



## iValue: A knowledge-based system for estimating customer prospect value

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### ABSTRACT

In the past, companies changed their focus from product-oriented within marketing to demand-oriented within quality improvement. Today, they emphasize customer service, customer loyalty, and customer profitability. The significance of customer-centric services has become critical and essential. However, certain research which investigates the effect of customer lifetime value focuses only on lifetime values of existing customers. This study devises a novel model to predict customers' prospect value. In the proposed model, we utilize the concept of finance which stands in the current status and predicts future value based on historical data. The simulated results reveal that, in a long-term simulation, customer prospect value rises when reach rate increases. Decreasing reach rate and costs result in high customer prospect value; however, the value of customer prospect value decreases in a long-term simulation. The new model complements the existing customer lifetime value model from a different perspective and provides clues to customer value for future researches.

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### 1. Introduction

In the past, companies changed their focus from product-oriented within marketing (1960s) to demand-oriented within quality improvement (1980s). Today, they emphasize customer services, customer loyalty, and customer profitability. That is, customers drive future strategies and are an important part of assets for most companies [10,11,19]. Companies are not only aware of the significance of customer loyalty but also consider how customers are beneficial in terms of a long-term relationship.

Liu et al. [18] indicated that high customer value will result in superior customer satisfaction and affect customer loyalty. The benefit is enormous when customers are loyal to products or services. Moreover, enterprises operate more effectively if they realize further value from consumers or potential customers [12]. Hence, retaining loyal customers is the foundation of profit from either the cost or the revenue perspective. That is, good customer relationships drive companies' survival.

In the service industry, customers are no longer satisfied simply through purchasing one product in the conventional sales model, as services bundled with the products play a vital role in gaining profits [26]. In addition, the transaction model has evolved from face-to-face to electronic, and certain research investigates the significance of ubiquity in today's information society [9]. Thus, selling products and services in a ubiquitous environment will be essential in order to provide a new transactional channel to cus-

tomers. Service providers can respond to real-time customer needs, reduce complaints, raise customer satisfaction, and attain good quality of customer services [5,24].

Customer lifetime value (CLV) quantifies lifetime value of a customer [27]. Berger et al. [1] indicated that companies need to consider revenues and costs based on cash flow of profits in measuring CLV. The profits are generated by a customer who purchases products or consumes services. The traditional CLV model has been extended by several studies, either applied to diverse applications or modified by different parameters. However, research that investigates the effect of future value compared to present value of cash flow is still lacking.

The significance of customer-centric services has become critical and essential. Some research has investigated the effect of CLV but it has focused only on lifetime value of existing customers. Additionally, most research focus on physical products or services when applying CLV concept. This study devises a novel model (customer prospect value, CPV) to predict customers' future values in a ubiquitous environment (e.g., based on ubiquitous services). This model complements the existing CLV model from a different perspective and provides clues to customer value for future service providers. That is, this work will change the concept from present value to future value in order to estimate future customer. Moreover, we use a simulation to investigate the differences in CPV among various types of markets (e.g., perfect or imperfect).

The rest of this paper is organized as follows. Section 2 surveys the extant literature, such as customer value/customer lifetime value and service quality. Section 3 devises a mathematical model for measuring the proposed customer prospect value. Section 4

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provides the results of simulation, while Section 5 discusses the major contributions, and Section 6 provides a conclusion.

## 2. Background

### 2.1. Customer value

In today's business environment, companies attempt to increase customer values and enhance customer loyalty in order to penetrate the market. In particular, they extend the business life cycle through providing satisfying products and services to customers. Evidence from past research and insights from an exploratory investigation are combined in a conceptual model that defines and relates price, perceived quality, and perceived value. Zeithaml [28] developed a model to evaluate quality and value and how quality and value were communicated to consumers. Parasuraman and Grewal [23] provided a component that showed four different types of perceived value based on the four service quality dimensions: acquisition value, transaction value, in-use value, and redemption value. These components suggest that perceived value is a dynamic construct in that the relative emphasis on each component may change over time. Thus, companies not only provide particular products and services but also consider the effect of time for customers.

However, the ambiguous definition of value for products or services and inappropriate positioning of customer value will result in failure. Table 1. Some research has provided clues to measuring customer lifetime value from the perspective of several variables (e.g., financial indicators) and has evaluated how customers affect companies [8,14,22]. That is, this work investigates the degree of how marketing channels influence customer value and what are the future values of a customer.

### 2.2. Customer lifetime value

The needs of different customers are diverse because they are based on their differing contexts, e.g., background and values. Generally, even a single customer's needs change from time to time. Companies seeking to understand what marketing strategies are beneficial and how to increase customer value when organizing marketing plans often utilize statistical approaches to estimate customer lifetime value or other indicators and to identify customers.

For example, FedEx analyzed the top 30 customers (e.g., top 10% sales of total revenues) and found that some customers consistently limit their contributions and increase their demands. FedEx

decided to increase the rate for these customers, with the result that some customers eventually changed partners (e.g., to UPS) [20]. A profitable customer is one who can create profits, increase revenues, and assist in reducing losses [13,21], and the difference between the revenues and costs generated by a customer is the customer lifetime value (CLV) [8].

Some researchers have proposed similar concepts to CLV, revising it from different perspectives. Mulhern [21] utilized the concept of present value and future value to measure customer lifetime value from the financial perspective. Nadeem [22] investigated the models of marketing strategy for long-term and short-term CLVs in an e-business context. Liu et al. [17] applied different variables to CLV in the service context and defined several relationships to customer value. The current work synthesizes the CLV concept to devise a knowledge-based system which estimates customer future value. In addition, the proposed method complements the existing CLV from a different perspective.

### 2.3. Knowledge-based systems

In general, a knowledge base is a centralized repository for information, including a public library or a database of related information about a particular subject can be considered as the examples of knowledge bases. A knowledge base is a machine-readable resource for the dissemination of information, generally online or with the capacity to be put online. Knowledge-based systems are systems based on the methods and techniques of artificial intelligence. Typically, the core components are the knowledge base and the inference mechanisms. The basic techniques of a knowledge-based system include rule-based techniques, inductive techniques, hybrid techniques, case-based techniques, model-based techniques, and etc.

Lin [16] utilizes an object-oriented method to build customer knowledge management information system (CKMIS). The method is use case driven with UML notations utilized and extended as its modeling tool. Also, the method provides an effective approach to manage customer relationships. Choy et al. [6] propose a knowledge-based supplier selection and evaluation system. The knowledge of suppliers can be retained, categorized, retrieved and managed effectively through the system. Chen and Yan [4] devise an in-process customer utility prediction system for product conceptualization. The system aims at capturing customer desirability genuinely and timely. It synthesizes the customer involvement and marketing analysis for product conceptualization. Moreover, Lin and Hong [15] utilize customer knowledge to design electronic catalog through a data mining system. The system enables marketing managers to rapidly establish marketing strategies to enhance sales and profit.

Hence, the present paper synthesizes certain concepts and attempts to propose a knowledge-based system in order to estimate, reuse, and aggregate customer prospect value with certain benefits: (1) more efficient estimation for customer value (2) a different perspective to predict what are customer prospect values, and (3) customer knowledge accumulation and reusing.

## 3. Conceptual framework

### 3.1. System framework

Fig. 1 presents iValue system framework with three provided modules and a CPV knowledge base. iValue system extracts transactional data of a customer from historical database (e.g., prices and costs) dynamically and utilizes the information to estimate the profit. Next, the estimated profit will be employed to predict additional

**Table 1**  
Summarizes the major differences between CPV and CLV.

	CPV	CLV
Research direction	Utilizes service quality and reach rate to measure customers' future value	Evaluates customer lifetime value
Advantages	<ol style="list-style-type: none"> <li>1. Financial perspective</li> <li>2. Design for ubiquitous services</li> <li>3. Combination of service quality and reach rate</li> </ol>	<ol style="list-style-type: none"> <li>1. Financial perspective [8]</li> <li>2. Utilizes customer retention rate [22]</li> <li>3. Customer value table [21]</li> </ol>
Limitations	<ol style="list-style-type: none"> <li>1. A simple mathematical model</li> <li>2. Service quality is not easy to quantify</li> <li>3. Ignores the differences among various types of market</li> </ol>	<ol style="list-style-type: none"> <li>1. Complicated computation [17]</li> <li>2. Ignores satisfaction [22]</li> <li>3. Appropriate only for physical environment</li> </ol>

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