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Consuming information systems: An economic model of user satisfaction

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ABSTRACT

This paper has two major objectives. The first objective intends to answer the following question which is of significant interest to information system (IS) researchers and practitioners: *How does user satisfaction (satisfaction) respond to changes in system use and system attributes?* The second and more ambitious objective is to promote the application of economic theories in user behavior research. In contrast to prior research that conceived the development of user satisfaction as an information valuation and integration process, we consider such development to be embedded in the IS consumption process, that is, users gain utility (satisfaction) from consuming (using) the system. This perspective enables us to re-conceptualize user satisfaction as a proxy of utility and apply utility research in economics to study user satisfaction. An economic model of user satisfaction was developed. Two empirical studies were conducted to examine the research model. The findings confirmed the consumptive nature of user satisfaction. Apart from enriching our understanding of user satisfaction, this research demonstrates the usefulness of economic theories in user behavior research.

1. Introduction

As a major intervener between information technology (IT) investments and the realization of their economic value, user satisfaction (satisfaction) has been an enduring topic of interest over the past two decades [6,37,67]. This paper attempts to answer the following important yet under-researched question: *How does user satisfaction respond to changes in system use and to system attributes?* IT practitioners often attempt to promote the use and quality of information systems (ISs), thus they need to know how such efforts work to improve user satisfaction. Understanding this research question helps practitioners formulate an optimal IS implementation strategy and make better decisions regarding resource allocation to maximize user satisfaction.

Among various theoretical lenses applied by scholars to investigate IS user satisfaction, the IS Success Model by DeLone and McLean [19] continues to be widely used. Relying strongly on information integration theory (IIT) in psychology [4,24], the IS Success Model and its subsequent extensions have predominantly focused on how users evaluate information systems and integrate their evaluations in developing user satisfaction. Linear models have been widely used in user satisfaction studies, indicating the presumed monotone effect of system use and user perceptions of system attributes (such as information quality and system quality) on user satisfaction. Our specific research question – i.e., how user satisfaction responds to changes (increases or decreases) in system use and to improvements or deteriorations in system attributes – remains unanswered.

Several studies have explored the non-linear formation of user satisfaction from different theoretical perspectives. Drawing on the lens of information integration, Sethi and King [68] examined whether different ways (linear and non-linear) of *integrating* cognitive elements affect user satisfaction. However, the results of their study offer minimal insights to explain the effects of changes in the perception of system attributes on user satisfaction. Grounded on expectation-disconfirmation theory in psychology, Brown et al. [14] applied polynomial regression analysis to investigate whether non-linear relationships exist across experience, expectation, and user satisfaction. They argued that researchers' use of polynomial analysis is consistent with expectation-disconfirmation theory; however, their results suggest that the investigated relationships are linear in nature. The aforementioned studies, all inspired by psychological theories, investigate possible non-linear relationships across user evaluation, user experience, and user satisfaction. However, none of these studies have theoretically modeled how user satisfaction responds to changes in user evaluations and system use.

To achieve this end, this research refers to economics for theoretical support. Economics, especially microeconomics, explicitly studies changes in user utility and preferences, and thus can be helpful in exploring the answer to our research question. Conceiving user satisfaction as a proxy of the utility derived from IS consumption, we draw on utility research to re-theorize the relationships between user satisfaction and system use and between user satisfaction and information quality/system quality. Specifically, we use Law of Diminishing Marginal Utility to propose non-linear effects from system user and information and system qualities on user satisfaction. Accordingly, the more a person uses an IS,

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the less an increase in system use will enhance user satisfaction. Similarly, the higher the information quality/system quality is, the less one unit change in information quality/system quality can contribute to user satisfaction.

This paper makes two primary contributions. First, this research is the first to offer an enriched understanding of user satisfaction by referring to economics as the theoretical foundation. As will be illustrated in detail later, this paper uses utility theory in economics to re-conceptualize user satisfaction and its relationship with information quality, system quality, and system use, thereby advancing our understanding of the nature of user satisfaction. This also renders significant practical implications with regard to investment on information systems improvement, as will be discussed later. Second, this paper bridges economic research and user behavior research. "We see things in part by how we talk about them and the concepts and constructs we use in our descriptions" ([23], p. 16). This research demonstrates *how* to apply the utility theory to study user satisfaction with information systems. To do so, several assumptions held in economics are released. We hope that this research can encourage more studies in the interdisciplinary area of economics and user behavior.

2. Conceptual developments

2.1. Theoretical foundation: Utility theory

Utility is a fundamental concept in economics. Its definition has changed over the past centuries. The original definition of utility dates back to the 1780s. Bentham conceived utility as "pleasure and pain, the 'sovereign masters' that 'point out what we ought to do, as well as determine what we should do'" ([10], cited from [41]). This original definition views utility as a subjective feeling. Conceptually, utility is abstract rather than concrete or observable. We can arbitrarily assign a value to measure utility for the sake of comparison (for example, we can compare apples and bananas in terms of how much utility a person can obtain from eating them). As the foundation of classical economics, the work of Bentham profoundly influenced economists during his time and in the succeeding generations [21,39]. Bentham's definition of utility was later labeled as *experienced utility* because it emphasized the actual experience of people [41]. Subsequent researchers also proposed other types of utilities, e.g., decision utility (utility that can be inferred from decisions) [65,75,76]. Nevertheless, the definition of Bentham is the most fundamental and hence, the most widely used. In fact, Kahneman et al. [41] emphasized that we should "go back to Bentham" when studying utility. Accordingly, we refer to the traditional Bentham definition of utility in this research.

A revolutionary event in the field of economics was the development of the notion of marginal utility by neoclassical economists [39,49,53]. In contrast to preceding classical economics movement that focused on total utility, neoclassical economics emphasized marginal utility. Marginal utility refers to the additional benefit or amount of utility gained from each extra unit of consumption. According to the law of diminishing marginal utility, marginal utility decreases with each additional unit of increase in the consumption of a good (Fig. 1). Marginal utility depends on how much a person has already consumed, such that the more goods an individual consumes, the less incremental utility he or she obtains from the last unit of that good. Accordingly, total utility increases at a slower pace as an individual consumes more of the same good (for example, a person obtains less utility from the second apple than from the first one). With few exceptions, goods exhibit diminishing marginal utility [31].

Bentham's definition of utility focuses on past consumption, whereas the other stream of utility research emphasizes *expected* utility of future consumptions. Researchers (e.g., [5,26,43,66,93]) have argued that a person chooses between prospects by comparing their expected utility values. Specifically, expected utility values of prospects are usually conceived as the weight sums obtained by adding utility values of outcomes multiplied by their respective probabilities. People compare utilities of the future state with the current state. Rational people would wish to obey the axioms of the theory, and most people do so most of the time [40].

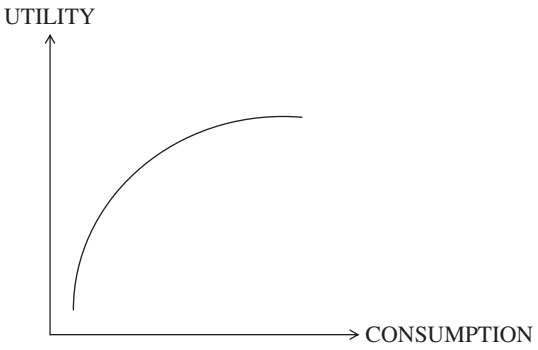

Fig. 1. Diminishing marginal utility.

Furthermore, when developing their Nobel Prize-winning prospect theory, Kahneman and Tversky [40,86] argued that people evaluate utility of prospects based on gains and losses relative to a reference point rather than on weight sums of the utility of different outcomes [9]. A reference point is usually the "current position" of an individual, although exceptions exist [9,86]. For example, a widely used reference point in economics is current wealth. The impact of a prospect of wealth on a person's happiness depends on the amount of wealth he/she currently possesses.

Despite its differences from the original utility theory, the prospect theory also embraces diminishing sensitivity,[2] a concept similar to the law of diminishing marginal utility. Diminishing sensitivity posits that the first expected gains/losses lead to the largest increase/decrease in utility [9,40,86]. The value of a change (that is, marginal value) "decreases with the distance from the reference point" ([86], p.1048). Although diminishing sensitivity and diminishing marginal utility are "logically independent" ([86], p.1049), both predict that the distance from the current status determines incremental contribution to utility of one unit change of consumption/evaluations. From the reference point (the current status), additional consumption contributes diminishingly to utility. Therefore, both utility theory and prospect theory will yield an empirically similar diminishing contribution of deviations from the reference point.

2.2. Re-theorization of the IS Success Model: A utility approach

Although prior IS Success studies have resulted in various model re-specifications and extensions [20,63,67], user satisfaction remains a pivotal construct. Satisfaction has been conceptualized as "a subjective evaluation of the various consequences… evaluated on a pleasant–unpleasant continuum" ([67], p.246). Satisfaction has also been viewed as "the attitude that a user has toward an information system" ([97] p. 87), an object-based attitudinal evaluation of the system rather than the use of the system alone.

From the utility perspective, we conceive user satisfaction, which has an obvious happiness component in its definition, as a valid proxy for utility. As stated earlier, utility refers to the subjective pleasure and pain of a person and cannot be measured directly ([10, cited from 41]). A number of experts describe utility as "agreeable states of consciousness," whereas others explicitly refer to utility as "the satisfaction of people's informed

[2] One major assumption of the prospect theory is that people are generally risk averse [40,80,85] and as such, people usually place more weight on potential losses than potential gains. However, we do not study risk aversion in this paper, that is, we do not distinguish between the weights of gains and losses because of two reasons. First, both gains and losses still demonstrate diminishing sensitivity; from a reference point, marginal sensitivity of both gains and losses is declining. Second, expected utility theory has long considered risk aversion to be equivalent to the concavity of the utility function, that is, diminishing marginal utility [5,62]. Nevertheless, risk aversion is a promising topic for future research.