

MARKET SHARE AND CUSTOMER EQUITY MEASUREMENT USING MARKOV CHAIN

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Abstract

Various techniques have been developed to measure firm's market share and the return on investment (ROI) of firm's marketing expenditures. However, most of those techniques are usually used to assess the past performance of a marketing program, using history of longitudinal data instead of expected future performance of a planned marketing program. In the absence of historical data base, measurements of expected ROI could still be carried out using a cross sectional survey, evaluating customer future purchase intentions as influenced by a new loyalty program to be launched by the firm in near future. Using survey of domestic airline passengers and Markov Chain approach, the model incorporates competition whereby customers are free to switch from one carrier to another from time to time. Expected ROI of loyalty program is measured by changes in the customer equity. Using MatLab software, future market share of Lion Air, Mandala Air, and Merpati Airline could be estimated quite accurately, and subsequently, changes in customer equity could be measured. Loyalty programs indeed induce changes in customers' future share of wallet and customer equity. Managers are encouraged to regularly conduct customer survey to guide them prior to launching a marketing action, using changes in customer equity as the ultimate dependent variable of ROI measurement.

Keywords: brand switching, customer lifetime value, customer equity, Markov Chain

Abstrak

Banyak teknik telah dikembangkan untuk pengukuran pangsa pasar dan imbal hasil (ROI) dari pengeluaran kegiatan pemasaran perusahaan. Namun demikian, kebanyakan teknik tersebut biasanya digunakan untuk mengevaluasi kinerja pemasaran di masa lampau dengan data historis dan bukan dengan data prakiraan kinerja masa depan sebuah program pemasaran. Jika data historis tidak tersedia, pengukuran ROI tetap bisa dilakukan dengan survei yang mengukur minat beli pelanggan diakibatkan adanya program loyalitas di masa depan. Penelitian ini menggunakan survei terhadap penumpang pesawat udara dan pendekatan Rantai Markov, di mana model tersebut memasukkan faktor kompetisi, jadi pelanggan bebas memilih maskapai yang berbeda-beda pada setiap kali akan bepergian. ROI dari program loyalitas diukur dari perubahan ekuitas pelanggan. Menggunakan aplikasi Matlab, pangsa pasar masa depan dari Lion Air, Mandala Air, dan Merpati dapat diperkirakan dengan akurat dan perubahan ekuitas pelanggan dapat diukur. Program loyalitas akan dapat membuat perubahan dari pangsa dompet pelanggan dan ekuitas pelanggan. Manajer diharapkan melakukan survei secara berkala sebelum meluncurkan program pemasaran baru, dengan menggunakan perubahan ekuitas pelanggan sebagai variabel terikat yang menunjukkan besaran ROI

Kata kunci: brand switching, customer lifetime value, customer equity, Markov Chain

JEL Classification: M30, M31

1. Introduction

Firms have adopted some popular metrics as surrogate measures of the value of their customers or customer profitability (Reinartz and Kumar, 2006). These measures help firms prioritize their customers in a manner that helps them assign a higher proportion of resources to selected customers whom firms expect will generate greater profits in the future. Size of wallet and share of wallet are popular metrics frequently used by firms as surrogates for their customer profitability. By definition, size of wallet is the category sales (in monetary value) of all firms to a particular customer while share of wallet is the proportion of category value accounted for by a focal brand or firm within its base of buyers.

Despite the popular use of size of wallet and share of wallet metrics as surrogates for customer profitability, both metrics are unable to provide a clear indication of future cash flow or profits expected from a customer. Therefore, firms are now shifting to use more strategic metric to measure their customer profitability which is customer lifetime value (CLV). The metric was firstly introduced by Blattberg and Deighton (1996) and has gained wide acceptance from marketing scholars and practitioners since then.

This research uses stochastic approach of Markov Chain process in estimating the customer lifetime value (CLV) and customer equity (CE) as proxy of firm value to determine the return on investment of the loyalty programs. The ability to make a projection of the return on any marketing actions is also in line with the Marketing Science Institute's research priorities of measuring marketing productivity and ROI measurement of marketing expenditures (Marketing Science Institute, 2002, 2008; Rust, Ambler, Carpenter, Kumar, and Srivastava, 2004a) and the shift in firms' practice toward treating marketing expenditures as long term investments rather than short term costs (Rust, Lemon, and Zeithaml, 2004b). Therefore, the current research strives to close the gap in marketing literature, by focusing on *ex ante* (prior to being launched) measurement of effectiveness of a loyalty program instead of *ex post* (after it is launched).

Given the high cost and risks involved in implementing and administering loyalty programs (Partch, 1994), this research intends to investigate the imperatives for firms to plan meticulously before launching loyalty programs for their customers. If the program turns out to be unsuccessful, it is hard and costly to modify it after the implementation. Succinctly, the main emphasis of the current research is on period prior to implementation of the program, in which firms are still in the process of planning their loyalty programs. As the program is non-existing yet, it is not possible to measure the effectiveness of loyalty program using customer historical transaction data base.

The current research proposes that such measurement could still be carried out using a cross sectional survey, evaluating customer future purchase intentions as influenced by a new loyalty program to be launched by the firm. Future purchase intentions which are assumed to be constant for each customer would be stretched to the period of the next 3 (three) years as such that market share could be estimated, individual CLV could be measured, and eventually CE could be evaluated. Changes in CE would be used as yardstick for firms, as the changes reflect expected ROI of the loyalty programs being considered by the firm.

2. Literature Review

CLV is the sum of cumulated cash flow, discounted with the firm's cost of capital, of a customer over his or her entire relationship with the firm (Kumar, Ramani, and Bohling, 2004). There is another stream of CLV definition which regards CLV as the present value of all future profits obtained from a customer over his or her relationship with a firm (Gupta, Hanssens, Hardie, Kahn, Kumar, Lin, Ravinshaker, and Sriram, 2006). The use of CLV metric, gains increasing importance in the marketing field. Many of articles and empirical researches on CLV have been written for the past decades, among others are from Berger and Nasr (1988), Pfeifer

and Carraway (2000), Bolton, Lemon, and Verhoef (2004), Fader, Hardie, and Lee (2005), Reinartz and Kumar (2000, 2003, 2006).

Scholars have recommended CLV as a metric for selecting customers and designing marketing programs (Reinartz and Kumar, 2003; Rust et al., 2004b). Companies like IBM, LL Bean, and ING are using CLV routinely as a tool to manage and to measure their business performance (Gupta et al., 2006). Some of the factors causing the popularity of CLV are: first, increased pressure in making marketing accountable. Traditional marketing metrics such as brand awareness, attitude toward the product, or even sales revenues, are no longer sufficient to show the return on marketing investment (Rust et al., 2004b). It is possible that marketing actions which improve sales or market share actually hurt long term profitability (Yoo and Hanssens, 2005).

Second, financial metrics such as ROI, profit margin, do not provide the solution either, as they usually are neither disaggregate nor diagnostic metrics in nature. A diagnostic metric is required, for example, to identify profitable customers from the non-profitable ones, as some researches have found that not all customers are profitable for firms to keep (Blattberg, Getz, and Thomas, 2001; Gupta and Lehman, 2005; and Rust et al. 2004b). The third factor accounted for CLV popularity is the development in database technology. Currently it is relatively easy for firms to collect enormous amount of individual customer's data and transaction records. Modeling techniques have made it possible to convert these data into useful information and insights for firms.

Knowing the CLV of individual customers enables a firm to improve its customer selection, customer segmentation, and marketing resource allocation. At aggregate level, CE is defined as the total of discounted lifetime values summed over all current and potential customers of a firm (Blattberg and Deighton, 1996; Rust et al., 2004b). Understanding a firm's CE provides the firm with a long term perspective and serves as a yardstick for monitoring long term growth and profitability.

The combined CLV of all current and future potential customers yield the value of the customer base (CE), which represents the entire net operating cash flow of a firm. Using publicly available data of five firms, Gupta, Lehman, and Stuart (2004) showed that estimates of CLV are reasonably close to market valuation of the firms. Kim, Mahajan, and Srivastava (1995) showed a strong relationship between the net present value of cash flows and the growth in the number of customers and stock prices. Overall, there is a consensus on the link between CLV and firm value, and the link will help marketers show the consequences of marketing activity on the market capitalization of the firm.

The current research adopts the CLV calculation model as proposed by Rust et al. (2004b). The model incorporates customer specific brand switching matrices although only for customers in the selected sample. This model requires information about both the focal brand and the competing brands to model the acquisition and retention of customers in the context of brand switching. Respondents in a selected sample provide information such as the brand purchased in the previous purchase occasion, the probability of purchasing different brands, and individual specific customer equity driver ratings.

The Markov switching matrix then models individual customer's probability of switching from one brand to another based on individual level utilities. The probability thus calculated is multiplied by the contribution per purchase to arrive at the customer's expected contribution to each brand for each future purchase. Summation of expected contribution over a fixed time period after making adjustments for the time value of money (i.e. discount factor) yields the CLV for the customer.

The modeling of CLV requires modeling of the switching matrix for each individual customer. Rust et al. (2004b) used individual level data from a cross sectional sample of customers, combined with purchase intention data, to model each customer's switching matrix

and estimated model parameters that enable the modeling of CLV at the individual customer level. The advantage of this approach is that competitive effects can be modeled, resulting in a fuller and truer measurement of CLV and CE. The method from Rust et al is also more realistic as it does not use assumption that the retention rate is always constant (i.e. model from Gupta and Lehman) nor the sales take place only once a year (i.e. model from Berger and Nasr).

3. Research Method

Based on data from the next purchase probability, average amount spent for every purchase, and average frequency of purchase, the magnitude of customer lifetime value can be calculated. Each customer i has an associated $1 \times J$ switching matrix, where J is the number of airlines with switching probabilities p_{ijk} , indicating the probability that customer i will choose airline k in the next purchase, conditional on having used airline j is the most recent purchase. The Markov switching matrix is denoted as M_i , and the $1 \times J$ row vector A_i has as its elements the probabilities of purchase for customer i 's current trip.

For airline j , d_j represents airline j 's discount rate, f_i is customer i 's average airfare per trip, v_{ijt} is customer i 's expected number of tickets bought from airline j in purchase t . π_{ijt} is the expected contribution margin per unit of airline j from customer i in purchase t and B_{ijt} is a $1 \times J$ row vector with elements B_{ijt} as the probability that customer i flies airline j in purchase t . The probability that customer i flies airline j in purchase t is calculated by multiplying by the Markov matrix t times:

$$B_{it} = A_i M_i^t$$

The CLV of customer i to airline j is :

$$CLV_{ij} = \sum_{t=0}^{T_{ij}} (1 + d_j)^{-t f_i} v_{ijt} \pi_{ijt} B_{ijt},$$

where T_{ij} is the number of tickets customer i is expected to purchase before airline j 's time horizon, H_j . B_{ijt} is a firm-specific element of B_{it} . Therefore, $T_i = \text{int}[H_j f_i]$. CE_j can be estimated as:

$$CE_j = \text{mean}_i (CLV_{ij}) \times \text{POP}$$

where $\text{mean}_i (CLV_{ij})$ is the average CLV for airline j 's customers i across the sample, and POP is the total number of customers in the market across all airlines, in this case is the domestic market. Based on data from BPS (Badan Pusat Statistik, 2011), total domestic airline passengers are expected to reach 38 million people in 2011.

Discount rate (d_j) used in this research is assumed to be the same for all airlines, which is estimated at 12%. Contribution margin is also assumed to be the same for all airlines, estimated at 10%. It is not possible at this stage to derive accurate measurement for firm's cost of capital and profit margin, as currently there is none of domestic airlines in Indonesia are a public company; hence no financial data are available to public.

4. Result and Discussion

The survey was carried out using 37 respondents of university students (graduate program) in a private university in Jakarta, using convenience sampling method (questionnaire available upon request). The small number of respondents was due to the preliminary nature of the research. Upon confirmation of the model used small samples, a large scale of survey involving actual airline passenger is deemed necessary to generalize the findings of the current research. The respondents were asked on their pattern of usage (previous use) on 3 domestic airlines (Lion Air,

Merpati, and Mandala) for the past one year. Subsequently, they were told that these respective airlines are about to launch a loyalty program in due course, and then they again were asked to predict their future pattern of usage (future use) for the 3 airlines, given the existence of the loyalty program. Respondents were also asked on their frequency of flying and average airfare they pay to the airline. Please see appendix for the exact questionnaires items.

To perform data analysis, Matlab software was used, which is often used to perform engineering numerical calculation and modeling. Matlab was chosen as it is a very powerful tool for performing many kinds of analyses on linear systems, including matrix operations. Matlab uses matrix and vectors for doing numerical computations and it can display information graphically as well. The data in this research is modeled as Markov chains and it can be easily computed using Matlab since Markov chains is considered as a linear system.

The general flow for calculating the CLV as well as the market share of the surveyed airlines is shown in the Figure 1. From the individual switching matrices, this research can obtain Markov transition matrix M. The matrix is of 3 x 3 size, representing the 3 airlines being researched. The sequence is Lion, Merpati, and Mandala.

$$M = \begin{pmatrix} 0.9533 & 0.0333 & 0.0133 \\ 0.1530 & 0.7765 & 0.0706 \\ 0.2000 & 0.0800 & 0.7200 \end{pmatrix}$$

The diagonal of M shows the magnitude of brand inertia. For example, probability of a Lion Air passenger to fly Lion Air again in his or her next purchase is 95.33%, whereas probability of a Merpati passenger to return to Merpati in the next occasion is only 77.65%, and for Mandala is 72%.

Applying B_{it} and CLV_{ij} , this research could obtain the CLV for each respondent of each airline, as depicted in Appendix 1, 2, 3, and 4 respectively. The figures show how CLV of respondent of each airline is generally increased. That would mean that the loyalty programs being advised to respondents indeed affect their future flying pattern for the focal airline, introducing the loyalty program. The Matlab output also shows average CLV of each airline, and by applying CE_j , this research could obtain the CE of each airline. The summary of output is tabulated in Table 1.

Table 1. Summary of CLV and CE

	Average CLV (in Rp'000)			CE (in Rpbillion)		
	Lion	Merpati	Mandala	Lion	Merpati	Mandala
Past Use	219.95	37.69	10.89	8.58	1.47	0.42
Future Use	241.53	85.73	16.34	9.42	3.34	0.64

The difference of CE for each airline is the measurement of ROI of the loyalty programs being considered. Investment required to establish, to monitor, and to run the programs would have to be assessed against the difference of CE created. In this case, all loyalty programs create higher CE for each of the firm, but the amount of investment required would have to be determined separately. The result shows that managers are encouraged to regularly conduct customer survey to guide them prior to launching a marketing action, using changes in customer equity as the ultimate dependent variable of ROI measurement. The current research proposes that CE measurement could still be carried out using a cross sectional survey, evaluating customer future purchase intentions as influenced by a new loyalty program to be launched by the firm. Future purchase intentions could be stretched to the period of the next 3 (three) years as such that market share could be estimated, individual CLV could be measured, and eventually CE could be evaluated.

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Appendixes

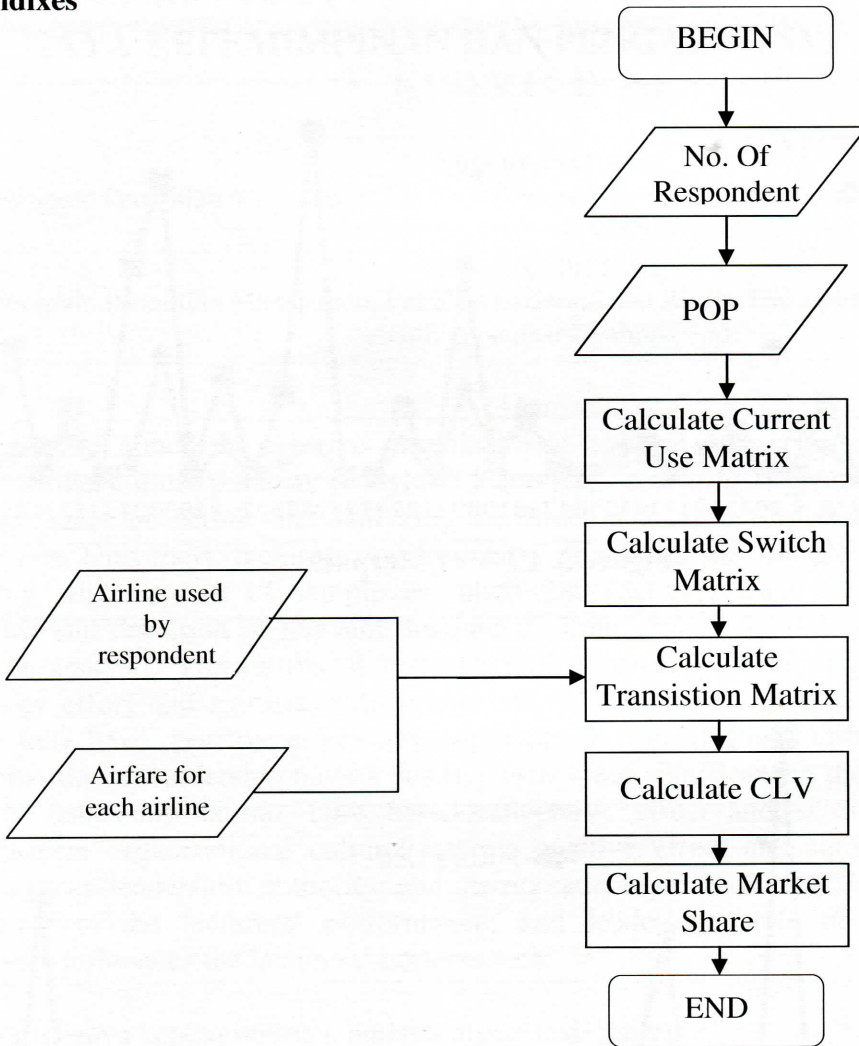


Figure 1. Flow of CLV and CE Calculation

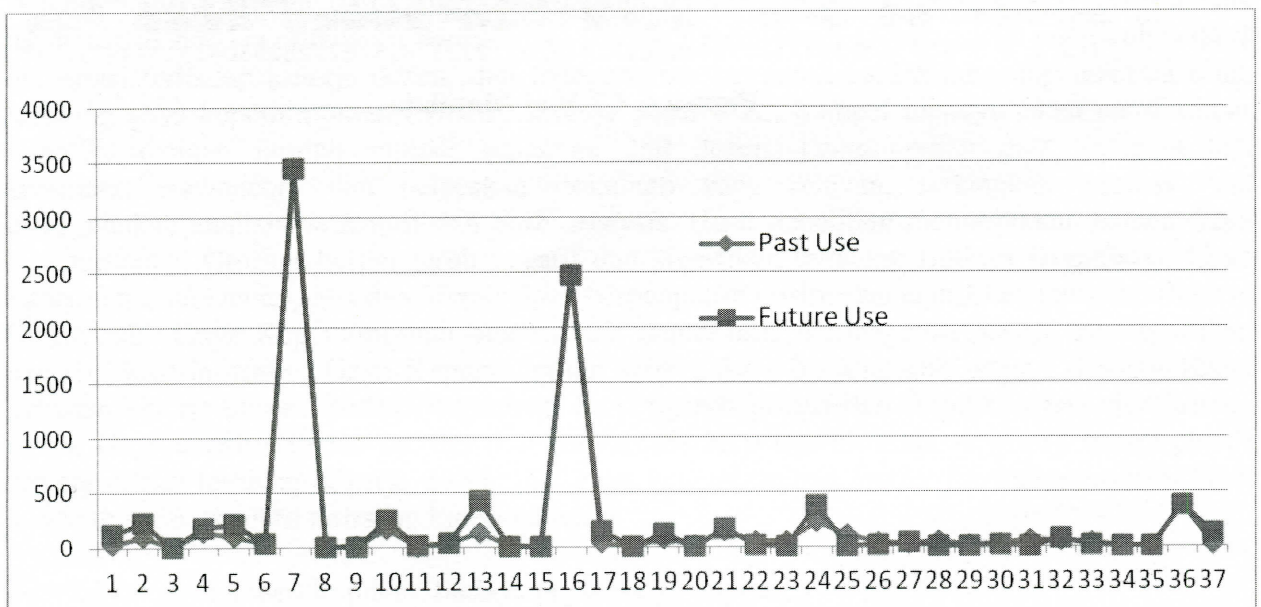


Figure 2. CLV of Lion Air

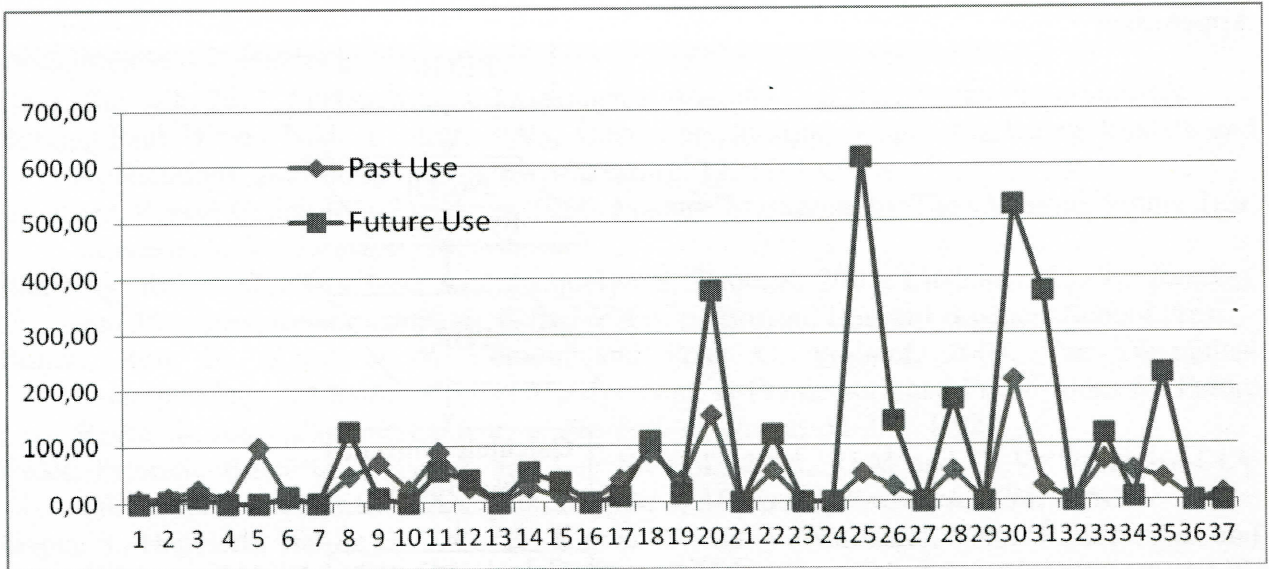


Figure 3. CLV of Merpati

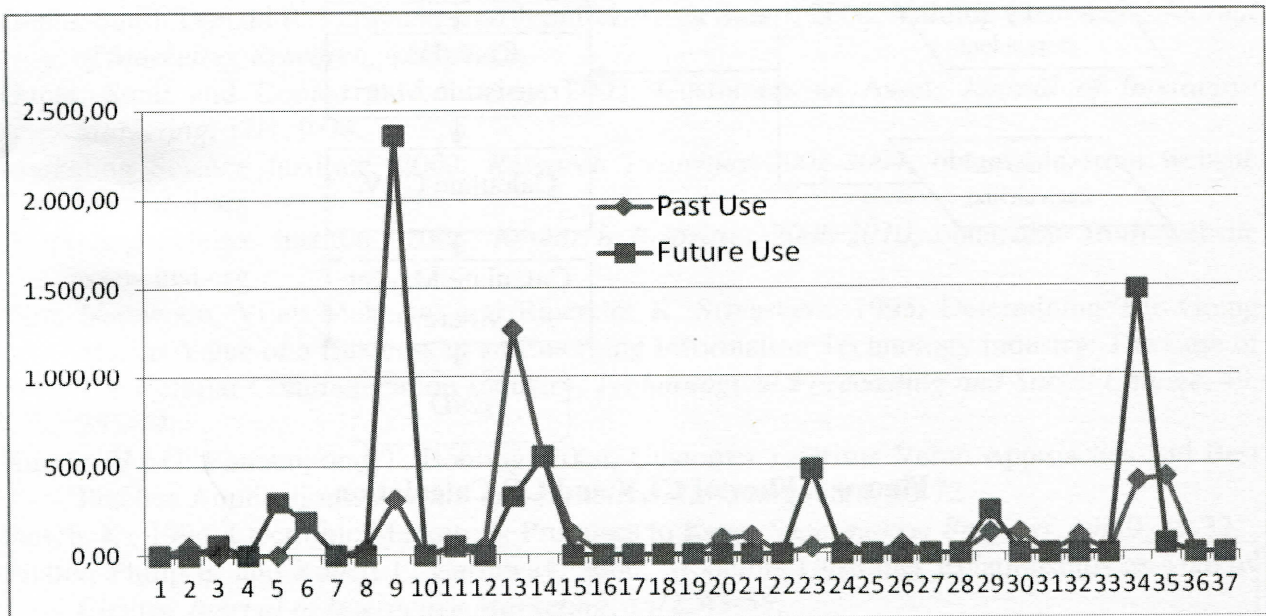


Figure 4. CLV of Mandala