

Customer Value Network Analysis: Improving Ways to Compute Customer Life-Time Value

Monireh Hosseini
Tarbiat Modares University, Tehran, Iran
Email: monhosseini@modares.ac.ir

Amir Albadvi
Tarbiat Modares University, Tehran, Iran
Email: Albadvi@modares.ac.ir

ABSTRACT

Today's constant changes around the world have exposed many companies to unprecedented business competition. This situation, especially in e-commerce, complicates the decision-making process about target customers and recommending products to them. On one hand, understanding and measuring customer lifetime value (CLV) is a critical factor for long-term success. On the other hand, the value network is a new concept that considers both tangible and intangible complex dynamic value exchanges between two or more enterprises, customers, suppliers, etc. In this paper, we introduce a new definition of value networks called "business customers' value network", which focuses on customer relationship management (CRM) concepts. Then, we suggest that the value network analysis (VNA) approach is a powerful tool to model and analyze tangible and intangible relationships between a company and its business customers. Finally, we propose that VNA can improve the networking potential of CLV. This study provides a conceptual framework for mapping a newly proposed value network consisting of three schemas (star, community, and compound schemas) with an illustrated example. Our future aim is to develop a new networked measure of CLV called network customer lifetime value (NCLV).

Keywords: Customer lifetime value (CLV), Value network analysis (VNA), Customer relationship management (CRM), Business-to-business, Network customer lifetime value (NCLV).

1. INTRODUCTION

Our constantly changing world means that organizations have encountered unprecedented opportunities and challenges. The ever-changing environment of e-commerce makes the decision-making process about target customers a complex process. In this situation, measuring CLV is a way to evaluate and rank customers. Moreover, the emergence of e-commerce systems that support recommending products to customers has raised CLV as a critical measure in marketing decisions for each customer [1-2]. Consequently, many recent studies have focused on measuring CLV [3-6].

Received February 20, 2009; Accepted July 13, 2009.

Corresponding Author: *Albadvi@modares.ac.ir*, P.O.Box:14115-111, Tarbiat Modares University, Tehran, Iran. (A. Albadvi)

Today, most business relationships are composed of dynamic networks. Organizations therefore strive to find more effective ways to manage and control their surrounding network [7]. Networking potential is one of the most important and influential value components of CLV that can generate additional revenue. Further, this aspect of CLV may result in customer referrals and network relationships [8]; however, it has not received sufficient attention.

In addition, in recent years organizations have been forced to change their strategic analysis tools to consider intangibles in addition to tangibles. The value network is a successful business perspective that encompasses both tangible and intangible exchanges between two or more individuals, groups, or organizations aimed at generating economic value and other benefits for all of participants [9-10]. In the quickly-changing world of e-commerce, business webs are a type of value network. The approach of a value network takes into account the role of knowledge and intangible value exchanges as the foundation of emerging networked enterprises. Among the basic contributions to analysing value networks (see Table 1); the Value Network Analysis (VNA) approach that Allee [10] proposed is both comprehensive and applicable. This approach, which is a business modeling methodology to understand the complexity of interactions among multiple sets of actors, can help organizations recognize and model value exchanges between participants [10]. Allee's [10] approach also has the ability to model network relationships between network business customers.

Table 1. Previous Research Contributions to Analysing Value Networks

Author	Year	Contribution
Kothandaraman and Wilson [11]	2001	Proposed a model of value-creating networks and defined the scope, depth of interactions, and competitive environments of value networks.
Allee [10]	2002	Proposed a value network approach for modeling and measuring intangibles.
Peppard and Rylander [12]	2006	Introduced the value network as a way to analyse competitive ecosystems.

CRM has been defined in terms of measuring both input across all functions (including marketing, sales, and service costs) as well as output in terms of customer revenue, profit, and value [13]. Real value to companies, however, lies in the value they create for their customers, which is given back to them accordingly by those same customers [14]. The Internet has provided a platform to exchange superior value; thus, as businesses move to the Web, CRM will move, accordingly, to e-CRM. The goal of e-CRM is to improve customer service, retain valuable customers, and provide analytical data. Moreover, it helps companies increase customer value by motivating valuable customers to remain loyal [15]. In the fluid market of e-commerce, understanding the value streams of online customers is a critical success factor for online businesses, which can subsequently help them sustain their competitive advantage.

We recognize the importance of CRM and relationships with customers on the one hand and organizations' shift from products, activity, transactions, and satisfaction to services, creating value, interactions and loyalty on the other. With these relationships in mind, we introduce a new form of value network that focuses exclusively on relationships between a company and its customers on one hand and between customers themselves on the other. Then, we propose a conceptual framework that features three schemas to illustrate this new value network. Further, we suggest the VNA approach for modeling

and analysing those schemas to improve the networking potential component of CLV. Finally, we illustrate the schemas using a real-world example. This research seeks to develop a new measure for evaluating customer lifetime value, which takes into account both tangible and intangible value exchanges with the help of the value network analysis (VNA). We call this “network customer lifetime value” (NCLV).

2. IMPORTANT APPROACHES TO COMPUTING CLV

Marketing has radically shifted from a transaction-oriented view of exchanges to a relational view, which focuses on developing long-term relationships with customers [16]. Because not all customers are financially attractive, it is critical for companies to measure the customers’ level of profitability according to their lifetime value. Many studies have focused on measuring CLV and most of the calculation models presented have similar structures with only slight differences. Some of these calculation methods are reviewed in the next paragraphs.

Berger and Nasr [3] proposed a calculation model as shown in Eq(1):

$$LTV = \sum_{i=0}^n \pi(t) \frac{1}{(1+d)^i} \quad (1)$$

where $\pi(t)$ is the function of customer profits according to time, t ; i is the period of cash flow from customer transaction; n is the total number of periods of customer transactions; and d is the discount rate.

Bayo’n, Gutsche, and Bauer [4] presented the fundamentals of a calculation model for individual customer lifetime. The model for customer c is shown below in Eq (2):

$$CLV_c = [C_c + WOM_c] * W_c \quad (2)$$

Where C_c is the sum of the cash surpluses, discounted to the present as a result of the direct transactions generated by customer c , as viewed over the entire duration he or she is retained (lifetime). They considered WOM_c as the cash surpluses generated by word of mouth activities by customer c , while $W_c \geq 1$ is the aggregated weighting for the discounted cash surpluses generated by customer c as a result of his lead user, reference, and option value potential. Moreover, they presented a calculation model for C_c with details (see [4] for more information).

Rosset, Neumann, Eick, and Vatnik [5] presented a model that computed the expected lifetime value of a given customer as Eq(3):

$$E \left\{ \int_0^T v(s) ds \right\} = \int_0^\infty v(s) \{1 - F(s)\} ds \quad (3)$$

Where $v(s)$ is the value function; T is the length of time a customer stays with the company; and $F(s)$ is the distribution function of variable s as time.

Hwang, Jung, and Suh [6] suggested a customer lifetime value model that considered not only past profit contributions, but also an individual customer’s expected future cash flow and future financial contribution i at period t_i . This is expressed as Eq (4):

$$LTV_i = \sum_{t_i=0}^{N_i} \pi_p(t_i)(1+d)^{N_i-t_i} + \sum_{t_i=N_i+1}^{N_i+E(i)+1} \frac{\pi_f(t_i) + B(t_i)}{(1+d)^{t_i-N_i}} \quad (4)$$

Where t_i is the service period index of customer i ; N_i is total service period of customer i ; d is the interest rate; $E(i)$ is the expected service period of customer i ; $\pi_p(t_i)$ is the past profit contribution of customer i at period t_i ; $\pi_f(t_i)$ is the future profit contribution of customer i at period t_i ; $B(t_i)$ is the potential benefit from customer i at period t_i ; and finally, LTV denotes lifetime value.

Hwang, Jung, and Suh [6] evaluated customer value from three viewpoints – current value, potential value, and customer loyalty – represented by Eq(5), Eq(6), Eq(7) as follows:

$$\text{Customer value} = \frac{\text{Average amount asked to pay} - \text{commulative amount in areas}}{\text{Total service period}} \quad (5)$$

$$\text{Potential value}_i = \sum_{j=1}^n \text{prob}_{ij} \times \text{profit}_{ij} \quad (6)$$

Where prob_{ij} denotes the probability that customer i would use the service j among n optional services and profit_{ij} denotes expected profits from customer i who uses optional service j .

$$\text{Customer loyalty} = 1 - \text{churn rate} \quad (7)$$

Where churn denotes the number or percentage of regular customers who abandon their relationship with a service provider. Customer loyalty measures customer retention.

As shown above, some recent models such as Bayon, Gutsche, and Bauer [4] and Hwang Jung, and Suh [6] have a more comprehensive view than the others. These models consider other aspects of customer value such as word-of-mouth activities, a customer's potential benefits, past and future profits, and customer loyalty. The existing CLV models only consider one type of network relationship between participants; that is, word-of-mouth denotes relationships between customers and customer loyalty denotes the relationship between a company and its customers. They do not pay enough attention, however, to intangible aspects of relationships such as knowledge, sense, reputation, influence, or other benefits that can increase customer value. In this regard, the authors of this paper believe that other aspects of network relationships (both tangibles and intangibles) should be considered in the calculation model of CLV.

3. NEW APPROACH IN CLV USING THE CONCEPT OF VALUE NETWORK RELATIONSHIPS

According to traditional studies, value networks are defined as a set of relatively autonomous and different economic actors (suppliers, partners, allies, etc.). These actors can be managed independently, but they work together in a framework of common agreements to co-produce value [9-10, 12]. The value networks are engaged in more than just transactions relating to goods, services, and revenue. Because values like knowledge and intangibles differ from physical revenue, it is a mistake to treat them as tangibles.

Value networks, therefore, consider two orders types of exchanges: tangible and intangible. Tangible exchanges are transactions that involve goods, services, revenues and contractual knowledge of products or services that directly generate revenue or are expected. Intangible exchanges are non-contractual; involve knowledge and information that flow around and support the core product and service value chain; and help build relationships (e.g., planning knowledge). Intangible benefits such as advantages or favors that can be extended from one participant to another are also considered intangible exchanges (e.g., sense of community or loyalty) [10]. Value Network Analysis (VNA) is a business modeling methodology to understand value networks. VNA consists of three important analyses:

- 1) **Exchange analysis:** The overall pattern of exchanges is formed using “Holomap” diagramming that relies on three elements: ovals, arrows, and labels that represent participants. The elements move in the direction of an exchange and the exchange description or the deliverable.
- 2) **Impact analysis:** This analysis determines the impact that each value input has on the other participants.
- 3) **Value creation analysis:** This analysis determines the value that each participant adds to others.

In recent years, academic research has emphasized value is created in buyer-seller relationships [16]. Previous research has also posited that the real value to companies lies in the value they create for their customers or the value the customers return to the companies [14]. It has been posited that direct and indirect network effects may shift the future focus of management from key accounts to key networks [17].

This study contributes to developing a new concept of value networks, called “business customers’ value network,” which focuses on relationships between a company as a focal point and its business customers as nodes of the business networks. We have developed this model for several reasons. First, existing CLV models have paid poor attention to networking potential, particularly intangibles, benefits, and knowledge. Second, the concept considers the importance of CRM or the customer-centric view and the value of customers in business relationships. Finally, it helps us understand value drivers as critical to the long-term success of business-to-business relationships [18]. We suggest the value network analysis (VNA) approach as a powerful tool to model and analyze tangible and intangible relationships between a company and its customers, and propose VNA to improve networking potential of CLV.

A conceptual framework including three schemas is therefore proposed to model the introduced value network. These schemas are illustrated in Figures 1-3.

- Star schema of business customers’ value network. This schema consists of a company as a focal point and its business customers as nodes, only considering relationships between the focal business and its customers (Figure 1). In Figure 1, I_{fj} denotes the flow of an intangible relationship from the focal point of the network to node j ; similarly, I_{ij} denotes that flow from node i to node j (e.g., I_{f2} denotes the flow of an intangible relationship from the focal point of the network to BC_2 , while T_{f2} denotes the flow of a tangible relationship from the focal point to BC_2).
- Community schema of business customers’ value network. This schema only considers relationships that exist among business customers themselves (Figure 2).
- Compound schema of business customers’ value network. This is, in fact, a combination of the previous schemas; that is, the star and community schemas. It therefore can embrace two types of relationships: first, between the focal point and its customers and second, among customers (Figure 3). In Figures 2 and 3, the

relationships between BC_1 and BC_4 on one hand and between BC_2 and BC_3 on the other have not been shown.

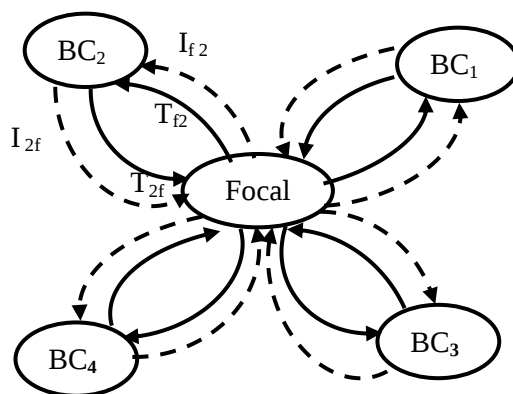


Figure 1. Star schema of business customers' value network

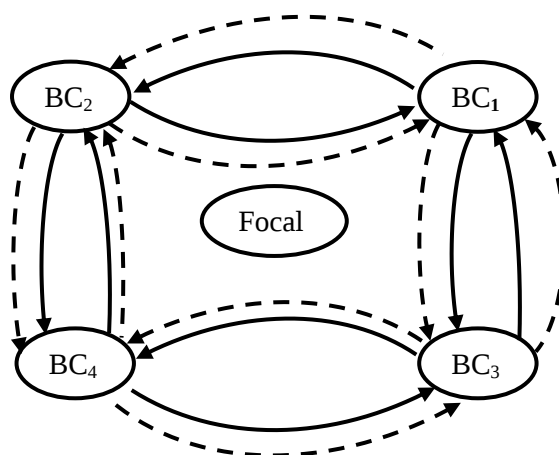


Figure 2. Community schema of business customers' value network

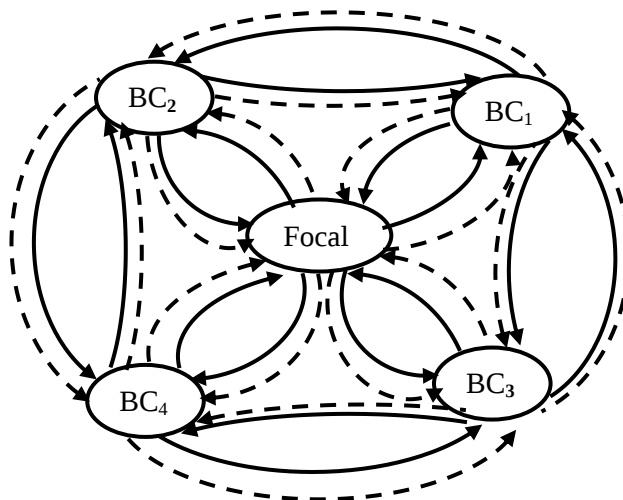


Figure 3. Compound schema of business customers' value network

Now, to understand these schemas and suggested value network, we present an example from the real world. Consider a medical equipment company (both manufacturer and seller) as a focal point of the business customers' value network. This company has four business customers: a hospital, a home for the aged and invalids, an emergency center, and a medical research center. The company has several tangible and intangible exchanges with each of the four customers, which are mapped through the star schema of business customers' value network in Figure 4. Moreover, some tangible and intangible relationships exist among the company's customers themselves. These have been mapped in Figure 2 through the community schema of the business customers' value network. To avoid confusion, the compound schema has not been drawn, but it could be shown by integrating Figures 4 and 5. Some of the relationships among customers can affect the lifetime value of a customer, who has evaluated his/her CLV from the focal company's viewpoint.

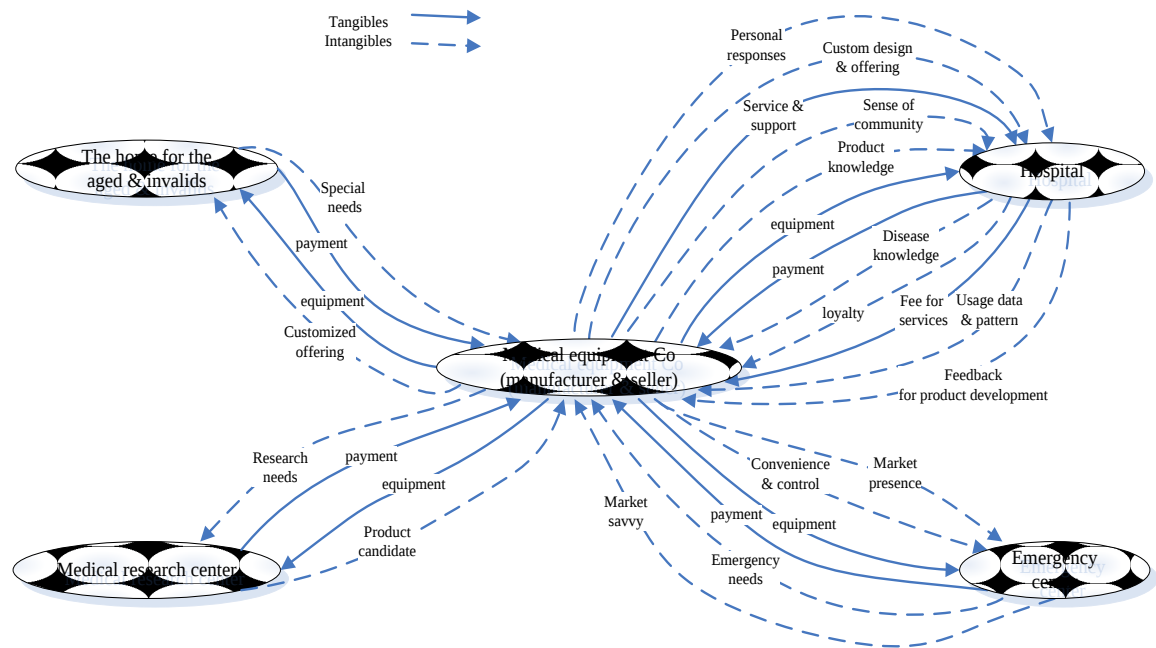


Figure 4. Star schema of business customers' value network for a medical equipment company

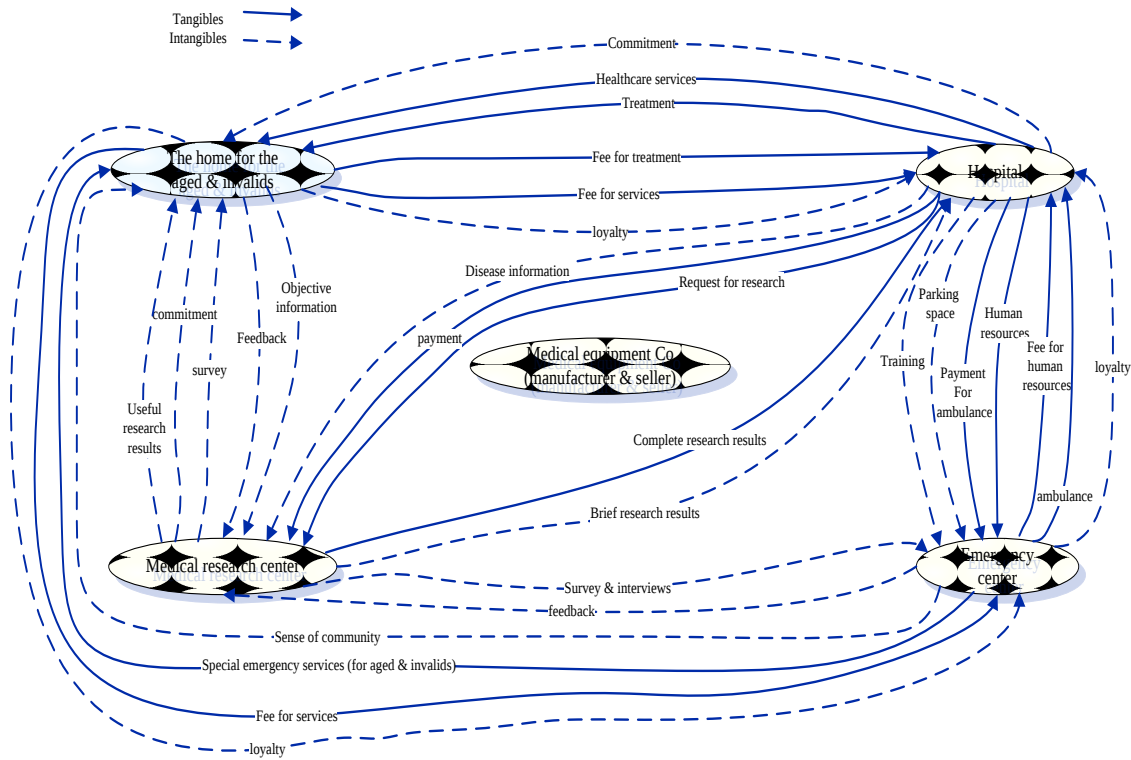


Figure 5. Community schema of business customers' value network for a medical equipment company

This means that we cannot look at a business customer as an isolated island. Clearly, it is a mistake to compute CLV without considering both tangible and intangible relationships between a customer and others. For example, the CLV of the emergency center may be evaluated as very low through existing CLV models. But, the tangible and intangible values added to the hospital by the same customer (e.g., fees or loyalty), make it valuable and increase its CLV from the focal company's viewpoint. This interpretation can hold true for other customers such as the home for aged and invalids or the medical research center. This means that an isolated CLV of a customer is not sufficient to segment customers and judge them as key accounts. In addition to CLV, therefore, the network relationship value (NRV) of each customer with the company's other customers should necessarily be considered. For example, the network relationship value between customers i and j can be formulated only as a transfer function between customers i and the focal company and customer j and the focal company. In other words, the value transferring power between two distinct customers can be computed through the focal company according to the ability of customer i to transfer received value from the focal company to the delivered value from customer j to the focal. Because the whole of NRV is not important from the focal company's viewpoint, we consider the coefficient α_{ij} , which varies between 0-1 to indicate the importance of network relationship value (0 indicates unimportant and 1 indicates extremely important). As a result, the network customer lifetime value (NCLV) of a customer i can be calculated as follows:

$$NCLV_i = CLV_i + \sum_{j=1}^n \alpha_{ij} NRV_{ij} \quad i \neq j, \quad j = 1, \dots, n, \quad 0 \leq \alpha_{ij} \leq 1 \quad (8)$$

Where $NCLV_i$ denotes network customer lifetime value of customer i ; CLV_i denotes the CLV of customer i ; NRV_{ji} is the network relationship value between customer i and j ; α_{ij} is the importance of NRV_{ji} from the focal company's viewpoint; and n is the total number of customers.

We believe that the presented schemas of business customers' value network can recognize and map intangible relationships among participants. Moreover, in Eq (8) we suggest the VNA approach to better address both tangible and intangible network relationship value.

For future research, we have contemplated exploring network relationships among participants more profoundly. The aim would be to develop precise measures for each relationship through suggested value network schemas and using value network analysis approach. This would be done to improve $NCLV_i$ and also optimize the value of every business customers' value network.

4. CONCLUSION

Customer lifetime value (CLV), as an important concept in segmenting, selecting, and retaining customers, plays a crucial role in the decision-making process and existing e-commerce recommender systems. Among the growing literature on CLV, researchers have presented calculation models that are not capable of considering all types of relationships in a network context. The existing CLV models do not pay enough attention to the intangible aspects of relationships such as knowledge or other benefits.

In this study, using the value network analysis (VNA) approach to understand the complexity of tangible and intangible exchanges, we proposed a new and interesting concept of value networks that considers the relationships between a company and a network of its customers called a business customers' value network. We have also suggested a conceptual framework that includes three schemas that could be used to enrich mapping, modeling, and analyzing the proposed value network. Further, we presented an example from the real world showing how the suggested schemas could be applied. The aim was to better understand and model the network relationship values of customers.

Regarding the importance of the network relationship value from the company's viewpoint, we introduced an equation to compute the network customer lifetime value. Finally, we anticipate that this research will contribute to developing a NCLV model that considers all aspects of networking potential of customers.

REFERENCES

- [1] D. R. Liu and Y. Y. Shih, Hybrid approaches to product recommendation based on customer lifetime value and purchase preferences, *The Journal of Systems and Software*, 77(2), 181-191, 2005.
- [2] Y. Y. Shih and D. R. Liu, Product recommendation approaches: Collaborative filtering via customer lifetime value and customer demands. *Expert Systems with Applications*, 35(1-2), 350-360, 2008.
- [3] P. D. Berger and N. I. Nasr, Customer lifetime value: marketing models and applications. *Journal of Interactive Marketing*, 12(1), 17-30, 1998.
- [4] T. Bayo'n, J. Gutsche and H. Bauer, Customer Equity Marketing: Touching the Intangible. *European Management Journal*, 20(3), 213-222, 2002.
- [5] S. Rosset, E. Neumann, U. Eick and N. Vatnik, Customer lifetime value models for decision support. *Data Mining and Knowledge Discovery*, 7(3), 321-339, 2003.

- [6] H. Hwang, T. Jung and E. Suh, An LTV model and customer segmentation based on customer value: a case study on the wireless telecommunication industry. *Expert Systems with Applications*, 26(2), 181-188, 2004.
- [7] P. V. Freytag and T. Ritter, Dynamics of relationships and networks—creation, maintenance and destruction as managerial challenges, *Industrial Marketing Management*, 34(7), 644 - 647, 2005.
- [8] H. K. Stahl, K. Matzler and H. H. Hinterhuber, Linking customer lifetime value with shareholder value. *Industrial Marketing Management*, 32(4), 267- 279, 2003.
- [9] V. Allee, Reconfiguring the Value Network. *Journal of Business Strategy*, 21(4), 1-6, 2000.
- [10] V. Allee, A Value Network Approach for Modeling and Measuring Intangibles. *Presented at the conference of "The Transparent Enterprise, The Value of Intangibles*, Madrid, Spain, 2002.
- [11] P. Kothandaraman and D. T. Wilson, The Future of Competition Value-Creating Networks, *Industrial Marketing Management*, 30(4), 379-389, 2001.
- [12] J. Peppard and A. Rylander, From Value Chain to Value Network: Insights for Mobile Operators. *European Management Journal*, 24(2-3), 128-141, 2006.
- [13] N. Gooding, What is CRM: A buzz word or an effective process, *Article was located at <http://www.crmcentreworld.com>*, 21/07/03.
- [14] F. Newell, *Loyalty.com: Customer relationship management in the new era of Internet marketing*, New York: McGraw-Hill, 2000.
- [15] J. Dyche, *The CRM Handbook: A Business Guide to Customer Relationship Management*, Addison-Wesley, 2001.
- [16] R. M. Morgan and S. Hunt, The commitment-trust theory of relationship marketing, *Journal of Marketing* 58(3), 20-38, 1994.
- [17] J. Ojasalo, Key network management. *Industrial Marketing Management*, 33(3), 195-205, 2004.
- [18] D. J. Flint, R. B. Woodruff and S. F. Gardial, Exploring the phenomenon of customers' desired value change in a business-to-business context. *Journal of Marketing*, 66(4), 102- 117, 2002.