

e-CRM and Digitization of Word of Mouth

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ABSTRACT

Well-known e-CRM strategy is to focus on profitable customers and pay less attention to unprofitable ones. Moreover, some researchers recommend not serving unprofitable ones any more. However, it often neglects customers' indirect value. Deselecting unprofitable customers can raise the issue of bad word-of-mouth publicity especially in the age of the Internet. Some studies pointed out that a customer's decision to buy a product or service is often strongly influenced by others. In this paper, we consider customers' word-of-mouth effect on quality learning of inexperienced customers. We show that firms implementing e-CRM must take the effect into the consideration when deselecting unprofitable customers.

Keywords: CRM Adoption, Market Competition, Customer Value, Word-of-Mouth, Reputation

1. INTRODUCTION

The Information Technology (IT) revolution has enabled firms to collect and store an enormous volume of customer data, analyze customer profitability and interact more effectively with customers. Moreover, it has created a new marketing paradigm, Customer Relationship Management (CRM). The objective of CRM is to maximize profit by retaining customers and leveraging customer value. However, some researchers have noted that not all customers are equally profitable [7]. It

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means that customers make different costs and revenue contributions. Some commercial banks provide more extreme examples. They find that 10 percent of their top current customers are responsible for more than 100 percent of their profits, while the other 90 percent lose money [9]. IT as a CRM-enabler allows for detailed analysis of each customer and therefore, increases the focus on customer profitability when CRM strategy is implemented.

A typical analysis model of customer profitability is the lifetime value (LTV) analysis. A customer's LTV is the present value of the sum of the expected margins over time less the cost of serving the customer [4]. Peppers and Rogers [7] insist that firms must treat different customers differently depending on customer profitability. Many research papers also agree with the strategy of firms' cream skimming of profitable customers [1, 13]. Similar tactics such as "demarketing" [6] or "firing" [7] are suggested as treatment of the unprofitable customers

However, the above studies only focus on the effect of the customers' direct value on profit and do not mention the second-order effects of the customers [10]. Firing unprofitable customers can raise the issue of bad word-of-mouth publicity especially in the age of the Internet. When First Chicago Bank began charging customers for doing transactions at a teller window that could have been performed at an ATM, the goal was to provide a disincentive to those unprofitable customers who tended to take up more teller-window time and money than the profit contribution. However, the result was a wave of very bad publicity, held up by the press as an example of disservice to customers [7]. On the other hand, if a firm treats the unprofitable customers well, the customers can indirectly contribute to the firm through spreading positive word-of-mouth [10].

Domingos and Richardson [3] pointed out a customer's decision to buy a product or service is often strongly influenced by her friends, acquaintances and etc. Vettas [11] says that consumers that are uncertain about the characteristics of products are often able to learn from word of mouth of other customers who have previously experienced the products. The idea of word-of-mouth learning about products was introduced in a study of air conditioner sales in North Philadelphia neighborhoods by Whyte [12], and has been found to be a significant source of customers' learning in a variety of markets [11]. Especially in the recent Internet age, communication technology makes the exchange of information among experienced customers and potential new customers more powerful. Banerjee and Fudenberg [2], and Ellison and Fudenberg [5] explore learning dynamics with word-of-mouth communication. Rogerson [8] derives that owing to reputation, high quality firms have more customers because they have fewer dissatisfied customers who leave, and word-of-mouth advertising results in more ar-

rivals. Vettas [11] study focuses on a monopolist introducing a new durable good of unknown quality. Consumers are able to learn about the quality through other experienced customers. The firm has better information about the quality of the good, and through its choice of supply path, it controls the rate of information diffusion.

In this paper, we consider customers' word-of-mouth effect on quality learning of inexperienced customers. We show that firms implementing CRM must take the effect on potential customers into the consideration when deselecting unprofitable customers. Additionally, we show how firms decide to deploy CRM depending on the difference of firms' CRM deployment costs.

2. Model

2.1 Basic Model Setting

We assume duopoly firms in the market. A firm can decide whether to implement CRM. If the firm decides to implement CRM, it can select the target customers and implement upgraded service for them. The firm can fire unprofitable customers or just keep them for strategic reasons. We assume that customers are not equally profitable. For simplicity, it is assumed that there are two extreme groups of customers – highly profitable customers (H) and highly unprofitable customers (L). The number of customers in Group H is N_H and the number of customers in Group L is N_L in each period ($N_H + N_L = 1$). τ_i represents the profitability of each group. We assume that $\tau_H = 1$ and $\tau_L = 0$. The utility function of the customer is $U_i = \alpha_{jk}^i (1 - \beta) \tau_i$, where α_{jk}^i represents the quality of service or product that firm j provides to group i in period k . Each customer in Group H is willing to pay $\alpha_{jk}^H \beta \tau_H$ while each customer in Group L contributes nothing to the firm since $\tau_L = 0$. It is assumed that the quality of service or product is unknown before purchasing but is revealed once the consumers buy it. Therefore, inexperienced new customers can only expect the quality based on the average reputation of the service or product of the firm. Firms have exact information about the quality of service or product they provide. Therefore, they can manipulate the reputation by providing a good quality product or service.

We designed a two-period game and the timing is as follows:

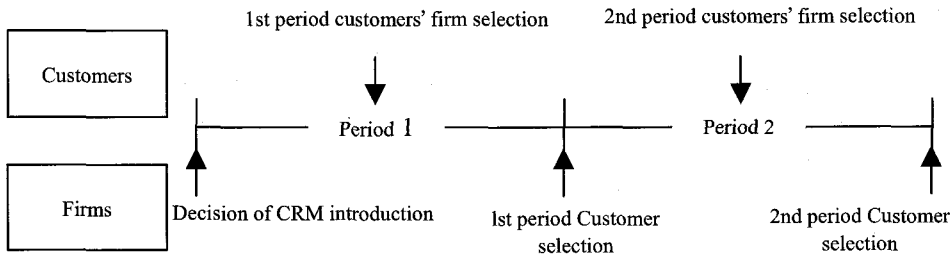


Figure 1. Two-period game of the model

- (1) In the first period, duopoly firms simultaneously decide whether to implement CRM. If the firm decides to implement CRM, it pays the investment cost of CRM deployment – building data warehouse, purchasing software, rebuilding process and transforming organization. We assume the investment cost can differ from firm to firm since it is highly depend on a firm's situation.
- (2) The first period customers select between firm1 and firm2. Customers only expect quality based on reputation. However, such reputation has not been made in the previous period. Therefore, we assume that the customers expect that qualities of two firms are indifferent, $E(\alpha_{11}^i) = E(\alpha_{21}^i)$. Therefore, customers are evenly distributed between the firms.
- (3) Having observed the incoming customers, a firm that implements CRM can select the target customer group to serve and deselect the group not to serve considering the word-of-mouth effect on the second period customers. However, if the firm doesn't implement CRM, the firm could not study customers and could not distinguish customers' profitability. In this case, we assume the firm can only serve all the customers at the same level of general service.
- (4) In the beginning of the second period, the customers flow into the market and can get the word-of-mouth information from first period customers. First period customers spread word-of-mouth publicity. If they are treated well with upgraded service in the first period, they spread positive word-of-mouth publicity about the quality of service or product. If they are refused service, then they spread negative publicity. The second period customers can get the information about the average reputation. Depending on the information, the second period customers choose a firm.
- (5) After observing the incoming customers, a firm that implements CRM selects the target customer group to serve. If the firm doesn't implement CRM, the firm can only serve all the customers at the same level of general service.

2.1.1 Basic Profit of firms

If both firms decide not to implement CRM, first and second period customers are evenly distributed between two firms since the following conditions, $E(\alpha_{11}^i) = E(\alpha_{21}^i)$ and $E(\alpha_{12}^i) = E(\alpha_{22}^i)$ hold. We assume that without CRM, firms cannot distinguish customers' type. Therefore, both firms serve all customers who choose the firm with basic level of service, α . We assume the cost of basic level of service is 1. The profit of firms is $\pi_i(F1 - NoCRM, F2 - NoCRM) = (\alpha\beta - 1)N_H - N_L$, where $\alpha\beta > 1$. We regard this function as the basic profit of the potential market. The basic profit can be positive or negative. First, we consider the case of positive or zero basic profit and then investigate the case of negative one.

2.2 Case of Non-negative Basic Profit

If a firm implements CRM, it can differentiate service level, selecting and serving with upgraded service, selecting and serving with basic level of service or deselecting and refusing to serve. We assume the quality of upgraded service as $\delta\alpha$ ($\delta > 1$) and the cost of the service as δ . The firm then serves customers with different level of service depending on customers' profitability and reputation effect. To Group H customers, it is always profitable to serve them with upgraded service. On the other hand, Group L customers always make direct loss to the firm. If it's one period game, the firm is better not to serve them. However, for building better reputation, the firm has incentive to keep 1st period Group L customers in some situation. But, the firm that implements CRM has no incentive to serve 2nd period Group L customers.

2.2.1 Only One Firm with CRM

In case, if only one of firms, firm1 implements CRM, the firm can manipulate the reputation to the 2nd period customers by selecting, selecting and value leveraging or deselecting first period customers. As written above, firm1 will always retain and value leveraging Group H customers. Therefore, the strategic decision is whether to retain Group L customers or not. If firm1 deselect type L customers, the expected quality of service or product of the firm to the second period customers is $E(\alpha_{12}^i) = \delta\alpha N_H$.

On the other hand, firm2 serve to all the customers who choose firm2 with basic level of service. The expected quality of firm2 to the second period customer is α . In the second period, the firm that has better reputation takes all the potential customers. Therefore, all second period customers choose firm1 if

$E(\alpha_{12}^i) > E(\alpha_{22}^i)$. If $E(\alpha_{12}^i) = E(\alpha_{22}^i)$, firm1 and firm2 evenly share second period customers. Otherwise, all second period customers choose firm2. If $N_H > 1/\delta$, $E(\alpha_{12}^i) > E(\alpha_{22}^i)$. Therefore, the profit function of firm1 is as follows. Notation, D_1 represents that firm1 deselected Group L customers. F_1 represents CRM introduction cost of firm1.

$$\begin{aligned}\pi_1(F1 - CRM, F2 - NoCRM, D_1, N_H > 1/\delta) &= 3\delta(\alpha\beta - 1)N_H/2 - F_1, \\ \pi_1(F1 - CRM, F2 - NoCRM, D_1, N_H < 1/\delta) &= \delta(\alpha\beta - 1)N_H/2 - F_1, \text{ and} \\ \pi_1(F1 - CRM, F2 - NoCRM, D_1, N_H = 1/\delta) &= \delta(\alpha\beta - 1)N_H - F_1.\end{aligned}$$

If firm1 retains Group L in 1st period, firm1 can maintain better reputation than firm2. The expected quality of service or product of the firm to the second period customers is $E(\alpha_{12}^i) = \delta\alpha N_H + \alpha N_L$. The profit of firm1 is $\pi_1(F1 - CRM, F2 - NoCRM, SB_1) = 3\delta(\alpha\beta - 1)N_H/2 - N_L/2 - F_1$. Notation, SB_1 represents that firm1 serves Group L customers with basic level service.

The optimal strategies and profits depending on the condition are described as follows.

Condition	Group L	Profit
$N_H \leq 1/\delta$	Keep with basic level of service	$\pi_1(F1 - CRM, F2 - NoCRM, SB_1)$
$N_H > 1/\delta$	Deselect and refuse to serve	$\pi_1(F1 - CRM, F2 - NoCRM, D_1, N_H > 1/\delta)$

It means that firm1 is always better off through maintaining better reputation than firm2. However, the strategy to maintaining better reputation can differ based on different exogenous condition. If the number in Group H is greater than $1/\delta$, it can maintain better reputation even though it deselected Group L customers

2.2.2 Two firm with CRM

If both firms implement CRM, we assume that they play non-cooperative game. If firm2 deselected Group L customers, firm1's optimal strategy is retaining Group L customers to maintain better reputation than firm2. The profit function of firm1 when firm2 refuse to serve Group L customers is

$$\pi_1(F1 - CRM, F2 - CRM, SB_1, D_2) = 3\delta(\alpha\beta - 1)N_H/2 - N_L/2 - F_1,$$

where D_2 represents that firm2 deselected 1st period Group L customers. The profit function of firm2 is

$$\pi_2(F1 - CRM, F2 - CRM, SB_1, D_2) = \delta(\alpha\beta - 1)N_H / 2 - F_2 .$$

If firm2 retains Group L with basic level of service, the optimal strategy of firm1 is retaining Group L customers with upgraded service to maintain better reputation than firm2. The profit of firm1 is $\pi_1(F1 - CRM, F2 - CRM, SU_1, SB_2) = 3\delta(\alpha\beta - 1)N_H / 2 - \delta N_L / 2 - F_1$.

SU_1 represents that firm1 serve 1st period Group L customers with upgraded service. The profit function of firm2 is $\pi_2(F1 - CRM, F2 - CRM, SU_1, SB_2) = \delta(\alpha\beta - 1)N_H / 2 - N_L / 2 - F_2$.

If firm2 retains Group L with upgraded service, the optimal strategy of firm1 is retaining Group L with upgraded service. In this case, firm1 has no way to maintain better reputation since firm2 achieve maximum level of reputation. Therefore, firm1 is willing to maintain same level of reputation compared with firm2 for not loosing the second period market. The profit function of firm1 and firm2 is the same as follows.

$$\pi_i(F1 - CRM, F2 - CRM, SU_1, SU_2) = \delta(\alpha\beta - 1)N_H - \delta N_L / 2 - F_i$$

The reaction strategy of firm2 given firm1's strategy is same to that of firm1's strategy given strategy of firm2. Therefore, there exists one Nash equilibrium solution that both firms retain Group L customers and serve them with upgraded service. The optimal strategies and profits depending on the condition are described as below.

Group L	Profit
Keep with upgraded service	$\pi_i(F1 - CRM, F2 - CRM, SU_1, SU_2)$

2.2.3 Decision of whether to deploy CRM

Given optimal strategy scheme in each situation, firms must make decision of whether to deploy CRM. If the cost of CRM introduction is zero, both firms are willing to deploy CRM. However, CRM introduction cost can be severe and differ from firm to firm.

Firm1 Firm2	CRM	No-CRM
CRM	$\pi_1(F1 - CRM, F2 - CRM)$ $\pi_2(F1 - CRM, F2 - CRM)$	$\pi_1(F1 - NoCRM, F2 - CRM)$ $\pi_2(F1 - NoCRM, F2 - CRM)$
No-CRM	$\pi_1(F1 - CRM, F2 - NoCRM)$ $\pi_2(F1 - CRM, F2 - NoCRM)$	$\pi_1(F1 - NoCRM, F2 - NoCRM)$ $\pi_2(F1 - NoCRM, F2 - NoCRM)$

\tilde{F} is the cost that makes $\pi_1(F1-CRM, F2-CRM)$ and $\pi_1(F1-NoCRM, F2-CRM)$ indifferent. \hat{F} is the amount of fixed cost that makes $\pi_1(F1-CRM, F2-NoCRM)$ and $\pi_1(F1-NoCRM, F2-NoCRM)$ indifferent. Therefore, the result for a firm is illustrated as follows.

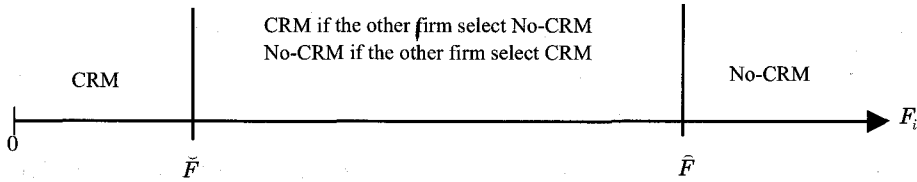


Figure 2. Reaction strategies of firms of the case of non-negative basic profit

Considering both firms' result simultaneously, the result can be derived as follows.

2.2.4 Results

Proposition 1: *If a firm can make non-negative profit without CRM, it is better off maintaining better reputation than the other firm when implementing of CRM.*

Proof. Omitted

Proposition 2: *If a firm can make non-negative profit without CRM, the 1st period unprofitable customers are refused to be served when only one firm is implementing CRM and the number of profitable customers is large enough to building better reputation without serving unprofitable ones.*

Proof. Omitted

Proposition 3: *If firms can make non-negative profit without CRM and only one firm is implementing CRM, the required number of profitable customers for building better reputation than the other firm without serving 1st period unprofitable customers decreases as the effectiveness of CRM, δ increases.*

Proof. The only firm that implements CRM can build better reputation without serving unprofitable customers when $N_H > 1/\delta$ and $\partial(1/\delta)/\partial\delta < 0$.

CRM effectiveness allows the only firm that implement CRM to less rely on unprofitable customers for maintaining better reputation.

Proposition 4: *If firms can make non-negative profit without CRM, the 1st period unprofitable customers are retained and serve with upgraded service when both firms implement CRM.*

Proof. Omitted

Proposition 5: *If the CRM deployment costs of firms are in the same symmetric range, so is CRM deployment decision.*

Proof. If $0 \leq F < \tilde{F}, \tilde{F} \leq F < \hat{F}$ and $\tilde{F} \leq F$, the optimal strategies of firms are both deploying CRM, both playing mixed strategy with same probability scheme, both not deploying CRM.

Proposition 6: *If firms can make non-negative profit without CRM, only the firm whose CRM deployment cost falls in relatively lower cost range than the other firm implements CRM.*

Proof. If firm1's cost falls in the range of $0 \leq F < \tilde{F}$ while the cost of firm2 is in $\tilde{F} \leq F < \hat{F}$, then only firm1 deploys CRM. If firm2 deploy CRM, it is worse off.

2.3 Case of Negative Basic Profit

2.3.1 Only One Firm with CRM

Like in Case of Non-negative Basic Profit, the firm is willing to maintain better reputation than the other firm that doesn't implement CRM. However, if the number in Group H is smaller than $N_L / 2\delta(\alpha\beta - 1)$, the firm that implements CRM gives up building reputation for 2nd period market and only serve Group H in the first period. The optimal strategies and profits depending on the condition are described below.

Condition	Group L	Profit
$N_H \leq N_L / 2\delta(\alpha\beta - 1)$	Deselect and refuse to serve	$\pi_1(F1 - CRM, F2 - NoCRM, D_1, N_H \leq N_L / 2\delta(\alpha\beta - 1)) = \delta(\alpha\beta - 1)N_H / 2 - F_1$
$N_L / 2\delta(\alpha\beta - 1) < N_H \leq 1/\delta$	Keep with basic level of service	$\pi_1(F1 - CRM, F2 - NoCRM, SB_1) = 3\delta(\alpha\beta - 1)N_H / 2 - N_L / 2 - F_1$
$N_H > 1/\delta$	Deselect and refuse to serve	$\pi_1(F1 - CRM, F2 - NoCRM, D_1, N_H > 1/\delta) = 3\delta(\alpha\beta - 1)N_H / 2 - F_1$

2.3.2 Two firm with CRM

Unlike the case of positive or zero basic profit, firms need more sophisticated re-

action strategies. The reaction strategies of firm1 can be illustrated as follows in given firm2 strategy and condition.

Given firm2 strategy of Group L in 1 st period	Given Condition		Firm1's optimal reaction strategy of Group L in 1 st period
Keep with upgraded service	All condition		Deselect and refuse to serve
Keep with basic level of service	$\delta \leq 2$	$N_H > \frac{N_L}{2(\alpha\beta - 1)}$	Keep with upgraded service
		$N_H \leq \frac{N_L}{2(\alpha\beta - 1)}$	Deselect and refuse to serve
	$\delta > 2$	$N_H > \frac{(\delta - 1)N_L}{\delta(\alpha\beta - 1)}$	Keep with upgraded service
		$\frac{N_L}{\delta(\alpha\beta - 1)} < N_H \leq \frac{(\delta - 1)N_L}{\delta(\alpha\beta - 1)}$	Keep with basic level of service
		$N_H \leq \frac{N_L}{\delta(\alpha\beta - 1)}$	Deselect and refuse to serve
Deselect and refuse to serve	$N_H > \frac{N_L}{\delta(\alpha\beta - 1)}$		Keep with basic level of service
	$N_H \leq \frac{N_L}{\delta(\alpha\beta - 1)}$		Deselect and refuse to serve

The reaction strategy of firm2 given firm1's strategy is same to that of firm1's strategy given strategy of firm2. Therefore, there exists one Nash equilibrium solution under the following conditions. The optimal strategies and profits depending on the condition are described as below.

Condition	Group L	Profit
$N_H \leq \frac{N_L}{\delta(\alpha\beta - 1)}$	Deselect and refuse to serve	$\pi_i(F1 - CRM, F2 - CRM, D_1, D_2)$ $= \delta(\alpha\beta - 1)N_H - F_i$
$\delta > 2$ & $\frac{N_L}{\delta(\alpha\beta - 1)} < N_H \leq \frac{(\delta - 1)N_L}{\delta(\alpha\beta - 1)}$	Keep with basic level of service	$\pi_i(F1 - CRM, F2 - CRM, SB_1, SB_2)$ $= \delta(\alpha\beta - 1)N_H - N_L / 2 - F_i$

In other conditions, there doesn't exist pure Nash equilibrium. Therefore, in that situation, we need to derive mixed strategy. Firms will execute mixed strategy as follows.

- Firms will deselect Group L customers with probability $1 - (\delta - 1)(1 - N_H) / \delta(\alpha\beta - 1)N_H$

- Firms will serve Group L with basic level service with probability $(1 - N_H) / (\alpha\beta - 1)N_H - 1$
- Firms will serve Group L with upgraded service with probability $1 - (1 - N_H) / \delta(\alpha\beta - 1)N_H$

2.3.3 Decision of whether to deploy CRM

Given optimal strategy scheme in each situation, firms must make decision of whether to deploy CRM. If the cost of CRM introduction is zero, both firms are willing to deploy CRM. However, CRM introduction cost can be severe and differ from firm to firm. The result for a firm is illustrated as follows.

If $N_H \leq N_L / 2\delta(\alpha\beta - 1)$

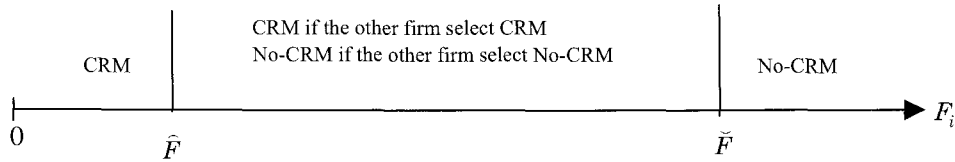


Figure 3. Reaction strategies of firms of the case of negative basic profit

Otherwise the result for a firm is just the same as that of Positive or Zero Basic Profit case.

2.3.4 Results

Proposition 7: *The only firm that implements CRM gives up building reputation if it makes severe negative profit without CRM*

Proof. Omitted.

Proposition 8: *Unlike the proposition 4, even though both firms implement CRM, both give up building better reputation and deselect unprofitable customers in the 1st period if they make significant level of negative profit without CRM.*

Proof. If $N_H \leq N_L / \delta(\alpha\beta - 1)$, both firms deselect unprofitable customers.

Proposition 9: *If firms make severe negative profit without CRM, the cost efficiency of one firm leads the other firm to deploy CRM if the CRM deployment cost of the other firm is not large enough.*

Proof. If firm1's cost is in the range of $0 \leq F < \hat{F}$ while the cost of firm2 is in

$\hat{F} \leq F < \tilde{F}$, then firm2 deploys CRM from the optimal reaction strategy of firm2 in the cost range, deploying CRM only when firm1 is deploying CRM and surely the firm1 deploys CRM since the cost of firm1 is in the range of $0 \leq F < \hat{F}$.

We can infer that the low cost structure of one firm can facilitate the other firm to deploy CRM. Finally both firms are better off through cutting off unprofitable customers without competing for better reputation.

Proposition10: *If firms make severe negative profit without CRM and both firms' CRM deployment cost is in the range of $\hat{F} \leq F < \tilde{F}$ where two Nash equilibria exist, both deploying CRM and both doing without CRM, there exists the incentive to cooperatively deploy CRM or not to deploy CRM cooperatively.*

Proof. If $F \leq \tilde{F}$, $\pi_1(F1 - CRM, F2 - CRM) \geq \pi_1(F1 - NoCRM, F2 - NoCRM)$. Else if $F > \tilde{F}$, $\pi_1(F1 - CRM, F2 - CRM) < \pi_1(F1 - NoCRM, F2 - NoCRM)$ where $\hat{F} < \tilde{F} < \bar{F}$.

Even though there exist two possible pure Nash equilibriums, firms can achieve better profit through cooperatively deploying CRM and kick out all unprofitable customers or cooperatively don't deploy CRM if the cost is relatively high and bear serving unprofitable customers.

3. CONCLUDING REMARKS

In this paper, we investigate the effect of word-of-mouth on customer selection. When considering the effect of the word-of-mouth, even the customers who contribute no profit directly can also be valuable to firms. Moreover, if both firms implement CRM, to improve their reputation, there exists an incentive to provide upgraded service even to the unprofitable customers if the market condition makes firms earn non-negative profit. However, if the loss occurred by unprofitable customers cannot be covered by the profit from profitable customers and the magnitude of the loss is significant, firms are willing to cooperatively give up competition for gaining a better reputation. Many researchers have suggested developing a customer selection and customer value leveraging strategy based on the direct valuation of customers. However, our research shows that the firm must take account of the indirect value of customers as well as their direct value when crafting a customer selection and customer value leveraging strategy. We

show that firing all the unprofitable customers can result in business failure in the age of the Internet.

Addition to that we show the win-win perspective of CRM adoption of firms. In the real world market, firms tend to adopt CRM to acquire competitive advantage. However, our analysis shows that CRM adoption can create win-win solution to firms when most of the customers are unprofitable. In this case, firms would rather not compete for gaining a better reputation but prefer to fire unprofitable customers cooperatively. Repeatedly, our model shows that CRM can be a win-win cooperative solution for firms.

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