Insurance Contract Analysis for Company Decision Support in Acquisition Management

H P Chernovita, D Manongga and A Iriani

Faculty of Information Technology, Satya Wacana Christian University, 52-56 Diponegoro Street, Salatiga, Indonesia

Abstract. One of company activities to retain their business is marketing the products which include in acquisition management to get new customers. Insurance contract analysis using ID3 to produce decision tree and rules to be decision support for the insurance company. The decision tree shows 13 rules that lead to contract termination claim. This could be a guide for the insurance company in acquisition management to prevent contract binding with these contract condition because it has a big chance for the customer to terminate their insurance contract before its expired date. As the result, there are several strong points that could be the determinant of contract termination such as: 1) customer age whether too young or too old, 2) long insurance period (above 10 years), 3) big insurance amount, 4) big amount of premium charges, and 5) payment method.

1. Introduction

One of company activities to retain their business is marketing the products, in the form of goods or service [1]. Maximum marketing activity will increase sales number and impact the increase of company revenue. Customer Acquisition Management [2] is an effort by the company to manage acquisition process or an approach to the customer candidate. This activity includes gaining information about potential customer, measure customer value, and allocating resources to acquire those with greater long-term value [3]. There is tendency that company more invest their resources, like bigger cost to marketing and sales activities [4]. So, the company try hard to gain bigger revenue to return the venture capital.

Marketing aim to attract customer candidates and retain loyal customer who binding contract with the insurance company [5]. Insurance companies will compete each other to gain customers using promising offerings to bring out customer interest. Insurance company often promising protection [6], service [7], and certain bonuses [8] to make customer want to invest their money in the company. Conflict handling according to customer's need includes in customize service [9] that should be done maximally by the company to prevent customer disappointment that could lead the customer to move to competitor company or terminate the contract.

Decision support is vital element in insurance company to help the company to provide proper insurance product offering [8], suggestions, and alternatives for prospective customers in acquisition process. One of many algorithms used is Iterative Dichotomizer Three (ID3) which take form of decision tree with root, branch, and leaf as the parameters [10] which then being calculated and arranged based on the entropy score of each parameter.

Insurance Contract Analysis in this paper will try to create decision support using ID3 algorithm to arrange rules that could be used by insurance company in customer acquisition process. This is necessary for the company to make customer could survive until the end of insurance contract and prevent customer to terminate their contract before its expired date. Parameter used in this research will be from customer side and insurance contract side. Result from ID3 will provide rules to guide insurance agent

to offer insurance product and confirmation of contract agreement content that will be undergo by the customer during specified time. Research result could help insurance company to raise customer acquisition and increase customer lifetime. Along with it, the customer trust and satisfaction will go up because the company can offer the proper product according to customer's need, condition, and ability.

2. Related Work

Research by Akinsola [10] used data mining to gather dataset from motor vehicle insurance in Lagos about 17,000 records. Each record contains 57 fields of attributes that through filter process to obtain suitable data and attributes. Insurer risk analysis using ID3 to produce rule to decide insurer risk class: Low Risk, Medium Risk, and High Risk. Result of decision tree will be used by insurance company to be more careful when define the premium policy.

Research by Balaji [11] tried to examine the Decision Tree Induction technique to predict customer preferences over the life insurance policies. Dataset from Life insurance database about 10,000 records from June 2011 to December 2011. The decision tree lead to four kinds of class: Class A, Class B, Class C, and Class D that will be used by the company in order to retain the profitable customer with perform cross-selling and upselling insurance products.

Research by Roberts-Lombard [8] explored two important ways to enhance customer retention: two-way communication and conflict handling. Data gathered using questionnaire to 254 customers. The result shows that close relationship between insurance company and customer will provide a long-term retention, so timeously it will create greater customer loyalty.

Recent study will adopt the ID3 algorithm to analyse insurance contract agreement between customer and the company to create decision support rules in acquisition management. Insurance company could use this rules to offer proper product needed by the customer. Excellent product offerings by insurance company will help the customer to decide what product should they buy, how long the contract could they take, which payment method they will take, and how much the premium they could pay. This effort will make the customer could projecting their financial before binding insurance contract. The main goal of this paper is to increase company service in customer acquisition process that will increase customer satisfaction then lead to customer loyalty to the company.

3. Research Method

This research using data from well-known insurance company in Indonesia, but the dataset came from branch office in Salatiga from January 2016 to May 2016 about 245 records with 37 attributes. The data is insurance claim report submitted by customers to the company which divided in four kinds: completion, termination, retrieval, and school expense. This research using the completion claim about 102 records and termination claim about 27 records to find out characteristic or condition that will lead customer to complete or terminate their insurance contract. The data then cleansed with removing unnecessary attributes from 37 attributes to 7 attributes: product name, customer age when binding insurance contract, insurance period, insurance amount, payment method, premium charge, and final claim. Figure 1 shows table structure of data claim inserted in a spreadsheet and adjusted with the code in Table 1. In the spreadsheet, field name for each attribute will be shortened as: PRODUCT for insurance product name, AGE for customer's age when start the insurance contract, PERIOD for insurance validity period, AMOUNT for sum assured amount, PAYMENT for payment method, PREMIUM for premium charge, and FINAL for final claim.

PRODUCT	AGE	PERIOD	AMOUNT	PAYMENT	PREMIUM	FINAL
PERMATA	5	1	2	5	2	COM
PERMATA	4	1	3	5	2	COM
PERMATA	3	1	4	5	2	COM
PERMATA	4	2	3	5	3	COM
MELATI	4	1	2	2	2	COM
POESAKA	3	1	1	5	1	COM

Figure 1. Table structure of imported data in RapidMiner.

Table 1. Table of attribute code.

Attribute	Class	Code
Customer Age (years old)	17 - 24	1
	25 - 32	2
	33 - 40	3
	41 - 48	4
	49 - 56	5
Insurance Period (years)	4 - 6	1
	7 - 9	2
	10 - 12	3
	13 - 15	4
	16 - 18	5
Sum Assured Amount (IDR)	2,000,000 - 6,600,000	1
	6,600,001 - 11,300,001	2
	11,300,002 – 16,000,002	3
	16,000,003 – 20,700,003	4
	20,700,004 – 25,400,004	5
Premium Charge (IDR)	16,840 – 403,472	1
	403,473 – 790,105	2
	790,106 – 1,176,738	3
	1,176,739 – 1,563,371	4
	1,563,372 – 1,950,004	5
Payment Method	Monthly	1
	Quarterly	2
	Semester	3
	Year	4
	Single	5
Final Claim	Completion	COM
	Termination	TER

Code shown in Table 1 that inserted in the spreadsheet for each attribute represents insurance contract content that have been claimed to the insurance company. If in the insurance contract written that the customer age 30 years old, binding insurance contract for 10 years, with sum assured IDR 20,000,000, with premium charge IDR 500,000, payment quarterly, then the final claim is termination will be inserted as: AGE = 2, PERIOD = 3, AMOUNT = 4, PREMIUM = 2, PAYMENT = 2, and FINAL = TER. The code was made to simplify the contract content to be processed in the next step.

When the spreadsheet is complete with the contract content for each customer, then it imported in RapidMiner Studio 7.3 to be processed with ID3 algorithm with choosing Operators: Modeling → Predictive → Trees → ID3. In the Parameters setting, set the criterion with "accuracy", minimal size of split with 2, minimal leaf size with 1, and minimal gain with 0.1. When the setting is complete and RapidMiner "Run the process", the application will create the decision tree based on the imported data.

4. Result

The result in this research is a decision tree which could being used by insurance agent as decision support when offer insurance product to the prospective customers. Figure 2 shows rules formed based on entropy calculation from each involved attribute. The decision tree has PRODUCT attribute as its root and followed by AGE, PERIOD, AMOUNT, PAYMENT, and PREMIUM attribute as the branches, while FINAL attribute set to be the label or the leaf. The leaf or node have two kinds of colour. Blue leaf represents the completion claim, while red leaf represents the termination claim. There also leaf which have two colours in the same leaf, that means the leaf represents same chance of both completion claim and termination claim in one rule. On the decision tree, there are total 53 rules formed,

which consist of 33 rules of completion claim, 13 rules of termination claim, and 7 rules with same chance of completion claim and termination claim.
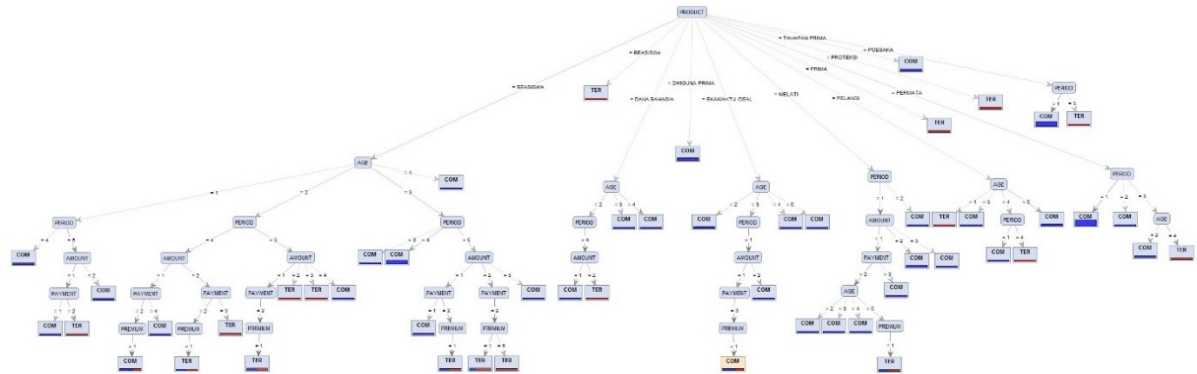

Figure 2. Decision tree based on insurance completion and termination claim.

Decision tree in Figure 2 produce 13 rules of termination claim that will be the main focus of this paper. Below are the rules that show the contract content lead to termination claim:

```
PRODUCT = BEASISWA, AGE = 1, PERIOD = 5, AMOUNT = 1, PAYMENT = 2: TER
{COM=0, TER=2}                                                        (1)
```
Contract with product "Beasiswa", customer age between 17-24 years old, insurance period 16-18 years, insurance amount between IDR 2,000,000 - 6,600,000, and payment method quarterly could lead to termination claim. This occurred because of customer age which is too young that predicted have not occupation with settled salary. Besides, the insurance period which too long makes the customer feels burdened to fulfil their contractual obligation. Consequently, this condition could lead the customer to terminate their insurance contract before its expired date.

```
PRODUCT = BEASISWA, AGE = 2, PERIOD = 4, AMOUNT = 2, PAYMENT = 3: TER
{COM=0, TER=1}                                                        (2)
```
Contract with product "Beasiswa", customer age between 25-32 years old, insurance period 13-15 years, insurance amount between IDR 6,600,001 - 11,300,001, and payment method semester could lead to termination claim. This occurred because customer in this age group usually on their way to pursue specific career and build household. In this time, there is a lot of changes happened in financial aspect like when the customer has more child, then the customer income automatically will be allocated to sufficient the daily needs. This could lead to contract termination because the cost that originally paid for insurance premium then being used to another necessity. Besides, the long insurance period also become additional issue that will lead to contract termination. Moreover, the payment method also affect the continuity of insurance contract because the longer payment period means the bigger premium charges. This contract has "semester" payment method that should be paid every six month with bigger premium charges that will give burden to the customer to pay such a big amount of money in every payment due date.

```
PRODUCT = BEASISWA, AGE = 2, PERIOD = 5, AMOUNT = 2: TER {COM=0, TER=1} (3)
```
Contract with product "Beasiswa", customer age between 25-32 years old, insurance period 16-18 years, and insurance amount between IDR 6,600,001 - 11,300,001 could lead to termination claim. This occurred because of the reasons appeared in Rule (2). The difference is at insurance period that longer from previous rule which could lead to termination claim.

```
PRODUCT = BEASISWA, AGE = 2, PERIOD = 5, AMOUNT = 3: TER {COM=0, TER=1} (4)
```
Contract with product "Beasiswa", customer age between 25-32 years old, insurance period 16-18 years, and insurance amount between IDR 11,300,002 - 16,000,002 could lead to termination claim. This occurred because of the reasons appeared in Rule (3). The difference is at insurance amount that bigger than the previous rule. This means customer have to pay bigger premium charges for a long time. This condition shows that the longer insurance period and bigger premium charges could lead to termination claim.

```
PRODUCT = BEASISWA, AGE = 3, PERIOD = 5, AMOUNT = 2, PAYMENT = 2, PREMIUM =
5: TER {COM=0, TER=1}                                                      (5)
```
Contract with product "Beasiswa", customer age between 33-40 years old, insurance period 16-18 years, insurance amount between IDR 6,600,001 - 11,300,001, payment method quarterly, and premium charges IDR 1,563,372 – 1,950,004 could lead to termination claim. This occurred because the customer age includes in middle-aged category which have settled job and salary but usually have a lot more necessity than the younger customer. Besides, the long insurance period with big premium charge that should be paid quarterly or every three months will load the customer with big responsibility, while the customer should pay other bills in first place like school tuition, electricity, water, daily needs, etc. Those conditions in fact give disadvantages to customer that could lead to termination claim.

```
PRODUCT = BEASISWA, AGE = 3, PERIOD = 5, AMOUNT = 4: TER {COM=0, TER=1} (6)
```
Contract with product "Beasiswa", customer age between 33-40 years old, insurance period 16-18 years, and insurance amount between IDR 16,000,003 - 20,700,003 could lead to termination claim. This occurred because of the reasons appeared in Rule (5). The difference is at insurance amount that bigger from previous rule. The bigger insurance amount with same period will make the customer pay bigger amount of premium charges. This shows that customer in middle-aged category could terminate their insurance contract when the insurance period is too long and the insurance amount is too big.

```
PRODUCT = DANA BAHAGIA, AGE = 2, PERIOD = 4, AMOUNT = 2: TER
{COM=0, TER=1}                                                             (7)
```
Contract with product "Dana Bahagia", customer age between 25-32 years old, insurance period 13-15 years, and insurance amount between IDR 6,600,001 - 11,300,001 could lead to termination claim. This occurred because the customer has long insurance period, while the necessity increase every year, especially when the customer has more child. This also occurred when the customer has unexpected needs that demand a big amount of money, so the customer prefer to terminate the insurance contract.

```
PRODUCT = PELANGI, AGE = 1: TER {COM=0, TER=1}                             (8)
```
Contract with product "Pelangi" and customer age between 17-24 years old could lead to termination claim. This occurred because the customer age considered too young that have not settled job and salary yet. Another supporting reason like the long insurance period, big insurance amount, big premium charges, and unexpected needs could lead the customer to contract termination.

```
PRODUCT = PELANGI, AGE = 4, PERIOD = 4: TER {COM=0, TER=1}                 (9)
```
Contract with product "Pelangi", customer age between 41-48 years old, and insurance period 13-15 years could lead to termination claim. This occurred because the customer age which already have settled job and salary but also have more necessity must pay big amount of premium for a long period. The termination claim could be caused by unexpected need like illness, disaster, or non-lethal accident that demand a big amount of money.

```
PRODUCT = PERMATA, PERIOD = 3, AGE = 4: TER {COM=0, TER=2}                (10)
```
Contract with product "Permata", insurance period 10-12 years, customer age between 41-48 years old could lead to termination claim. This occurred because product "Permata" require single payment with big premium charges but after that, customer have to wait until the contract period is completed. The insurance period seems too long and usually there is an unexpected event or needs within a period of 12 years that could lead the customer to terminate their insurance contract. This kind of customer usually consider the insurance as emergency funds that could be claimed at any time.

```
PRODUCT = POESAKA, PERIOD = 3: TER {COM=0, TER=1}                         (11)
```
Contract with product "Poesaka", and insurance period 10-12 years could lead to termination claim. This occurred because the product "Poesaka" more like investment contract that every year passed will add cash value to the insurance earnings. The big premium charges paid in single payment and the customer have to wait until the insurance period is completed. Termination claim in this case is more likely to get the customer investment earnings for several years to be used as emergency fund.

```
PRODUCT = PRIMA: TER {COM=0, TER=1}                                    (12)
```

Contract with product "Prima" could lead to termination claim. This occurred affected by the other supporting reasons like customer age, insurance period, insurance amount, premium charges, and payment method. But in this case, the customer who binding the contract already in age between 49-56 years old, insurance period 10-12 years, insurance amount IDR 20,700,004 – 25,400,004, payment method yearly, and premium charge IDR 1,563,372 – 1,950,004. Those conditions could be big burdened for the younger customer, but this case include the oldest group of customer which really near to the retirement age. So, from this case, the customer age proven as the strong determinant of contract termination.

```
PRODUCT = PROTEKSI: TER {COM=0, TER=3}                                 (13)
```

Contract with product "Proteksi" could lead to termination claim. This occurred affected by the other supporting reasons like customer age, insurance period, insurance amount, premium charges, and payment method. In this case, all three customers with this kind of contract choose to terminate their contract because of unexpected event like sudden illness, non-lethal accidents, and dismissal from workplace that require a lot of money. The customer tends to terminate the insurance contract because their money more allocated to fulfil the daily needs than to pay insurance premium for a long time.

5. Conclusion

Contract analysis is important to observe the condition that will lead to the termination claim. The decision tree shows 13 rules that lead to contract termination claim with explanation for each rule. These "termination rules" could be a guide to insurance company as decision support in acquisition management to prevent contract binding with these conditions because it has a big chance for the customer to terminate their insurance contract before its expired date. Besides, there are several strong points that could be the determinant of contract termination such as: 1) customer age whether too young or too old, 2) long insurance period (above 10 years), 3) big insurance amount, 4) big amount of premium charges, and 5) payment method.

6. References

[1]   Cespedes F V 1995 *Concurrent Marketing: integrating product, sales, and services* (Boston, Massachusetts: Harvard Business School Press)
[2]   Saylor J 2004 The missing link in CRM: customer acquisition management http://www.destinationcrm.com/Articles/Web-Exclusives/Viewpoints/The-Missing-Link-in-CRM-Customer-Acquisition-Management-44024.aspx
[3]   Arnold T J, Fang R and Palmatier R W 2011 The effects of customer acquisition and retention orientations on a firm's radical and incremental innovation performance *J. of Ac.of Mark. Sci.* **39** 234-51
[4]   Winer R S 2001 A framework for customer relationship management *California Man. Rev.* **43** 4
[5]   Ayoubi M 2016 Customer segmentation based on CLV model and neural network *Int. J. of Comp. Sci. Iss.* **13** 31-37
[6]   Yadav R K and Mahonia S 2014 Claim settlement process of life insurance services - a case study of ICICI Prudential life insurance company *Int. Let. of Soc. and Hum. Sci.* **35** 26-32
[7]   Singhal P K and Gupta M A 2013 Assessment of service quality in insurance sector – a case study of private companies of Haryana state *Int. J. of Res. of IT and Man.* **3** 118-33
[8]   Roberts-Lombard M 2011 Customer retention through customer relationship management: the exploration of two-way communication and conflict handling *African J. of Bus.s Man.* **5** 3487-96
[9]   Saarijarvi H, Karjaluoto H and Kuusela H 2013 Customer relationship management: the evolution role of customer data *Mark. Intel. & Plan.* **31** 584-600
[10]   Akinsola A F, Sokunbi M A, Lawal O N and Okikiola F M 2015 A data mining to insurance risk analysis *Int. J. Of Eng. And Comp. Sci.* **4** 10255-8
[11]   Balaji S and Srivatsa S K 2012 Decision tree induction for mining Life Insurance databases *Int. J. of Comp. Sci. and Info. Tech. & Sec.* **2** 699-703