher the state of satisfaction that customers feel, the more delighted they will be. Hence, customers will reestablish their trust in firms. If the post recovery e-trust surpasses the prior e-trust, firms can win customers' e-loyalty back and encourage them to engage in positive word of mouth. In this case, the reuse rate will be higher for firms and service organizations can earn greater profit. In turn, a firm with greater revenue can invest more capital in self-service technology.

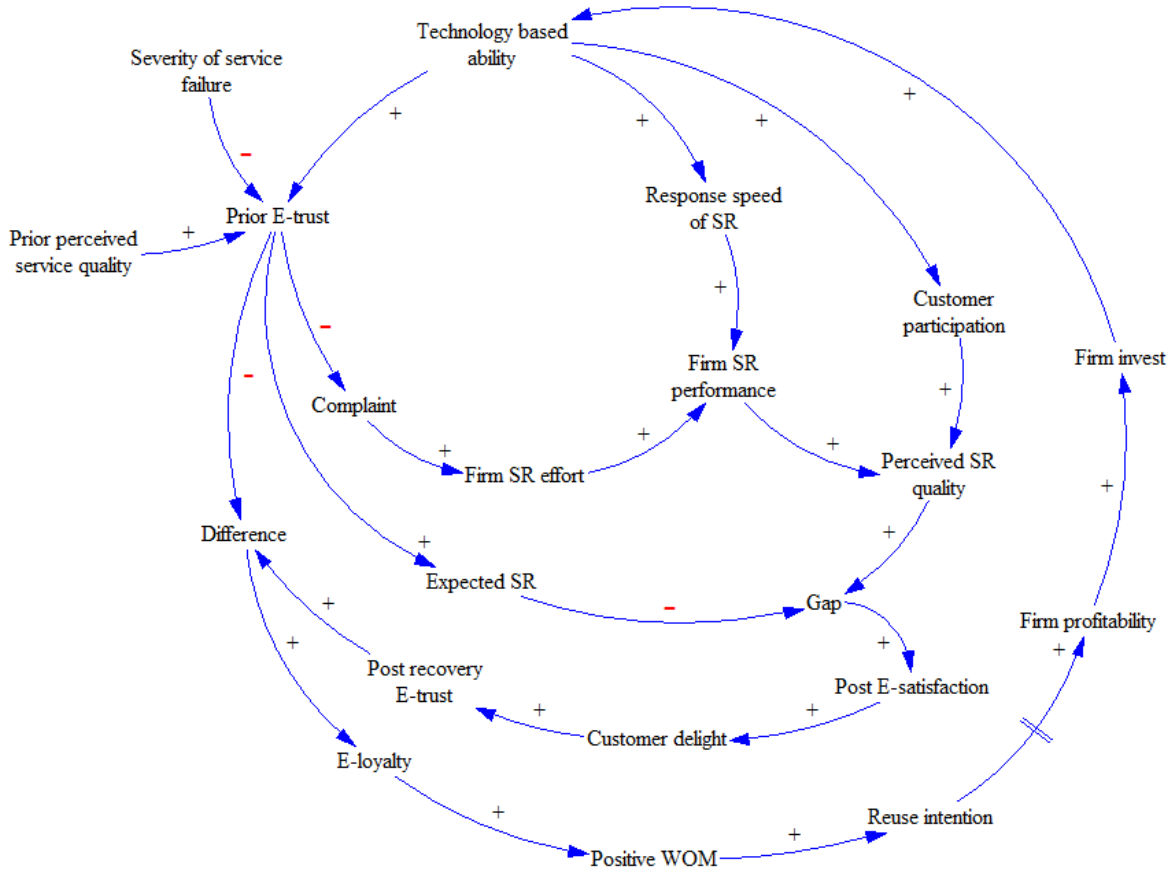


Figure 2. Causal loop diagram

4 ANALYSIS OF STOCK AND FLOW DIAGRAM IN MODELING E-SERVICE RECOVERY ON E-TRUST

A stock and flow structure can be derived from a causal loop diagram. Stock, accumulated with time, represents the state of the system, while flow is the amount running through the stocks. System dynamics model often choose variables of interest as stocks to observe their transformation. Accordingly, this study identifies four stocks (prior e-trust, post e-trust, firm profitability, and technology based ability) (Fig. 3). First, a win-win service recovery is supposed to consider the interests of service receivers and providers. That is, a good recovery can satisfy customer needs and benefit service organizations. Next, e-trust is a key factor in driving customer satisfaction and loyalty among service recovery; thus, the quality of recovery performance can be judged by an evaluation of customer e-trust. Finally, this study assumes that technology-based ability is superior to staff recovery ability when failures occur due to the unique characteristics of on-line services. Consequently, this study regards four variables as stocks to evaluate e-recovery performance.

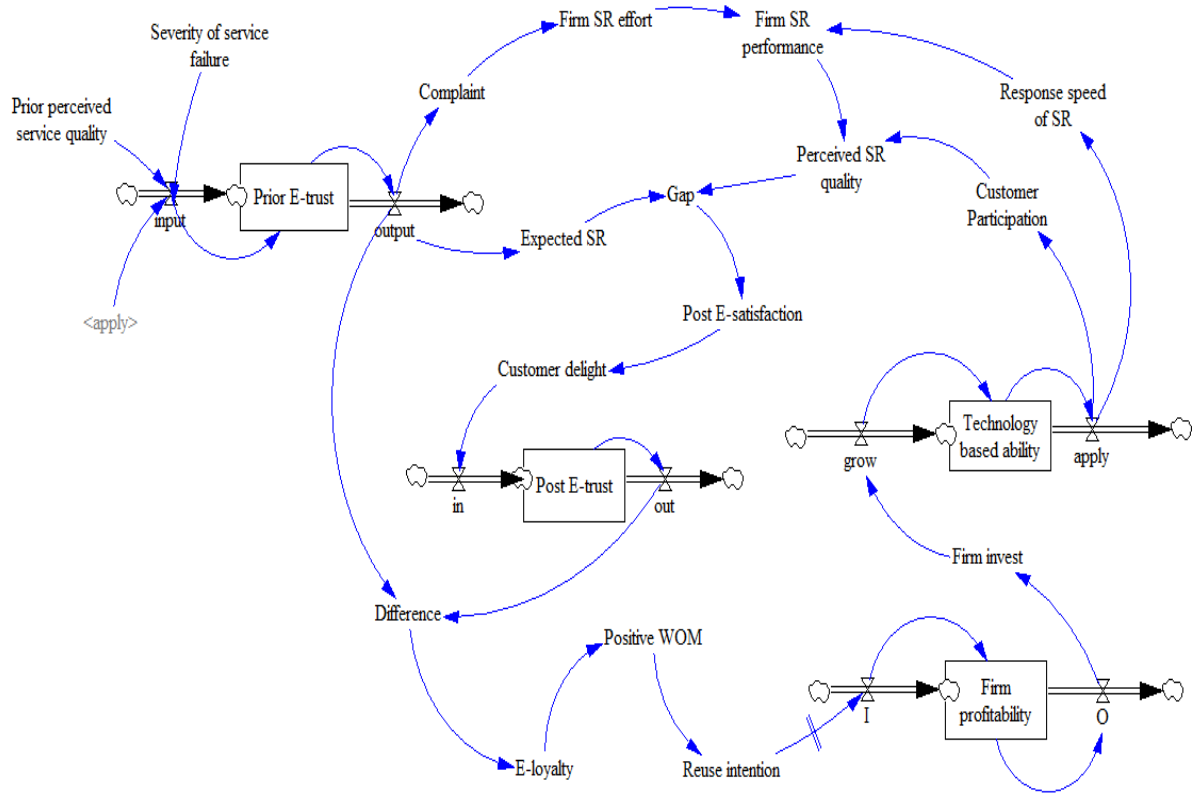


Figure 3. Stock and flow diagram

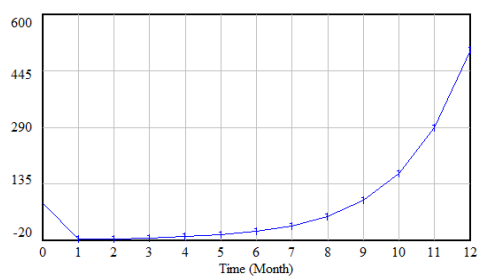
4.1 Equation and Assumption

This study applies the 80/20 rule to establish the equations. This study assumes that an excellent recovery can ultimately benefit service providers, regardless of the company's ability. Thus, the proposed model initially assumes that the range of initial values is from 0 to 100, and uses a service organization owning medium profitability (Initial Value (IV): 50) and medium technology-based ability (IV: 50) to examine how a good recovery affect firm profitability. Simultaneously, customers are assumed to own high prior e-trust (IV: 80), making it possible to observe its transformation with high failure severity (IV: 80) and service recovery. The positive influence on prior e-trust consists of 80% prior perceived service quality and 20% perceived application of technology-based ability. This study further assumes that 25% dissatisfied customers will air their complaints (The Wise Marketer, 2005), while 80% of them will expect service recovery. Once service organizations receive complaints, they endeavor to perform their recovery using 20% quick response and 80% recovery efforts. On the other hand, this study assumes that 50% of customers encountering failures will be involved in recovery (The Wise Marketer, 2005), where perceived recovery quality consists of 60% firm recovery performance and 40% customer participation. Once customers perceive quality of recovery exceeding the expected recovery efforts, 80% of them will be satisfied and increase their trust in service providers. If the post e-trust is higher than prior e-trust, 80% customers will become loyal, spread positive word of mouth, and enhance their reuse intention. A time delay before firm profitability is enhanced due to customer intentions is inconsistent with their reactions. Finally, this study assumes that firms will invest 55% in self-service technologies (Google financial table, 2010). This will speed up the response to customer after service failure and show customers how to participate in service recovery for the future.

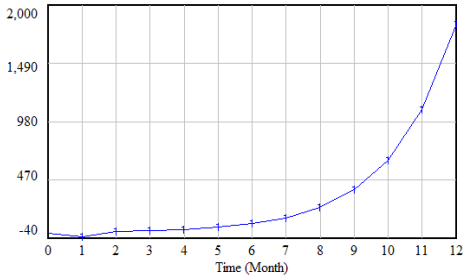
4.2 Evaluation

The four diagrams in Fig. 6 illustrate the process of e-service recovery in terms of e-trust. The simulation time is 12 months to evaluate a long-term performance of e-services recovery, as firms

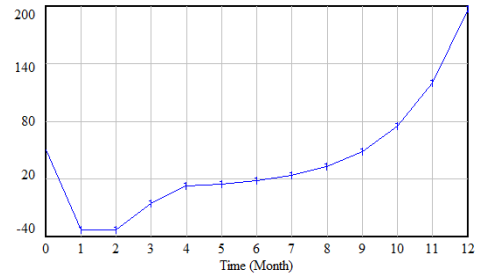
typically measure their profitability annually. Figure 4(a) indicates that customer prior e-trust will decrease in the first month due to the occurrence of service failures. Simultaneously, firm profits fall to the lowest point. When firms perceive their declined business, they will endeavor to recover customers in the second month. Accordingly, customer post e-trust gradually rises and increases 6% in the sixth month (Fig. 4(b)). Though firms improve their profit slightly after recovery, they are still below the starting point (initial value= 50) from the first to the ninth month. This implies that there are time delays between customer reuse intention and firm profitability. When customers perceive the recovery performance and reestablish their e-trust on service providers, they may reuse the service after a period to test the inconsistence between their reaction and perception. Hence, there is a sharp increase on firm profitability in the tenth month (Fig. 4(c)). On the other hand, technology-based ability plays an important role in the recovery process (Fig. 4(d)). The higher technological ability a firm possesses, the more effective recovery it will perform on customer e-trust. Figure 5 also provides a detailed analysis of numbers month by month for four stock variables. In summary, service recovery seems to cost firms in the short run, and recovery effects are difficult to detect, it can boost the firms' profits and revenue in the long run.



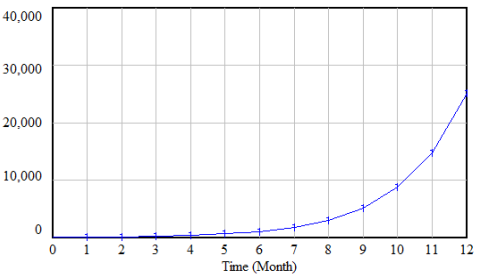
(a) Prior E-trust



(b) Post E-trust



(c) Firm profitability



(d) Technology based ability

Figure 4. The results of simulation for four stock variables

Time (Month	"(a) Prior E-trust" Runs: 1	"(a) Prior E-trus 80	"(b) Post E-trust" Runs: 1	"(b) Post E-trus 0	"(c) Firm profitability" Runs: 1	"(c) Firm profita 50	"(d) Technology based ability" Runs: 1	"(d) Technology based ability" 50
0								
1		-15.75		-29.4144		-32.768		60.25
2		-15.3913		15.086		-32.768		118.645
3		-13.3474		22.668		-5.59694		217.917
4		-9.87291		34.9113		12.4835		373.229
5		-4.43698		53.9415		14.7519		628.31
6		4.49087		85.3181		18.3436		1060.83
7		19.6289		138.651		23.9118		1794.32
8		45.3013		229.098		33.1068		3038.51
9		88.848		382.52		48.7513		5149.08
10		162.718		642.779		75.283		8729.31
11		288.026		1084.26		120.288		14802.6
12		500.59		1833.17		196.633		25104.8

Figure 5. The change of numbers for four stock variables

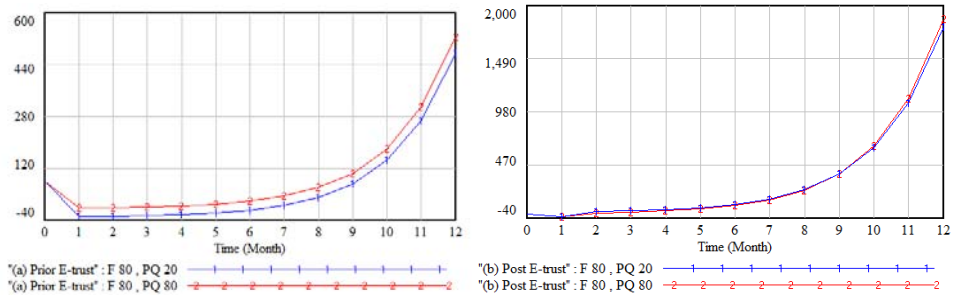
4.3 Discussion

This section provides cross analysis for different numbers of stock variables. Initially, this study assumes a service organization possesses medium profitability (initial value (IV): 50) and medium technology-based ability (IV: 50). Customers initially possess high prior e-trust (IV: 80). Two

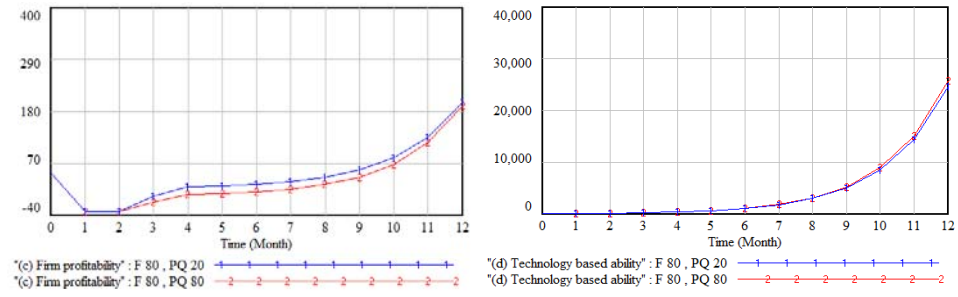
different levels of prior perceived service quality (IV: 80 vs. 20) are first given to examine how they affect customer e-trust and recovery performance. Next, this study assumes that failure severity (IV: 20 v.s. 80) will have a significant influence on customers, and thus result in different recovery performance. Finally, different degrees of customer participation (20%, 50%, 80%) were given to evaluate the role that customers play in the recovery process.

4.3.1 Perceived different levels of prior service quality

When the degree of service failure is the same (initial value (IV): 80), two groups of customers perceive two different levels of service quality before recovery. The first group has low perceived service quality (IV: 20), while the second group has high perceived service quality (IV: 80). Figure 6(a) indicates that the second group has greater prior e-trust than the first group when failures happen in the first month. That is, customer perceived service quality have positive effects on customer prior e-trust. However, the results of Fig. 6(b) reveal that the post e-trust in the first group grows faster than that in the second group during recovery. Additionally, firm profitability in the first group increases faster and becomes higher than the second group (Fig. 6(c)). Although two lines of profitability seem to converge in the long run, the gap between the two groups can lead to a 3.5 times and 0.04 times difference in profitability every month. This implies that customers with high prior service experience can expect high service recovery. When firms do not reach or exceed their expectations, customers may not feel satisfied with service recovery. This results in a reduction of customer reuse intention and the slow growth of profits for firms. On the other hand, the trend in Fig. 6(d) reveals that technology-based ability is positively related to customer post e-trust during the recovery process. That is, the higher technological ability a firm possesses, the more effective recovery it will lead to. In summary, customers who initially have a low prior perceived service quality will have greater post e-trust and generate more profit for firms than those with high perceived quality after recovery.



(a) Prior E-trust *(b) Post E-trust*



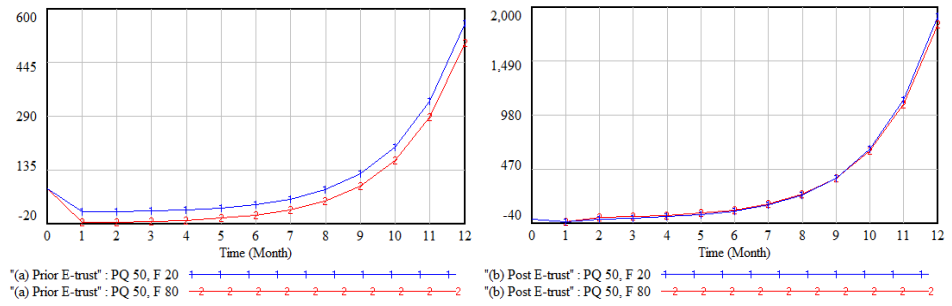
(c) Firm profitability *(d) Technology based ability*

Figure 6. Simulated results for different levels of prior service quality

4.3.2 Severity of failures

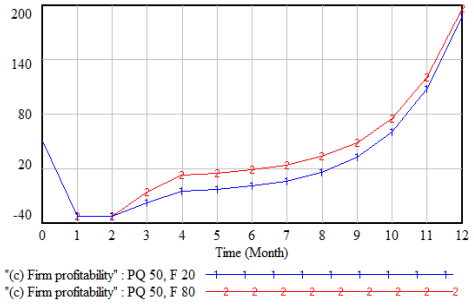
When that the perceived prior service quality of customers is similar (initial value: 50), the occurrence of failures with high (IV: 80) and low (IV: 20) severity will have different effects on e-recovery performance. Figure 7(a) indicates that failure severity negatively affects customer prior e-trust. Accordingly, customers who encounter a low degree of failure have greater e-trust than those

encountering a high degree of failure. However, Fig. 7(b) indicates that customers with high failure severity will possess higher post e-trust than the others after service recovery. Customers with high failure severity are 2.8 to 0.05 times more profitable every month than customers with a low degree of failure (Fig. 7(c)). Customers who initially encountered high degree of service failures but finally have their problems solved generate greater profit for the firm than those with low failure severity. This implies that customers with high failure severity may strongly voice their complaints; the more they speak out, the more recovery efforts firms will produce. Simultaneously, customers with high failure severity are likely more willing to engage in recovery. The more efforts customers contribute, the higher recovery performance. On the other hand, Fig. 7(d) shows that there is not much difference in technology-based ability. The values of two curves reveal that technological ability is critical to service recovery. The higher technology-based ability a firm has the more effective recovery it will achieve in customer e-trust. In brief, customers who have experienced high failure severity and finally have their problems solved have higher reuse intention and thus generate more profit for the firm than those experiencing a low degree of failure.

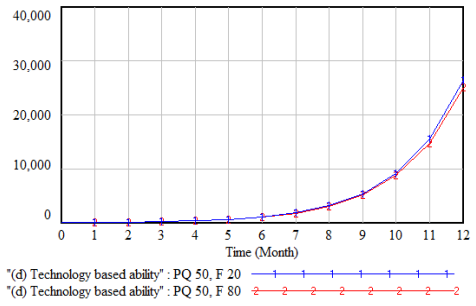


(a) Prior E-trust

(b) Post E-trust



(c) Firm profitability



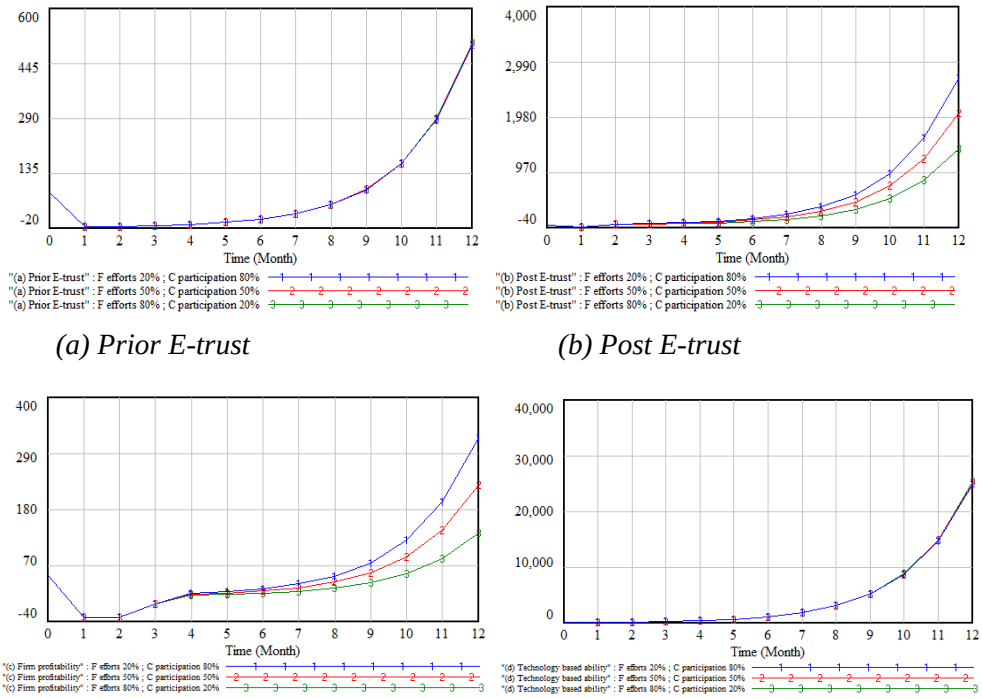
(d) Technology based ability

Figure 7. Simulated results for severity of failure

4.3.3 Degree of Customer participation

Assuming that customers play a key role in the e-recovery process, the degree of their participation will affect recovery performance. This study consider three groups of customers who encounter the same failure severity and possess similar prior perceived service quality, but contribute 20%, 50%, and 80% efforts to self recovery. As Fig. 8(a) shows, the curves of prior e-trust in three groups appear similar before firms rectify their problems. However, Fig. 8(b) reveals that the more customers engage in recovery process, the higher their e-trust will be. There is not much difference in the three curves before the seventh month, but the gaps widen in the eighth month. The change of post e-trust in these three groups significantly affects firm profitability. Figure 8(c) shows that the amount of firms' profits suddenly falls to the lowest point due to the occurrence of failures in the beginning. Next, a time delay obviously exists in the first and the second month, followed by a slight increase in firm profitability from the third to the seventh months. The gap appearing between the three curves becomes larger over time. This suggests that reduced interpersonal interaction and mediating technology result in high recovery difficulties in electronic commerce. When failures occur, customers rarely seek aid from the first-line staff members of e-service companies. Customer also causes some e-failures, such as

missing passwords. If customers perceive the risks of failures, they may be unwilling to participate in self recovery for fear of jeopardizing their safety and property. An example of this is theft identity to be used in illegal actions. While customer participation can help speed up the recovery process and shorten the recovery time, it can also result in high recovery performance. Conversely, customers who engage in the self-recovery process may have a better understanding of the e-service or have more interaction with service providers via website or email. Figure 8(d) shows little difference between the three groups in terms of technological ability. That is, the ratio that firms invest in technology is the same regardless of how profitable they are. This implies that firms may have grasped the appropriate ratio of investment that has the greatest effectiveness in self-service recovery technologies. In summary, customers with high participation are critical to successful recovery, and can also generate more profit for firms.



(a) Prior E-trust *(b) Post E-trust*

(c) Firm profitability *(d) Technology based ability*

Figure 8. Simulated results for different degrees of customer participation

5 CONCLUSION

The importance of e-service in the fiercely competitive e-commerce has grown over the years, attracting a lot of attention. To maintain long-term relationships with customers and their reuse intention rate, service providers must satisfy the needs of customers, and especially when service failures occur. If firms cannot deal with failures effectively, customers may easily become upset and quickly change service providers. One the other hand, e-trust plays a critical role in driving customer relationships in the e-recovery process. Thus, service managers must consider the whole recovery process when designing an efficient and successful strategy.

This study uses a system dynamics approach to model an e-service recovery framework for e-trust. The results of this study provide firms with insights into the causal relationships among trust issues in the complex recovery process. This study uses conduct simulation to evaluate the recovery performance based on the system dynamics approach. This study shows that the time delay effect creates the illusion that service recovery is costly, and ultimately boosts firms' profit and revenue. Thus, service recovery cannot be neglected. In addition, customer prior perceived service quality positively affects prior recovery e-trust when failures occur. However, customers who posses low perceived service quality will have higher post e-trust and subsequently generate more profit for firms

than those with a high perceived service quality. Thus, managing key members for firms is extremely important, as 20% of its customers generally produce 80% of its profit.

The severity of failures negatively influences customer prior recovery e-trust. Customers who encounter high failure severity yet ultimately resolve their problems will have greater post e-trust and generate more profit for firms than those with a low degree of service failure. Hence, service providers should recognize the failure severity and classify types of failures commonly occurring in e-services. Accordingly, firms can develop a customized service recovery strategy to satisfy a variety of customers. Finally, customer participation is critical to the success of recovery. The more customers contribute to the recovery process, the higher post e-trust will be. Thus, firms can develop explicit online instructions to show customers how to participate in self-recovery. On the other hand, firms can provide an integrated complaint system for those who are unwilling to participate in recovery. When dissatisfied customers voice their complaints, firms can immediately appease them.

There are a few limitations to this study, which should considered when interpreting the findings. First, there is a variety of factors in the service recovery process. To simplify, this study defines the research boundary and focuses e-service recovery on system-based trust and technology-based failures. Second, this study sets equations for computer simulation by referring to previous studies, and subsequently evaluates the recovery performance for service companies in the real world. Hence, the simulation results cannot be applied to all cases of e-service recovery, and are not appropriate for all kinds of e-service firms. Consequently, further research should use field studies, interviews, and case studies to collect accurate values and set appropriate equations for computer simulations. The e-recovery framework can also be modified according to each company's characteristics to simulate real recovery processes. Thus, it may prove beneficial for a company to apply the simulation results to its practices in the future.

References

Google financial table. http://investor.google.com/financial/tables.html

B2B News (2010). Amazon has suffered a temporary web service failure. http://www.modernb2b.com/amazon-have-suffered-a-temporary-web-service-failure/342106/.

Anderson, R. E. and Srinivasan, S. S. (2003). E-satisfaction and e-loyalty: a contingency framework. *Psychology& Marketing*, Vol. 20 (2), 123-138.

Bart, Y., Shankar, V., Sultan, F. and Urban, G. L. (2005). Are the drivers and role of online trust the same for all web sites and consumers? A large-scale exploratory empirical study. *Journal of marketing*, Vol. 69, 133-152.

Chiu, C. M., Huang, H. Y. and Yen, C. H. (2010). Antecedents of trust in online auctions. *Electronic Commerce Research and Applications*, 9, 148-159.

DeWitt, T., Nguyen, D. T. and Marshall R. (2008). Exploring customer loyalty following service recovery, the mediating effects of trust and emotions. *Journal of Service Research*, Vol. 10, No. 3, 269-281.

Dong, B., Evans, K. R. and Zou, S. (2008). The effects of customer participation in co-created service recovery. *Journal of the Academy of Marketing Science*, Vol.36, No.1, 123-137.

Gefen, D. and Straub, D. W. (2004). Consumer trust in B2C e-Commerce and the importance of social presence: experiments in e-Products and e-Services. *The International Journal of Management Science*, 32, 407-424.

Grabner-Kr.autera, S. and Kaluschab, E. A. (2003). Empirical research in on-line trust: a review and critical assessment. *International Journal of Human-Computer Studies*, Vol. 58, Iss.6, 783-812.

Holloway, B. B. and Beatty, S. E. (2003). Service failure in online retailing, a recovery opportunity. *Journal of Service Research*, Vol. 6, No. 1, 92-103.

Jr., R. L. H, Ganesan, S., Klein, N. M. (2003). Service failure and recovery: The impact of relationship factors on customer satisfaction", *Journal of the Academy of Marketing Science*, Vol. 31, No. 2, 127-145.

Kim, C., Zhao, W. and Yang, K. H. (2008). An empirical study on the integrated framework of e-CRM in online shopping: evaluating the relationships among perceived value, satisfaction, and

trust based on customers' perspectives. *Journal of Electronic Commerce in Organizations*, Vol.6, Iss. 3, 1-19.

Kim, J., Jin, B. and Swinney, J. L. (2009). The role of etail quality, e-satisfaction and e-trust in online loyalty development process. *Journal of Retailing and Consumer Services*, 16, 239-247.

Kotler P. (1997), *Marketing Management.*

Liao, N. N. H. and Wu, T. C. (2009). The pivotal role of trust in customer loyalty: empirical research on the system integration market in Taiwan. *The Business Review*, Vol.12, No.2, 277-282.

Maxham, J. G. (2001). Service recovery's influence on consumer satisfaction, positive word-of-mouth, and purchase intentions. *Journal of Business Research*, 54, 11-24.

Meuter, M. L., Ostrom, A. L., Roundtree, R. I. and Bitner, M. J. (2000). Self service technologies: understanding customer satisfaction with technology-based service encounters. *Journal of Marketing*,Vol.64, 50-64.

Michel, S., Bowen, D. and Johnston, R. (2009). Why service recovery fails. Tensions among customer, employee, and process perspectives. *Journal of Service Management*, Vol.20, No.3, 253-273.

Miller, J. L., Craighead, C. W. and Karwan, K. R. (2000). Service recovery: a framework and empirical investigation. *Journal of Operations Management*, 387-400.

Reichheld, F. F. and Sasser, W.E. (1990). Zero Defections: Quality Comes to Services. *Harvard Business Review*, September-October, 105-111.

Reichheld, F. F. and Schefter P. (2000). E-loyalty: Your Secret Weapon on the Web. *Harvard Business Review*, 78, 105-113.

Ribbink, D. Riel, A. C. R. V., Liljander, V. and Streukens, S. (2004). Comfort your online customer: quality, trust and loyalty on the internet. *Managing Service Quality*, Vo1.14, No. 6; 446-644.

Rousseau, D., Sitkin, M., Burt, R., and Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, 23(3), 393-404.

Sanchez-Franco, M. J. (2009). The moderating effects of involvement on the relationships between satisfaction, trust and commitment in e-banking. *Journal of Interactive Marketing*, 23, 247-258.

Seawright, K. K., DeTienne, K. B., Bernhisel, M. P. and Larson, C. L. H. (2008). An empirical examination of service recovery design. *Marketing Intelligence & Planning*, Vol.26, No.3, 253-274.

Skaanning, C. (2005). The costs and benefits of customer self-service. The Wise Marketer. http://www.thewisemarketer.com/features/read.asp?id=83

Sousa, R. and Voss, C. A. (2009). The effects of service failures and recovery on customer loyalty in e-services: An empirical investigation. *International Journal of Operations & Production Management*, Vol. 29, No. 8, 834-864.

Sterman, J. D. (2000). *Business dynamics, systems thinking and modelling for a complex world*. McGraw-Hill, United States of America.

Tamimi, N. and Sebastianelli, R. (2007). Understanding eTrust. *Journal of Information Privacy & Security*, 3(2), 3-18.

Urban, G. L., Amyx, C. and Lorenzon, A. (2009). Online trust: state of the art, new frontiers, and research potential. *Journal of Interactive Marketing*, 23, 179-190.

Wang, Y. S., Wu, S. C., Lin, H. H. and Wang, Y. Y. (2010). The relationship of service failure severity, service recovery justice and perceived switching costs with customer loyalty in the context of e-tailing. *International Journal of Information Management*, 1-10.

Weun, S., Beatty, S. E. and Fones, M. A. (2004). The impact of service failure severity on service recovery evaluations and post-recovery relationships. *Journal of Services Marketing*, Vol.18, No.2, 133-146.

Wu, A. (2011). Bank of America website down, leaving customers unhappy. Epoch Times. http://www.theepochtimes.com/n2/content/view/49326/.