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The Impact of Software Development Process on Information Systems Success: A Theoretical Perspective Integrating Customer Satisfaction, Technical and Organizational Issues

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Abstract

Total Quality Management (TQM) principles emphasize the use of customer satisfaction as a measure of quality. This paper shows how customer satisfaction can be managed during the systems development process to ensure software quality when technical quality and a fit between organizational needs and systems capabilities are present. To that end, we present a model for managing the customer satisfaction aspect of developing quality software. This model is based on the TQM philosophy for both service and production operations.

Introduction

Information technology (IT) hardware, communications technologies, and operating and application software form the core of information systems (IS). While the success of an IS depends on the quality and appropriate deployment of all components of an IS, it has been shown that IS success or failure is largely dependent on the quality of the application software (Jones, 1996). IS success or failure is typically caused by the ability or inability of the application development process to meet the delivery schedule, budget or customer requirements (Jones 1996). Other causes of failure stemming from the application development process include incorrect estimations of resource needs, ease of learning and use, customer support levels required, and ease of maintenance and modification.

But how do we ensure that high quality software are developed so that we reduce the rate of IS failure? The traditional product quality approach to ensuring software quality did not help reduce IS failure rates. The emergence of new quality practices promoting the view that process quality is an antecedent of product quality (Deming, 1986; Shingo, 1986; Taguchi, 1986) shifted the focus of software quality management to ensuring systems development process quality (Thiagarajan, 1996; Rockart and Hofman, 1992). We concur with the view that systems development process quality is essential to ensuring software and hence IS quality. However, we contend that there is a lacuna in the literature in explicating how systems development process can be managed to ensure quality application software are developed.

In this paper we illustrate how software development process quality can be managed to ensure IS success. We specifically address two issues – 1) what are the key factors that determine software quality and hence IS success and 2) how can the software development process be managed to ensure the success of a system. Our paper has its broad theoretical foundations in total quality management philosophy. We put forth the notion that customer satisfaction is essential for system success. However technical properties of the system and the fit between the organizational needs and system capabilities need to be attended to, equally.

Our paper proceeds as follows. First we highlight the role of technical factors, the fit between organizational needs and system properties, and customer satisfaction for IS success. Second, we present our theoretical framework for managing software development process to explicate its usefulness in developing quality IS. The final section is the conclusion.

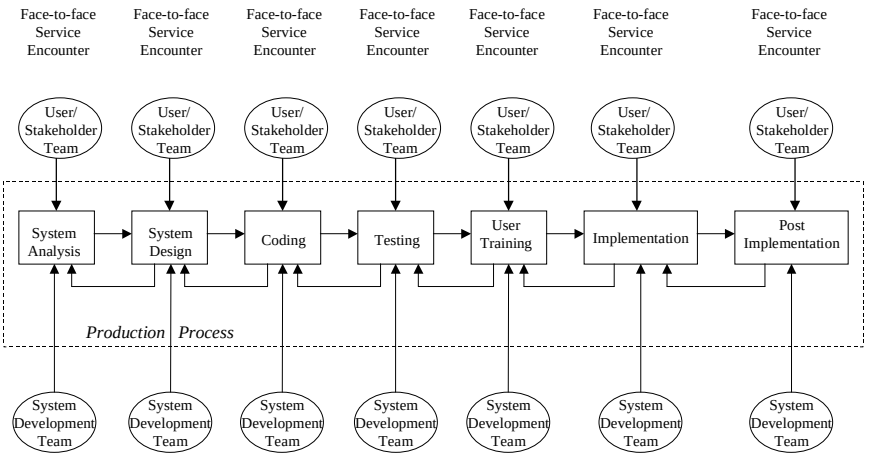
Determinants of IS Success.

Much has been discussed in IS literature on factors that affect information systems success and on the measurement of the same. It is not our intention here to delve into all factors that affect IS success. Instead, we focus on three issues – technical properties of a system, fit between organizational needs and system capabilities, and customer satisfaction - that we identify as key influencers of software quality and in turn of IS success. We highlight the role played by these three issues in ensuring application development success in this section.

Technical Properties of a System

The technical component of system success is the system specification, or the result of the system design step. This is the specification from which the system will actually be built. How well it reflects the requirements of the system will determine how well it contributes to overall system success. We identify the following four as the specific technical issues that need to be considered in the system specification to ensure system success. 1) use of effective software technologies, 2) use of adequate tool suites, 3) creeping user requirements and 4) the extent of

Figure 1- Steps of the System Development Process



use of reusable components and material. Other technical aspects that need to considered are choice of hardware, communication systems and network systems.

Appropriate technical choices are important to ensure system success. However, they are not sufficient to ensure success. We also need to consider the fit between the organizational needs and system capabilities, which we discuss next.

Fit between Organizational Needs and System Capabilities

Another factor of system success is how well the choices, such as platform and development tools, fit with the technology and business strategies of the organization. If there is a good fit, then this factor will contribute to overall system success because it will help take the organization down the strategic path it has chosen.

Some of the important strategic business factors that need to be addressed include an ability to provide new business capability, add business value, reduce operating costs, and enhance competitiveness. The strategic technology factors will include technology vision towards emerging technologies, matching technology choices with IS personnel skills and have technology experts available. It is important that there be a fit between these organizational needs and system capabilities. However, the strategic fit alone will not ensure system success. We also need to address the issue of customer satisfaction to ensure system success, which is now discussed.

Customer Satisfaction

Total Quality Management philosophy promotes customer satisfaction as a key indicator of quality. Dr. Noriaki Kano identified three components collectively contributing to customer satisfaction - dissatisfiers, satisfiers and exciters (Evans and Lindsay, 1996). Dissatisfiers are quality characteristics that by their presence do not add to the satisfaction of the consumer, but by their absence cause dissatisfaction. Satisfiers are those quality characteristics that help induce satisfaction among users. Exciters are those quality characteristics that the customer has not visualized and whose appearance in the software will truly delight the customer. Quality characteristics that are exciters at a point in time may not continue to be exciters over time. They usually become satisfiers and then end up as dissatisfiers. Thus the composition of dissatisfiers, satisfiers and exciters are constantly changing. A customer is said to be satisfied if the software both satisfies and excites him or her, and if there are no missing quality characteristics that will induce dissatisfaction.

We have two basic groups of customers for an IS – users and stakeholders. We consider users to be the end or direct users of the system. The stakeholders group consists of owners, indirect users and strategists. The owners are responsible for sponsoring and paying for the IS. Indirect users do not capture, input or manipulate data but use the information generated by the system. Strategists ensure that organizational needs and vision are reflected in the system. Both users and stakeholder groups need to be satisfied with the software developed to ensure system success.

While each of the three issues outlined above is necessary for system success, none of them, by themselves or in tandem with another, is sufficient to ensure system success. System success requires all three issues be thoroughly addressed. Our focus in this paper is the third factor of system success – customer satisfaction and we now turn our attention to managing customer satisfaction through the system development process.

Managing Software Quality

Even if a system is of high technical quality and fits with the organizational needs, it could still end up as a

Figure 2 User/Stakeholder Satisfaction Assessment

	System Analysis	System Design	Coding	Testing	User Training	Implement	Post Implement	Overall Satisfaction Score
Influencing Factor (1)	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"
Influencing Factor (2)	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"
Influencing Factor (n-1)	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"
Influencing Factor (n)	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"
Satisfaction Score	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	"+,0,-"	**"+,0,-"**

failure if the customer is not satisfied. If the customer is not satisfied with the system, (s)he will either not use the system, use it as little as possible, or use it in a way that is different from the design intent. For these reasons, managing customer satisfaction becomes an important issue in software development. While the issues of technical quality and strategic fit have been discussed in the IS literature, there is a vacuum in terms of how customer satisfaction can be managed to ensure system success. We now introduce our model for managing customer satisfaction. The model developed is based both on service quality and production quality concepts developed in the operations management area.

The system development process is composed of several steps with various feedback loops, as indicated in Figure 1. This is essentially a production process. Simultaneously, there are service encounters between the user/stakeholder team and the system development team throughout the production process. These service encounters may vary in intensity throughout the production process. As such, there is some degree of (dis)satisfaction that occurs as a result of the encounter. User/stakeholder satisfaction with each step of the development process will have an impact on overall user/stakeholder satisfaction at post-implementation. This concept is shown in Figure 2.

A plus sign (+) indicates that the service encounter resulted in customer satisfaction. A zero (0) indicates that the customer had no feeling of satisfaction or dissatisfaction with the service encounter. A minus sign (-) indicates that the customer was dissatisfied with the service encounter. Post-implementation satisfaction is the "sum" of the satisfaction/dissatisfaction scores at each service encounter throughout the development process.

This model assumes that the user/stakeholder team is representative of the general user/stakeholder population for the system being developed. In addition, there is a peer influence factor. In other words, if the user/ stakeholder group is satisfied or delighted with the development process, they will share that satisfaction with their co-workers thus building an air of anticipation regarding system delivery. If, on the other hand, the user/stakeholder team is dissatisfied with the development process, this too will be communicated to their co-workers. The result of this dissatisfaction will be an environment where the new system will be approached with hesitation and caution.

Every stage of the software development process has key influencing factors that affect the customer – user and stakeholder groups – satisfaction. A high level of satisfaction on all influencing factors across the system development process is required to ensure post implementation satisfaction with the software developed. TQM principles state that a final measure of quality would be customer satisfaction.

Conclusion

The Total Quality Management philosophy can be applied to both the service and production aspects of software system development. Employing this philosophy will help ensure that appropriate technical properties are designed into the system, there will be a good fit between organizational needs – both business and technology – and system capabilities, and that there will be a high degree of customer satisfaction with the software system being developed. Since these three are key determinants of system success or failure, managing them appropriately is crucial to developing a successful application software system. In this paper we focused on managing the customer satisfaction component during system development. We proposed a model whereby overall user satisfaction can be measured by "summing" the satisfaction scores of each step in the system development process. Managing the system development process so that customer satisfaction is the actual outcome at post-implementation will take the software system one step closer to being a success rather than a failure.

References available upon request from the authors.