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# Economics of CRM

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## Abstract

*With all the hype over CRM, most business practitioners believed that CRM technology would be able to solve all marketing problems and automatically create profitability from the customers. However many CRM implementation plans fail or are unsatisfactory. CRM incurs expensive introduction costs of technology and organizational transformation. In addition, more resources are needed for leveraging customer value, which is an important goal of CRM activities. Researchers blame CRM failure on the use of the wrong CRM strategy and imperfect organizational transformation. Then is there any right CRM guidance to correct these problems? Almost all the guidance we investigated seems to be obscure and speculative. Existing guidance do not take account of diverse market conditions that different firms face so that one-size-fit-all recipes may confuse the practitioner because it focuses more on CRM technology itself. They all advocate a firm's focus on retention and value leveraging of the limited number of only highly profitable customers. Then, what happens to less profitable customers? Does this cream-skimming work for every different market and firm? In order to answer these questions, we approach CRM from the economic point of view and derive the optimal strategic choices of CRM implementation pertaining to customer retention and value leveraging guidance. For different market situations, we consider network externalities. Our work provides a theoretical framework to verify the economic value of CRM. Our results show that market conditions and cost structure of CRM lead to quite different strategies in customer retention and leveraging. This may serve as a cautionary note to the hype that the CRM industry has created.*

## Keywords

CRM, CRM failure, CRM strategy, Customer selection, Network externalities, 20/80 rule

## 1. Introduction

The Information Technology (IT) revolution has enabled firms to collect and store an enormous volume of customer data, analyze customer profitability, interact more effectively with customers, and customize services or products. The combination of IT and marketing strategy has created the new marketing paradigm – Customer Relationship Management (CRM). There exist various definitions of CRM by academic researchers, business practitioners and market researching firms. Couldwell (1998) defined CRM as a combination

of information technology and the business process to understand customers. CRM is also defined as an integration of customer contact points that integrate the processes of marketing, sales and service (Öterle 1998). American Airlines defines it as a long-term business philosophy that focuses on collecting, understanding customer information, treating different customers differently, providing a higher level of service for the best customers and using these together to increase customer loyalty and profitability (Nairn 2002). Gartner Group defines CRM as a business strategy that optimizes profitability and customer satisfaction by organizing around customer segments, fostering customer-satisfying behaviors and implementing customer centric processes. The definitions above focus on somewhat different aspects of CRM but the converging view is that the goal of CRM is maximizing profit through *retaining profitable customers* and *leverage customers' value*.

In order to implement CRM, we need to deploy CRM technologies including a large data warehouse, call center software, self-service Web sites, OLAP and data mining. Companies like Siebel, E.piphancy, Oracle and others have made packaged products for CRM. We admit that CRM technologies play important roles in implementing CRM. However, CRM implementation cannot be completed without the right operation of CRM activities based on the *right* CRM strategy. To help implement CRM, researchers suggested various frameworks of the CRM process. Peppers and Roger (2000) proposed that the CRM process could be regarded as a series of identification, differentiation, interaction and customization steps. The first step is to view the customer across several points of interaction. Differentiation relates to the diverse needs and value potential of customers and suggests ways for further interaction and customization processes. Winer suggested that 7 basic components form the CRM process that include a database of customer activity, analysis of the database, decision about which customers to target with the given analysis, tools for targeting the customers, how to build relationships with the targeted customers, customer privacy issues, and measurement of the success of the CRM program (Winer 2001). According to the suggested CRM process, we first need to collect customer data from various channels and build a large database. The next step is to analyze customer profitability with the given database and analyzing tools or models. Typical analysis models of customer profitability are Recency, Frequency, Monetary (RFM) Analysis, and the Lifetime Value (LTV) Analysis that is measured by the present value of the sum of the expected margins over time less the cost (Dwyer 1997). The next decision is quite strategic. In this stage we have to determine the customers that we have to retain and the customers to be discarded. As a rule of thumb for customer selection criterion, the 80/20 rule has been suggested (Ryals & Knox 2001, Winer 2001). Pareto's 20/80 rule means that 20 percent of the customers contribute to 80 percent of the total profit and the rest of 80 percent of customers contribute only 20 percent of the profit (or revenue) (Koch 1998). Hence, it is very likely that the LTV of those less contributing customers becomes negative.

Some commercial banks provide more extreme cases. 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 of the customers lose money (Ryals & Knox 2001). Therefore, it is suggested that firms do cream skimming of those profitable customers (Adamian 1994, Ryals & Knox 2001, Winer 2001, Nairn 2002). Various business practitioners have implemented this criterion. A leading telecommunications company offers different levels of customer service according to their profitability in their long-distance telephone business. For highly profitable customers, they offer personalized services. A wireless provider raised monthly rates for unprofitable subscribers to drive away unprofitable subscribers (Winer 2001). Then, we have to ask now why this obvious simple strategy does not work if many of CRM implementations are indeed reported as failures. The main purpose of this research is to investigate the validity of this rule of thumb of customer selection that has been widely accepted but never theoretically tested. We claim that firms should be concerned not only with each individual customer's profitability but also with the interactions among them that characterize the firm's industry or products. One significant interaction involves network externalities which have been extensively studied in economics and MIS literature. There exist network externalities in various industries like computer hardware, software and the telecommunication industry. In the software industry, for the network externality, the firm is better off approving some piracy activities (Conner & Rumelt 1991, Slive & Berhardt 1998). Once the right customers are defined, customization, reward programs, loyalty programs and other various activities need to be implemented to selected customers. These programs and activities leverage customer value and finally create more profit for firms through the availability of cross-selling and up-selling. However, investment on these programs for customer value leveraging often incurs a high cost so that we need to consider the implementation of the programs carefully. A recent McKinsey study found that loyalty programs are expensive while the effectiveness is obscure (Cigliano et al. 2000).

Various firms decided to implement CRM to increase profit. However in reality, according to the Gartner Group, half of the US CRM projects and more than 80 percents of the European CRM projects are considered failures. CRM requires expensive investment for deploying CRM technologies. CRM implementation also causes invisible costs such as transformation of the organization and cross-functional coordination (Ryals & Knox 2001). Research firms blame the failure on the inappropriate organizational transformation (Cholewka 2002) and inappropriate CRM strategies according to the Gartner Group. Inappropriate CRM strategy seems to be the result of an insufficient understanding of customers and product characteristics, the absence of proven customer selection criterion and obscure effectiveness of customer value leveraging programs. The purpose of this paper is to provide CRM strategic guidance for customer selection and implementing leveraging programs. We approach CRM from the economic point of view, and we derive the optimal

strategies of CRM implementation under different market conditions, and we characterize the economic values of CRM.

## 2. The Model

As many cases and studies illustrate, not all customers provide equal profitability for a firm. The measurement models of customer profitability like NPV are related to a financial measure, return on investment (ROI). In the model, let the profitability or ROI of a customer be represented by  $\hat{t}$  where the revenue ( $R$ ) that is expected to be created by a customer over the expected cost ( $c, c > 0$ ) for serving the customer. That is,

$$t = \frac{R}{c}$$

If a customer's  $t$  is 0, the customer contributes no revenue to a firm while he costs the firm. If a customer's  $t$  is 1, the customer pays the exact amount of the cost she causes to the firm. Hence, the customer whose  $t$  is less than 1 is defined as the unprofitable one whereas the one whose  $t$  is more than 1 is defined as a profitable client. We assume there are  $aN$  customers who are willing to buy a firm's products or services. For tractability, we assume the customers'  $t$  are uniformly distributed according to  $U[0, a]$ , where  $a > 1$ .



Figure 1. Customer Profitability Distribution

The firm may not know the customers' profitability distribution due to the lack of a customer information database. To build the customer database and analyze customer profitability, the firm may need to invest in IT. If the firm only aims at understanding customer profitability distribution and decides not to invest in leveraging the customer valuation through extra programs such as a loyalty program and customization, then the firm doesn't need to deploy whole range of CRM-enabling technologies. Then, the firm may not require in-depth customer information such as personal preference or other detailed personal data. That may exclude the necessity of the larger expensive data warehouses. Small and inexpensive information systems may be good enough for the case where the firm does not suffer from other indirect costs such as organizational transformation for becoming more customer centric. In this case, based on the current customer profitability, the firm can select the customers to be served and deselect ones not to be served. The firm will invest in this *minimal CRM* as long as the benefit of cutting the loss expected by deselected unprofitable customers exceeds the cost of building such system.

If the firm advances with the customer value leveraging programs such as the loyalty program or mass customization, then it may have to invest in a larger data warehouse, various CRM technologies, and transforming the organization and processes as well. This will incur more expensive costs. Customer leveraging through up-selling and cross-selling can be achieved by personalized services, recommendation and other customization of marketing activities. Such programs require customer profiling, data mining, and customer filtering technologies accompanied with various incentive programs for the customer. CRM literature advocates a closed loop of marketing activities around CRM technology to take full advantage of CRM investment. We call such advanced system the *full CRM*. If the firm decides to implement customer value leveraging programs, the firm may implement the programs to all of the selected customers or only to the so-called VIP customers among the selected to be served. Recently firms are advised to pay more attention to such VIP customers. Private banking (PB) in the financial industry represents such an effort.

After selecting customers to be served based on CRM information, the firm's possible strategies include:

[S1] Employ minimal CRM to provide the minimal information on customers' profitability so that the firm can determine the customers to be served or to be discarded. However this lean system does not provide enough information or technology to implement any customer value leveraging programs.

[S2] Deploy the full CRM and implement customer value leveraging programs only to the limited VIP customers among selected customers. In other words, the firm provides differentiated services to its customers based on their profit contributions to the firm as seen in Private Banking, VIP Lounges etc.

[S3] Deploy the full CRM and implement customer value leveraging programs to all the selected customers.

We denote the cost of building the minimal CRM as  $F_{low}$  and that of the full CRM technology and other related costs as  $F_{high}$  (Of course,  $F_{high} > F_{low}$ ). As we noted, the industry or product characteristics affect the customer segmentation. To verify the influence of industry or product characteristics, we assume that the market is divided into two categories broadly, the market (M1) where each individual's purchase doesn't affect other consumers' consumption decisions, in other words, no network externalities, and the market (M2) with network externalities. We will derive the optimal strategy for the profit-maximizing firm in the market with and without network externalities.

## 2.1. Market without Externalities (M1)

Before implementing the minimal CRM, the firm could not distinguish its customers by their profit contributions. Then, the firm serves all the profitable and unprofitable customers with customer profitability information.

$$p_{0(M1)} = \int_0^a c(t-1)Ndt = Nac(\frac{1}{2}a-1) \quad (1)$$

If implementation of the optimal strategies of S1, S2 or S3 makes positive gain that is greater than  $p_{0(M1)}$  in Equation (1), the firm will certainly implement one of them.

**2.1.1. Implementation of S1**

If the firm employs S1, the firm needs to spend the fixed cost,  $F_{low}$ . Now the firm discovers the profitability distribution of its customers and can distinguish the desirable ones from the undesirable. Then, the firm may serve the desirable only. The firm is serving to customers whose  $\hat{o}$  is greater than  $x$ . The profit function of the firm becomes

$$p_{S1} = \int_x^a c(t-1)Ndt - F_{low}$$

The profit maximizing  $x^*$  is derived as 1 from first order condition,  $\frac{\partial p}{\partial x} = 0$ .

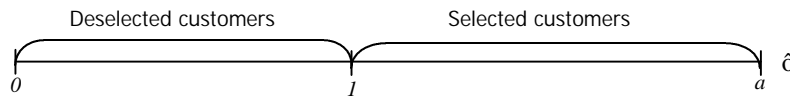


Figure 2. Customer selection criteria of S1 in M1 market

It means that the firm needs to serve only to the profitable customers. This conclusion is consistent with the 20/80 rule. The optimal profit of this strategy is

$$p_{S1}^* = \frac{1}{2}Nc(a-1)^2 - F_{low} \quad (2)$$

**2.1.2. Implementation of S2**

If the firm employs the VIP strategy, the firm needs to spend the fixed cost,  $F_{high}$ . Now the firm again finds the profitability distribution of customers, distinguish desirable ones, and then selectively serve the customers. Among the selected clients, the firm applies further customer value leveraging programs. The value-leveraging program creates additional costs. We assume the cost ( $I$ ) is additionally incurred for an act of value leveraging for each individual customer. We assume that the degree of the improvement of the customer

profitability through investment in the programs is proportional to the pre-defined  $\hat{o}$  of the each customer. For example, the investment in highly profitable customers makes a greater value leveraging effect while the investment in less profitable customers makes a smaller value leveraging effect compared to that of highly profitable ones. The investment in the programs improves  $\hat{o}$  by the amount  $d\mathbf{t}$ . The firm is implementing the program whose  $\mathbf{t}$  is greater than  $x_1$  (VIP threshold). The firm is serving a typical product or service to the customers whose  $\mathbf{t}$  is less than  $x_1$  and greater than  $x_2$  (Customer threshold). The profit function of the firm is

$$p_{S1} = \int_{x_1}^a \{c(1+d)\mathbf{t} - c - I\}Ndt + \int_{x_2}^{x_1} c(\mathbf{t} - 1)Ndt - F_{high}$$

From the first order condition, it is apparent that the optimal  $x_1^*$  is derived as  $\frac{I}{cd}$  and  $x_2^*$  is derived as 1. This will hold as long as  $1 \leq \frac{I}{cd} < a$ . It means that S2 is applicable where the condition,  $\frac{I}{ac} < d \leq \frac{I}{c}$  is met. Like the previous case, we retain only the profitable customers.

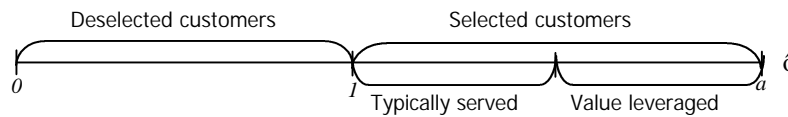


Figure 3. Customer selection criteria of S2 in M1 market

The optimal profit of this strategy is

$$p_{S2}^* = N\left\{\frac{1}{2}c(a-1)^2 + \frac{(acd - I)^2}{2cd}\right\} - F_{high} \quad (3)$$

### 2.1.3. Implementation of S3

When the firm implements S3, the all selected customers are targeted by the customer value leveraging program. The profit function of the firm is

$$p_{S3} = \int_x^a \{c(1+d)\mathbf{t} - c - I\}Ndt - F_{high}$$

From the first order condition, optimal  $x^*$  is derived as  $\frac{c+I}{c(1+d)}$ . If  $\frac{I}{ac} < d \leq \frac{I}{c}$ ,  $x^*$  is greater than 1. It means that the investment is costly to serve all the profitable customers since the efficiency of the investment is low. If  $d > \frac{I}{c}$ ,  $x^*$  is less than 1. It means that the efficiency of the leveraging effect is high enough that in addition to already profitable customers, some less profitable customers will be profitable additionally.



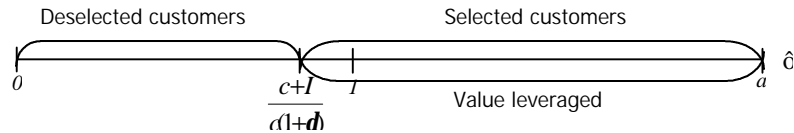


Figure 4. Customer selection criteria of S3 in M1 market

The optimal profit of this strategy becomes

$$p_{S3}^* = \frac{\{ac(1+d) - c - I\}^2}{2c(1+d)} N - F_{high} \quad (4)$$

## 2.2. Market with Network Externalities (M2)

In a market with network externality, a larger user base induces more buyers as the value of the product or service is improved as the number of users of the same product increases. Then the customers contribute not only through the direct revenue but also indirectly to a firm by adding more value to the product or service (Shapiro & Varian 1999). We define the indirect contribution of the number of  $q$  customers as  $qq$ . It means that each customer contributes the value  $q$  to the firm. Without CRM implementation, the firm has to serves all possible customers. Then the base profit of the firm can be derived as in Equation (5).

$$p_{0(M2)} = \int_0^a \{c(t-1) + q\} N dt = \frac{1}{2} Nac(a-2) + Naq \quad (5)$$

### 2.2.1. Implementation of S1

For implementing S1, the firm can selectively serve the customers as in the case of M1. The profit function of the firm is

$$p_{S1} = \int_x^a \{c(t-1) + q\} N dt - F_{low}$$

From the first order condition,  $x^*$  is derived as  $\frac{c-q}{c}$ . Clearly, the optimal threshold of selected customers in M2 is less than that of the market M1. This implies that firms cannot easily discard customers based on direct profitability under this market. If  $q$  is greater than  $c$ , optimal  $x^*$  is less than 0. So in this case, we define the optimal  $x^*$  as 0. In such an extreme case, all customers should be retained due to relatively large network value.

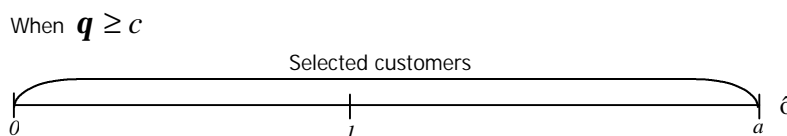


Figure 5. Customer selection criteria of S1 in M2 market when  $q \geq c$

The optimal profit of the strategy in case of  $q \geq c$  is

$$p_{S1}^* = \frac{1}{2}Nac(a-2) + Naq - F_{low} \quad (6)$$

If  $q$  is less than  $c$ , the optimal  $x^*$  is  $\frac{c-q}{c}$ , which is still less than the optimal  $x^*$  of S1 in case of M1. Still the firm is better off to include the customers who cause a loss in direct revenue to a firm but the indirect contribution covers the deficit caused by the customers. The firm needs to discard only highly unprofitable customers.

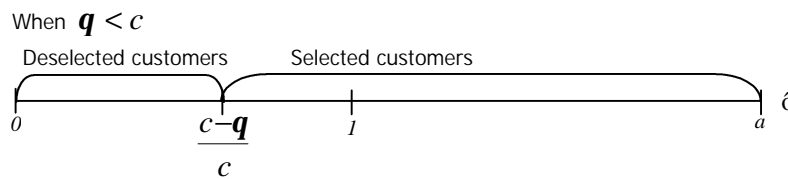


Figure 6. Customer selection criteria of S1 in M2 market when  $q < c$

The optimal profit of the strategy in case of  $q < c$  is

$$p_{S1}^* = N\{\frac{1}{2}c(a-1)^2 + \frac{1}{2c}q^2 + q(a-1)\} - F_{low} \quad (7)$$

### 2.2.2. Implementation of S2

With strategy S2, the profit function of the firm is

$$p_{S2} = \int_{x_1}^a \{c(1+d)t - c - I + q\}Ndt + \int_{x_2}^{x_1} \{c(t-1) + q\}Ndt - F_{high}$$

From the first order condition,  $x_1^*$  is derived as  $\frac{I}{cd}$ .  $x_2^*$  is derived as  $\frac{c-q}{c}$ . But as noted above, if  $q$  is greater than  $c$ , we define  $x_2^*$  as 0.  $x_1^*$  is the same as  $x_1^*$  of case M1. Since we can maximize the value of the network through the range of  $x_2^*$ , so the expensive value-leveraging program is implemented only for the highly profitable customers among selected ones. This will hold as long as  $0 \leq \frac{I}{cd} < a$  in case of  $q \geq c$ . It means that S2 is applicable

till the condition,  $\frac{I}{ac} < d$  is met in case of  $q \geq c$ .

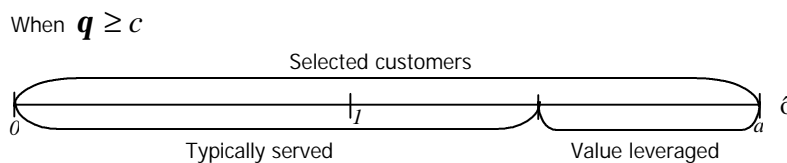


Figure 7. Customer selection criteria of S2 in M2 market when  $q \geq c$

The optimal profit of the strategy in case of  $q \geq c$  is as follows:

$$p_{S2}^* = N\left\{\frac{1}{2}ac(a-2) + aq + \frac{(acd - I)^2}{2cd}\right\} - F_{high} \quad (8)$$

When  $q < c$ , the optimal  $x_2^* = \frac{c-q}{c}$ . In case of S2, the firm is better off deselecting the highly unprofitable customers. This will hold as long as  $\frac{c-q}{c} \leq \frac{I}{cd} < a$  i.e.,

$$\frac{I}{ac} < d \leq \frac{I}{c-q} .$$

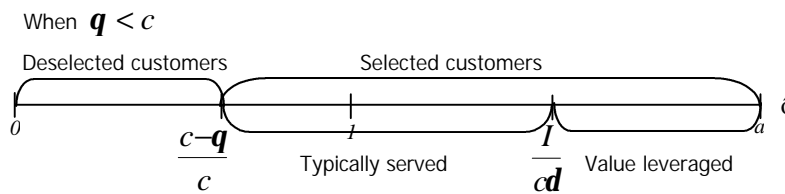


Figure 8. Customer selection criteria of S2 in M2 market when  $q < c$

The optimal profit of the strategy in case of  $q < c$  is

$$p_{S2}^* = N\left\{\frac{1}{2}c(a-1)^2 + \frac{1}{2c}q^2 + (a-1)q + \frac{(acd - I)^2}{2cd}\right\} - F_{high} \quad (9)$$

### 2.2.3. Implementation of S3

If S3 is employed, the firm implements its customer value leveraging programs to all of the selected customers. The profit function of the firm is

$$p_{S3} = \int_x^a \{c(1+d)t - c - I + q\} N dt$$

From the first order condition,  $x^*$  is derived as  $\frac{c+I-q}{c(1+d)}$ . If  $\frac{I}{ac} < d \leq \frac{I}{c-q}$  and  $q < c$ ,

$x^*$  is greater than  $\frac{c-q}{c}$ , the optimal level of S2 above. For expensive investment compared

with its effectiveness, the firm is better off reducing the number of customers. If  $d > \frac{I}{c-q}$ ,

$x^*$  is less than 1 for the effectiveness of the value leveraging programs.

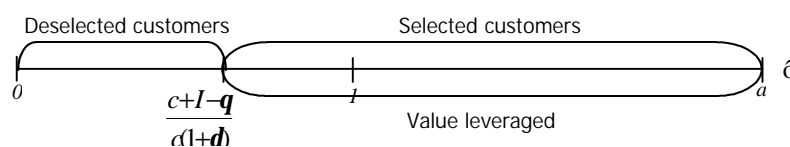


Figure 9. Customer selection criteria of S3 in M2 market

The optimal profit of this strategy is

$$p_{S3}^* = \frac{\{ac(1+d) - c - I + q\}^2}{2c(1+d)} N - F_{high} \quad (10)$$

### 3. Results

#### 3.1. Optimal strategy choice without Network Externalities

Now we compare the profit levels of the three CRM strategies for the market without network externalities. Note that the strategic decision of CRM implementation depends not only on the efficiency of the program itself but also on the cost structure of the service or product, and the customer profitability distribution.

**Proposition 1.** *If  $d$  is greater than  $\frac{I}{c}$ , S3 is the optimal strategy of the firm when the difference between  $F_{high}$  and  $F_{low}$  is small. Otherwise, S1 is the optimal strategy.*

**Proof.** If  $d$  is greater than  $\frac{I}{c}$ , S2 is not applicable. Then the remaining strategic choices are S1 and S3. Profit of implementing S3 is greater than that of implementing S1 if  $F_{low}$  equals  $F_{high}$  since variable profit of S1,  $\frac{1}{2}Nc(a-1)^2$  is smaller than that of S3,

$$\frac{\{ac(1+d) - c - I\}^2}{2c(1+d)} N. \text{ S3 can be the optimal strategy as long as } F_{high} - F_{low} \text{ is less than}$$

$$\frac{\{ac(1+d) - c - I\}^2}{2c(1+d)} N - \frac{1}{2}Nc(a-1)^2. \text{ If } F_{high} - F_{low} \text{ is greater than}$$

$$\frac{\{ac(1+d) - c - I\}^2}{2c(1+d)} N - \frac{1}{2}Nc(a-1)^2, \text{ S1 is the optimal strategy.}$$

As we noted, the value range of  $\ddot{a}$  is related to the value of  $I$  and  $c$ . If cost of a specific product or service,  $c_1$  is greater than that ( $c_2$ ) of the differentiated service for the same investment ( $I$ ) level, a specific value of  $d$  can be greater than  $\frac{I}{c_1}$  while  $d$  is less than  $\frac{I}{c_2}$ . Even for the same  $d, c$  and  $I$ , we must notice that the fixed cost has impact on

strategic choice. In reality, there exists much difference between the cost of a cheap marketing database,  $F_{low}$  and the cost of the full CRM enabling-technology and organizational transformation,  $F_{high}$ . So before implementing CRM strategy, a firm must consider the fixed costs of strategies.

**Proposition 2.** If  $\frac{I}{ac} < d \leq \frac{I}{c}$ , then S2 is the optimal strategy of the firm when the difference between  $F_{high}$  and  $F_{low}$  is small and S1 is the optimal strategy when the difference between  $F_{high}$  and  $F_{low}$  is high.

**Proof.** If  $\frac{I}{ac} < d \leq \frac{I}{c}$ , the profit of S3 is less than the profit of S2 since S2 gives more opportunity to make profit through providing service options ( $p_2^* - p_3^* = \frac{(I - cd)^2}{2cd(1+d)}N > 0$ ). But as in proposition 1, we must compare the profitability between S1 and S2 before determining the optimal strategy. The profit of implementing S2 is greater than that of implementing S1 if  $F_{low}$  equals  $F_{high}$  since variable profit of S1,  $\frac{1}{2}Nc(a-1)^2$  is smaller than that of S2,  $N\{\frac{1}{2}c(a-1)^2 + \frac{(acd - I)^2}{2cd}\}$ . S2 can be the optimal strategy as long as  $F_{high} - F_{low}$  is less than  $N\{\frac{1}{2}c(a-1)^2 + \frac{(acd - I)^2}{2cd}\} - \frac{1}{2}Nc(a-1)^2$ . If  $F_{high} - F_{low}$  is greater than  $N\{\frac{1}{2}c(a-1)^2 + \frac{(acd - I)^2}{2cd}\} - \frac{1}{2}Nc(a-1)^2$ , S1 becomes the optimal strategy.

In this case where investment is somewhat costly, it is better not to implement the costly customer-leveraging programs for all selected customers. However, we still do not have to discard the remaining profitable customers who don't qualify for the prestigious customer leveraging programs. To the remaining profitable customers we offer the typical service or products. In the real market, S2 is assumed to be the standard strategy and widely implemented. However, note that before considering the implementation of S2, the firm must weigh several factors such as the degree of the efficiency of the programs ( $d$ ), the investment on the leveraging programs ( $I$ ), the cost of customer transaction ( $c$ ), and the customer profitability distribution ( $a$ ) and the difference CRM setup costs of the minimal and full CRM technology.

**Proposition 3.** *If  $\ddot{a}$  is less than  $\frac{I}{ac}$ , then S1 is the optimal strategy of the firm.*

**Proof.** If  $\ddot{a}$  is less than  $\frac{I}{ac}$ , the investment ( $I$ ) exceeds the leveraging effect of the programs even for the most profitable customer. The leveraging value through investment in the most profitable customer is  $acd$ , which is less than the investment. So, S2 and S3 are not applicable in this situation. In this case, S1 is the optimal strategy if the profit of S1 is positive and exceeds the baseline,  $\mathbf{p}_{0(M1)}$ .

In this case, as the McKinsey study maintains, customer value leveraging programs such as loyalty programs may produce obscure or less profit gain than the expensive investment on the programs. We could prohibit the expensive investment in the program by analyzing the cost structure of the product or service and the customer profitability distribution.

## 3.2. Optimal strategy choice in the Market with Network

### Externalities

The firm needs to define the optimal strategy among the strategies. Unlike M1, the firm must consider the degree of the network effects.

**Proposition 4.** *If  $\ddot{a}$  is greater than  $\frac{I}{c-q}$  in case of  $q < c$ , S3 is the optimal strategy of the firm when the difference between  $F_{high}$  and  $F_{low}$  is small and  $\mathbf{p}_{S3}^*$  is positive and greater than  $\mathbf{p}_{0(M2)}$ . S1 is the optimal strategy when the difference between  $F_{high}$  and  $F_{low}$  is high and  $\mathbf{p}_{S1}^*$  is positive and greater than  $\mathbf{p}_{0(M2)}$ .*

**Proof.** If  $\ddot{a}$  is greater than  $\frac{I}{c-q}$ , S2 is not applicable in case of  $q < c$ . Then the remaining strategic choices are S1 and S3. The remaining proof is similar to proposition 1.

The interpretation of this proposition is similar to that of proposition 1. But in

proposition 1, if  $d$  is greater than  $\frac{I}{c}$ , invest to all selected customers. Note that  $\frac{I}{c}$  is less than  $\frac{I}{c-q}$ . The firm delays the implementation of S3 where  $d$  is greater than  $\frac{I}{c}$  but less than  $\frac{I}{c-q}$ . We explain it in the next proposition.

**Proposition 5.** *If  $\frac{I}{ac} < d \leq \frac{I}{c-q}$  in case of  $q < c$ , then S2 is the optimal strategy of the firm when the difference between  $F_{high}$  and  $F_{low}$  is small and  $p_{S2}^*$  is positive and greater than  $p_{0(M2)}$ . S1 is the optimal strategy when the difference between  $F_{high}$  and  $F_{low}$  is high and  $p_{S1}^*$  is positive and greater than  $p_{0(M2)}$ .*

**Proof.** If  $\frac{I}{ac} < d \leq \frac{I}{c-q}$ , the profit of S3 is less than the profit of S2 since S2 gives more opportunity for the firm to make profit through providing service options. The mathematical proof is similar to that of proposition 2. Then the remaining strategic choices are S1 and S2. The remaining proof is similar to proposition 2.

This proposition is similar to proposition 2. But there exists an additional range of  $\frac{I}{c} < d \leq \frac{I}{c-q}$  in this proposition. The firm's optimal strategy is S3 when M1 is in this range of  $d$ . But if the firm implements S3 in this range in case of M2, then the total number of retained customers becomes less than the number of retained customers of S2. It means that the value of the network decreases. The total benefit from the leveraged customers of S3 is less than the loss of the value of the network. For preserving the value of network, the firm is better off continuing providing leveraging programs only to the highly profitable customers in this  $d$  range.

**Proposition 6.** *If  $d$  is less than  $\frac{I}{ac}$  in case of  $q < c$ , then S1 is the optimal strategy of the firm when  $p_{S1}^*$  is positive and greater than  $p_{0(M2)}$ .*

The proof and explanation of the proposition is similar to proposition 3.

**Proposition 7.** *If  $d$  is greater than  $\frac{I}{ac}$  in case of  $q \geq c$ , then S2 is the optimal strategy of the firm when the difference between  $F_{high}$  and  $F_{low}$  is small and  $p_{S2}^*$  is positive and greater than  $p_{0(M2)}$ . S1 is the optimal strategy when the difference between  $F_{high}$  and  $F_{low}$  is high and  $p_{S1}^*$  is positive and greater than  $p_{0(M2)}$ .*

In this case, the proof is similar to that of proposition 5. However, the difference results from the fact that the network externality weighs more than the cost of the product or service. Then, the firm must retain all the customers to maximize the value of the network. So no customers are discarded.

**Proposition 8.** *If  $d$  is less than  $\frac{I}{ac}$  in case of  $q \geq c$ , then the firm better not implement any of the strategies.*

**Proof.** If  $d$  is less than  $\frac{I}{ac}$ , S2 and S3 strategies are not available as noted in proposition 3. The applicable strategy S1 results in serving all the customers. This is the same as the result of before introducing the CRM effort. But implement S1 causes fixed cost,  $F_{low}$ . So  $p_{0(M2)}$  is greater than  $p_{S1}^*$ .

It is ironic to notice that all the strategies damage the profit of the firm. Most of the researchers or CRM vendors insist that CRM creates value to the firm. And they blame the failure of the CRM on the wrong CRM strategy or wrong implementation. However this kind of hostile exogenous condition may lead to CRM failure regardless of the effort of the firm. Therefore, firms have to discard the myth that CRM will always increase the profit and implementation of CRM is always needed. In such situations, CRM surely damages the firm. This illustrates the importance of ROI even in CRM implementation.



## 4. Conclusion and future research

As we expected, the various exogenous variables and characteristics influence the optimal CRM strategy. We proved that the widely known CRM strategy, S2 that focuses on the highly profitable customers is not the universal strategy of CRM. S2 is appropriate where the level of the customer leveraging effect is somewhat medium in the market without network externality, and fixed cost of S2 implementation is not extremely high. S2 is more widely applicable in the market where there exists network externality. If the level of the leveraging effect exceeds the lower bound, S2 becomes the optimal strategy in case of importance of network externality exceeds the cost of serving the products or the service and the fixed cost of S2 implementation is not high. If the weight of network externality does exceed the cost, S2 is appropriate in the medium range of the level of effectiveness of the customer value leveraging program.

We indicate the effectiveness of the customer value leveraging with  $\alpha$ . However, the criterion of deciding the right level of  $d$  to implement the strategy is quite relative. Even for the same level of  $d$ , one firm's optimal strategy could be S1 and another firm's optimal strategy could be S2 or S3. If the firm's  $d$  is low enough, investment in the leveraging program even for the most highly profitable customers is not appropriate. If  $d$  is thought as an exogenous variable that is set by the combination of characteristics of customers and industry, then expensive CRM investment does not create value at all. So in this case, CRM should not be implemented. However, if we assume that  $d$  can be improved by the operation of CRM, then the optimal CRM strategy is changing with the improvement. For example, in the case of the market where network externality does not exist, if we assume that the profit of strategy S1, S2 or S3 is greater than the profit when the firm does not implement any of the CRM strategies, then the optimal strategy of first level will be S1 and then S2. The optimal strategy of the final stage will then be S3. For the same industry, product or service, we can expect that the investment ( $I$ ) level to produce same  $d$  can be even lower with the information technology development. Information technology enables mass customization with lower cost of customization. Dell Computer's build-to-order Web site and supply chain management system enable Dell Computer to produce personalized computers at a low cost. More advanced IT combined with management strategy makes per user service cost lower. So, we can expect that the comparative value of  $d$  that is the threshold for choosing S2 or S3 can be lowered with improvement of IT as Moore's law indicates.

Strategic choice of the firm in the market without network externality and that under the market with it is strikingly different. In the latter case, the firm tends to retain more

customers even the customers whose direct financial contribution is negative, since the indirect contribution of a customer become more important in such market. The customer retention criterion and the CRM strategy are different with different degrees of importance of network value in the market with positive network externality. Under this condition, the firm has to more carefully consider before deciding the customer segmentations to be discarded.

The so-called 80/20 rule should not be applied when the customer leveraging effect is high enough. If the customer value-leveraging program can change the unprofitable customers to the profitable customers, the firm is better off implementing those programs to the previously unprofitable customers. The 80/20 rule cannot hold in a market with network externality either. Since the value of the customer is determined not only by the direct revenue (profit) contribution but also by the indirect increase of the value of network.

Customers are valuable assets to the firm (Bell et al. 2002). So we need to consider carefully before abandoning unprofitable customers if there is any customer value improvement opportunity before discarding them. Additional risk of discarding unprofitable customers is that the deselected customers could harm the firm through bad word of mouth to the potential customers (Winner 2001). Our ongoing research includes the consideration of psychological and sociological/behavioral impacts of deselected customers on CRM or the customers served with inferior products/services. Moreover the impact of the CRM strategic choice under a competitive market is to be investigated since the current research is limited to a monopolistic situation.

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