



## Information Systems Maintenance: The Application of Total Quality Management Construct

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### Abstract

*This research discusses information systems (IS) maintainability in terms of control, reliability, user participation, and training (CRUT). Dependable IS have the potential to protect organizational information as well as data in cases of emergencies. This paper reviews the application of the total quality management (TQM) construct to suit organizational IS. The TQM elements that are mentioned in this research are integrity, training, employee involvement, and customer focus (ITEC). The research objective is to discover how organizational management may better preserve the quality of the IS they adopt and how their participation in IS development could impact quality maintenance. A qualitative research approach is proposed to explore the CRUT model in terms of IS maintenance.*

**Keywords:** IS, CRUT, TQM, ITEC, organization, management, systems.

### Introduction

Information systems (IS) have been known to aid organizational management in providing quality services to their customers. However, if the IS used in organizations are not properly maintained, the quality of the services provided may be regarded as poor. In contemplating how IS quality connects with IS maintenance, Dekleva (1992) observed that the amount of time invested in IS emergency error rectifications and system malfunctions is most likely to interfere with the application of contemporary systems. Proponents of IS management have also stressed the importance of considering IS strategy as an organizational outlook on operation and management (Chen, Mocker, Preston, & Teubner, 2010). If an organization's

customers do not trust the IS used in the services they receive, they may be more likely to consider other trustworthy organizations.

The IS literature suggests customers may assess the quality of an organization's systems by evaluating the level of the systems services preferred and the lowest level of services customers are willing to accept (Ketinger & Lee, 2005). For instance, customers may choose not to accept services from an organization if the systems used in the services are outdated or are unable to satisfy the needs of the customers. While some authors have studied the theoretical, pecuniary, technological, and realistic problems related to IS manufacturing and preservation (e.g., Manchanda, Singh, & Dave, 2009), little research has been conducted regarding IS quality and maintenance. Organizational management has the potential of maintaining the quality of the IS utilized by their organization. Nonetheless, it remains a challenge for management to consider various ways of preserving the integrity of the systems used in their organization while at the same time providing quality services to their customers.

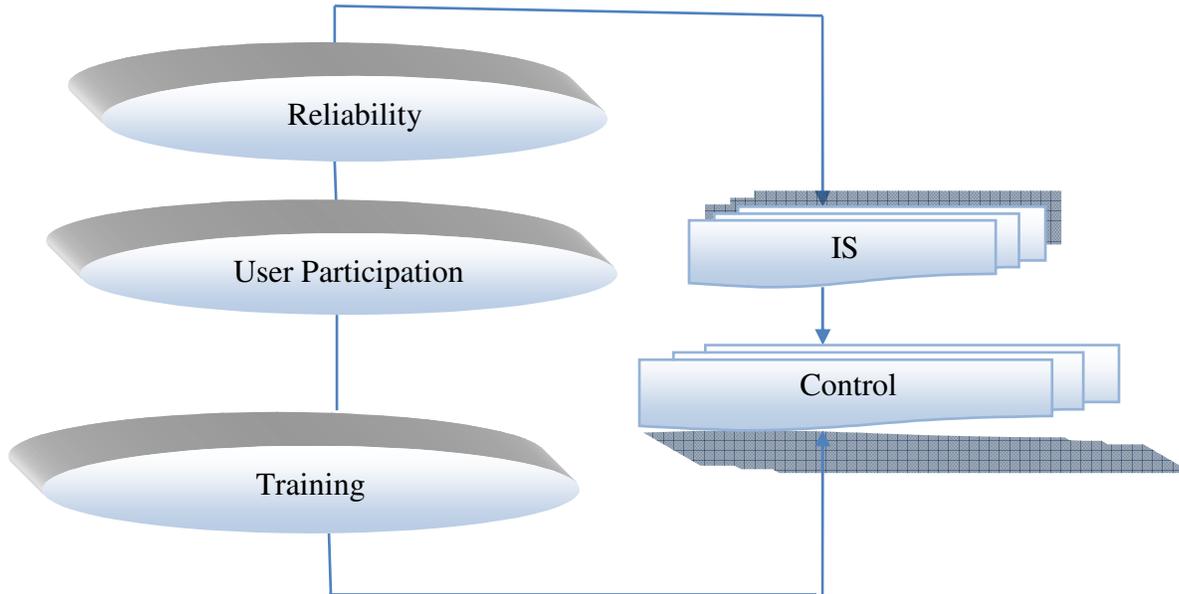
IS maintenance can be conducted through systems control, reliability, user participation, and training (CRUT). These elements are selected because they are hypothetically and practically significant in maintaining the IS quality used in organizations. Other IS researchers have addressed the centrality of reliability in IS success, how IS can be manufactured unequivocally for control and harmonization of organizational operations, the importance of user participation in IS development, and the benefits of training employees on IS maintenance (Zahedi, 1987; Pacini, Hillison, & Andrews, 2000; Tillquist, King, & Woo, 2002; Tiwana, 2010; Spears & Barki, 2010; Jun & King, 2008; Puhakainen & Siponen, 2010; Sharma & Yetton, 2007). The present research will explore how organizational management may better preserve the quality of the IS they adopt and how their participation in IS development could impact quality maintenance. The authors of the present research are interested in this topic because of the attention given to IS maintenance in the media.

The remainder of this paper is organized as follows. The second section discusses the CRUT model. The third section describes the theoretical framework. The fourth section mentions the proposed study's research approach. This paper concludes with a summarization of the research.

### **Control, Reliability, User Participation, and Training (CRUT) Model**

As organizations become heavily involved in IS adoption, management is more likely to pay attention to factors that would enable them to properly maintain the quality of the IS. The supporters of IS have pointed out how researchers have spent less time on technology growth and more time on the societal framework in which information technologies are intended and used (Sidorova, Evangelopoulos, Valacich, & Ramakrishnan, 2008). Considering the societal framework in which IS initiatives are established, Kappos and Rivard (2008) declared that the perspectives IS researchers have about systems do not capture the relationship between culture and the method of manufacturing IS. To properly adopt the right IS to accomplish organizational goals, management should consider utilizing systems that can be controlled and maintained.

**Figure 1. CRUT Model**



The elements in the CRUT model for IS maintenance are connected with each other. Without the element of control, the other elements would be inefficient. The element of control is also central because without accurate control of IS, it would be difficult to determine the effectiveness of the systems. The elements of reliability, user participation, and training are included because they contribute to proper control of an organization's IS.

### **Control**

IS control is the beginning of data preservation in an organization. In responding to the research objectives, organizational management may preserve the quality of their organizational IS by exercising control over the systems. Management should consider exercising control to uphold roles and responsibilities and avoid scope divergence, schedule slippages, and cost overruns (Subramanian, Klein, Jiang, & Chien-Lung, 2009). For instance, management may use individuals who are qualified and experienced in controlling systems before spending money on purchasing enhanced systems that may accomplish the same tasks as their current systems. If the IS used are not properly controlled, the integrity of organizational data would be compromised. For instance, IS that are not well-controlled may result in data breaches and infiltration by intruders. Huff and Prybutok (2008) noted that "planning and control of software development projects is the responsibility of the project manager" (p. 34). When project managers are informed of the software needs of the organization, the management are better able to manage the IS effectively. Lederer and Mendelow (1988) mentioned that IS executives should learn their organizations' purposes so that they can exercise control over the type of computer-based IS they contribute to the organization. Management can better maintain the systems their organization uses by adopting systems that are reliable.

## Reliability

Reliability is defined as the ability of merchandise to work effectively under obligatory circumstances for a pre-assigned time (Agmon & Ahituv, 1987). Unreliable systems may result in unforeseen problems. For instance, systems may not accomplish the intended tasks and information may be lost. Organizational management may determine if the IS are dependable based on how quickly they detect problems regarding their functions. IS that are unable to sense if a breach has occurred and has less security measures that would protect information may be considered untrustworthy. For example, IS that are manufactured to recognize how many people have logged into the systems for a period of time may fail to do so. Zahedi (1987) asserted that reliability is an irrefutable measure that is invaluable in the organization and supervision of IS. Systems that are incapable of detecting early problems are more likely to crash because warning signs that should have been handled may result in more serious problems.

In order to make sure an organization's IS are competent in sensing problems, management should update the systems they use on a regular basis. When envisioning how systems are manufactured, Butler and Gray (2006) discovered that IS developers concentrate too much on procedures for attaining reliable IS performance by constructing technically reliable systems from different combinations of components instead of concentrating on the software. De and Cheng (1986) related an account of a system that was adopted in an organization but was not maintained over the course of time. Due to the changes that were made in the organization, "the system's applications have evolved into a situation where its original design is no longer amenable to the information characteristics of the host enterprise, resulting in unsatisfactory system performance" (De & Cheng, 1986, p. 34). Even though there may be nothing wrong with an organization's IS, there is a need to upgrade the system so it will evolve as new problems arise and as the organizational environment changes. To ensure an organization's systems are well controlled and reliable, management would need to involve employees in the IS maintenance activities.

## User Participation

User participation in the quality of IS is important for effective maintenance. Prior to the 1980s, the terms *user participation* and *user involvement* had been employ interchangeably in IS examination (Jun & King, 2008). IS user participation is the input of systems production services of the individuals who make use of IS on a regular basis, for instance, employees, customers, etc. On the other hand, IS user involvement is the activities contributed by IS users on the development of IS, for instance, involvement in IS usage procedure manuals. Organizational management should not relinquish their responsibilities for making decisions about IS functions to any employees; instead, such responsibilities should be given to the IS specialists in the organization (Franz, 1985). IS research regarding user participation suggests that systems users who consider themselves experts are unlikely to accept a system unless they put forth a significant contribution on the system's design (Saleem, 1996; McKeen, Guimaraes, & Wetherbe, 1994; Hartwick & Barki, 1994). To effectively sustain the quality of IS used in organizations, management should encourage IS users in quality participation.

Spears and Barki (2010) identified three underlying theories in IS user participation: buy-in, system quality, and emergent interactions. In the buy-in theory, individuals who participate in IS development are more likely to understand the system as a whole. For example, management may be more accepting of IS if they are present or involved in the systems'

manufacturing process. The system quality supposition denotes that users may inform the IS producer of the information needed in the system. In this case, IS users and manufacturers would work together on how to enhance a system to meet organizational needs. Furthermore, the emergent interaction theory is concerned with the relationship IS users build with the systems' manufacturers and how this relationship has the potential of strengthening IS usage. Employees could benefit from using the emergent interaction theory if they notify the IS developers of the various features and nodes in the IS they used on a daily basis and how these features could be enhanced. By involving employees in systems development, employees and management are more likely to develop a good relationship with IS producers. This relationship has the potential of creating training opportunities for IS developers and organizational management.

## **IS Training**

Offering various training programs for IS employees would enable them to use the systems to achieve the organizations' goals. An early study by Barki and Hartwick (1989) suggested that users' responsibilities and accountabilities should be categorized according to IS roles depending on user involvement in the systems process. Barki and Hartwick (1989) further asserted that IS participants should be accountable as users for their behavior and activities to achieve overall success on a project. In addition, organizational leaders should be responsible in ensuring that their staffs are informed as IS users through ongoing systems accountability training programs and the creation of training manuals. Examples of management IS responsibilities include selecting of hardware or software, estimating costs, and requesting funds. IS researchers have echoed the need for organizational management to maintain the quality of the IS and to train their employees on how to concentrate on the systems project (Subramanian et al., 2009). Empirical studies have shown how systems' quality and organizational culture influence trust in the information technology artifact as well as how information and IS quality directly or indirectly influence adoption of enterprise resource planning (Vance, Elie-Dit-Cosaque, & Straub, 2008; Hsiu-Fen, 2010).

With unnecessary superfluties and embellishments that absorb too much time, cost too much money, and sap too much energy, the most important realization in organizational adoption of IS is not how many training programs employees are introduced to, but whether individual employees can use the IS implemented to manage the organization's data. Training programs should also teach employees how to refrain from accessing information that does not pertain to their job descriptions. Kanji (1991) mentioned that quality maintenance training should be used to change the way people think, operate, and feel in regard to their work duties. Training programs would be beneficial to an organization if they involved all personnel, including upper management.

The creation of user procedure manuals and detailed training programs are significant for IS project success and for understanding of the systems' users and participants. Organizational management should create policies and procedural manuals for IS users to be more accountable. Procedural manuals should be implemented for users who are involved in hands- on IS activity, including physical design and implementation. IS researchers have discussed the importance of hands-on IS training methods, particularly performance modeling (Lee, Kim, & Lee, 1995; Simon, Grover, Teng, & Whitcomb, 1996). Other IS training experts have mentioned the impact of training on IS acceptance within organizations, the significance of end-users' IS approval, and

the good relationship among end-users (Sharma & Yetton, 2007; Nelson & Cheney, 1987). IS users who engage in participative behaviors are also likely to engage in other behaviors (Barki & Hartwick, 1994) such as IS quality maintenance, intruder alerts training programs, etc. For organizations to be successful in IS quality maintainability, management would need to train employees on how to preserve the quality of the IS they use to do their work.

IS training is significant in complying with IS security measures (Dhillon & Torkzadeh, 2006; Straub & Welke, 1998). Prior studies have addressed diverse IS users' concerns through the use of sanctions based on deterrence theory (Siponen, Pahnla, & Mahmood, 2007; Straub 1990) and marketing campaigns (McLean 1992). The purpose of IS training and education is to persuade and activate employees' thinking processes and for them to internalize the importance of complying with security policies (Sinclair & Gardner, 1997). A study by Puhakainen and Siponen (2010) revealed the importance of training programs, managerial involvement, evaluations, and ongoing training as tools for IS success. To improve IS training and maintainability in organizations, management would need to explore the construct of total quality management (TQM).

## **Theoretical Framework**

The theoretical model posits that IS reliability, control, user participation, quality goals, and training may influence how management implement the elements of TQM in their organizations' systems. TQM is a managerial system that encourages employees to improve the quality of work their organization provides. Boaden (1997) considered TQM as a body with different sides or expressions in diverse conditions and areas within organizations at various stages of growth. Management of TQM-based organizations are constantly thinking of different ways to advance the organization's processes and operations. Supporters of TQM have examined the association between the policies and performance of human resource organizations and innovation activities of quality upgrading (Perdomo-Ortiz, Gonzalez-Benito, & Galende, 2009; Richard Yu-Yuan, Bella Ya-Hui, Shih-Chieh, & McLean, 2010).

In spite of all the examinations that have been made regarding TQM implementation, little has been said about directly applying TQM constructs to suit organizations' IS. Organizational management can potentially improve the quality of their IS. Nevertheless, it remains a challenge for them to apply the elements of TQM in their organization's IS and at the same time concentrate on making profits. Organizational systems can be used to accomplish a variety of tasks at a given moment; however, for management to maintain the quality of services the organization provides, they would need to apply the elements of TQM in the daily use of the IS. The elements of TQM that are mentioned in this research are integrity, training, employee involvement, and customer focus (ITEC) (Ahmad & Sein, 1997; Bossink & Gieskes, 1992; Aune & Kanji, 1998).

### **Integrity**

To ensure the services rendered to customers are satisfactory, organizational management should preserve the integrity of the systems used in services. Preserving organizational IS integrity is significant in attaining customers' satisfaction. Customers would not be pleased if the services they received are through IS that are unreliable and of low quality. This could result in their information being infiltrated by hackers and other uninvited guests. Nayar (1993) mentioned that when an organization's information is insecure, the firm may lose

its credibility, business, and customers' trust. When an organization's credibility is lost, it may take years for them to regain the public trust. Management of an organization may maintain their IS integrity by using systems that are strong and dependable. An organizational management who purchase IS that are low in quality simply to save money may end up spending more money bringing the systems up to date. Nayar (1993) further noted that "information integrity is the cornerstone to achieving total quality management, business process reengineering, and automated operations objectives" (p. 51).

Furthermore, maintaining the IS used in an organization enables management to maintain sustainability. Systems integrity may be preserved by hiring people who specialize in IS and who may recognize errors, breaches, or potential problems. Specialists may educate employees from other departments on how to detect problems in their various IS. Cooney and Sohal (2004) noted that leaders of organizations must not only have the capacity of leading a multifaceted organization, but also need to build up employees at all levels. When employees are educated on how to detect problems in their various IS, they are more likely to do their work well. Recognizing that process errors have the potential of affecting how an organization operates would enable management to provide the necessary IS training for their employees.

## **Training**

IS training is important in accomplishing TQM goals. Organizational management should put into place training programs that would enable employees to implement the elements of TQM to suit their organization's IS. When conducting surveys on employees' performance, IS researchers usually asked employees if they are trained in the job positions they occupy and if the training programs were efficient (Felstead, Gallie, Green, & Ying, 2010). Management should lead the way in IS training so that employees are better able to learn the implementation of TQM in their organization's IS.

To ensure employees understand the procedure for implementing the elements of TQM, management should create IS training programs that are geared toward TQM implementation. Employees may be successful in learning how to apply the elements of TQM in their systems by learning with other employees. Organizational management should recognize the positions of other people within the work environment who influence employees' learning, ideals, and performance (Gallivan, Spitler, & Koufaris, 2005). In addition, Lorenzo, Kawalek, and Ramdani (2009) noted that some training programs may take longer to master; however, the end result would be satisfactory if organizational management and employees are involved in the training process. Employees are more likely to be involved in IS maintainability when they are trained properly.

## **Employee Involvement**

Organizational employees are more likely to maintain the IS their organization uses if they are invited to be involved in the systems maintenance process. Drafting guidelines for employees to follow when implementing the elements of TQM may not be as beneficial as showing them in person. Welikala and Sohal (2008) indicated that the activities in an organization become more beneficial when people with different experiences and different educational backgrounds work together to achieve an organization's goals. By working together, employees would not only learn from each other, but would also have a sense of belonging to the

organization. On the other hand, simply involving employees in decisions regarding IS does not necessarily mean that all suggestions or contributions made by employees should be put into effect. Management must consider all contributions from employees and choose the ones that are most effective in achieving their organization's goals.

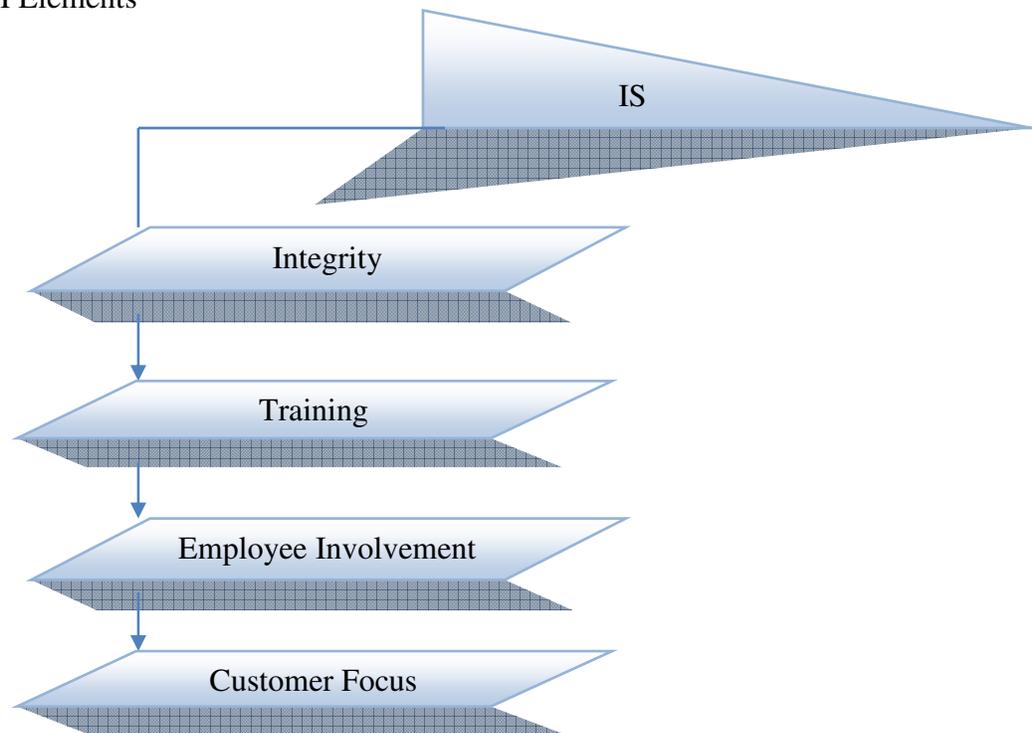
Involving employees in TQM achievement would encourage them to work in teams. Teamwork is an important part in accomplishing an organizational task. Supporters of teamwork and TQM implementation have indicated how TQM applications are best used to encourage employee involvement prospectus, how TQM implementation should be based on organizations' neighborhood conditions and motives, the connection of TQM workforce aspects and employee involvement, and the stability of teamwork within organizations from a TQM perspective (Lawler III, 1994; Wilkinson, Godfrey, & Marchingto, 1997; Daily & Bishop, 2003; Cooney & Sohal, 2004). Furthermore, organizational management may consider teamwork from a strategy team perspective. Strategy teams involve quality committees, procedure quality teams and quality enhancement teams (Welikala and Sohal, 2008). Organizational management may create strategy teams so that employees would be engaged in every potential aspect of the quality objectives of the organization.

Additionally, employees who are granted IS access to customers' information should occupy leadership positions. The leadership positions enable employees to provide team members with the customers' information needed to do their work; this is preferable to employees obtaining customers' information without any restrictions. Also, granting IS access to employees who occupy leadership positions would enable an organization to enhance its products. Seddon, Calvert, and Yang (2010) noted that enterprise vendors believed adding greater access to pertinent information in IS will further augment an organization's product suites. When an organization's products are augmented and community members are satisfied with the products, management may manufacture different types of products that are consistent with the needs of the community at large.

## **Customer Focus**

Organizational management should consider utilizing IS that would enable them to provide satisfactory services to their customers. Customers would be more trusting if they felt the systems used in the organizations will protect their information. Research shows that customer relationship management technology upholds and preserves business relationships, the importance of TQM implementation in regard to customer focus, and how some industries concentrate on customer focus and top management commitment to IS (Richard, Thirkell, & Huff, 2007; Wen-Hai & Yu-An, 2009; Dinh Thai & Laosirihongthong, 2010). Another study asserts that organizational services performance, customer satisfaction, and emphasis on quality would yield to more profits for an organization (Agus, 2004). Management would benefit more from implementing the elements of TQM to suit their organization's IS by conducting a qualitative research approach on how the CRUT model would enable them to effectively apply the construct of TQM in their systems.

**Figure 2.** TQM Elements



The TQM elements can be applied to suit organization's IS. This model is a top-down approach. Without maintaining or preserving the integrity of the IS, it would be irrelevant to involve employees in IS quality maintenance, not to mention involving them in proper protection of customers' information in the systems. In essence, the elements of training, employee involvement, and customer focus will come in play only after the integrity of the systems are preserved.

### **Proposed Research Approach**

#### **Methodology**

An exploratory study will be conducted to better understand the type of activities, behaviors, and tasks management engage in to implement TQM constructs in their daily IS operation. A background description of IS employees and management will outline the protocols management follows to ensure the CRUT model is in line with the elements of TQM.

#### **Data Collection**

To conduct this study, an organization that implements the construct of TQM will be identified. Ten semi-structured interviews will be conducted with IS managers and directors from the organization, and each interview will last approximately 60 minutes. Informants will be told the purpose of the study is to gain a better understanding of how TQM constructs could be applied to the CRUT model. Also, informants will be asked to recount the roles and activities employed by their organization in TQM implementation efforts along with the result of the outcomes.

## Analysis

Qualitative data scrutiny will be initiated from the beginning of the exploration (Liamputtong, 2009). In the process of collecting the data, the researchers will make conscious efforts and sense of the information that is collected. During this process, the researchers will apply codes by recognizing similar characteristic themes that become apparent (Smith & Firth, 2011). The researchers will begin the coding process at the early stage of the study because it would allow them to have a better perception of the data and the opportunity to follow up on unclear data (Liamputtong, 2009). Even though the coding process would be initiated early in the study, some of the codes recognized earlier may be eliminated and new codes may emerge as the researchers looked for meaning in the data.

After the codes have been assigned to a different group of characteristics, the researchers will then classify them. For instance, participants who use phrases such as quality management, training, employee involvement, and goals will be classified into one group. An iterative process of two coding procedures will be used to transliterate the information (Glaesser, 2009; Rabinovich & Kacen, 2010). First, an open-ended coding will be used to discover new code that surfaces from the interview record. Second, an axial coding technique will be used to recognize the connection between the codes. Using a qualitative research approach to explore how management and researchers would better implement the elements of CRUT and ITEC will enable them to realize better ways to preserve the quality of the systems that are used in their organization.

## Conclusion

In responding to the research objectives, organizational management may preserve the quality of the IS they use, and their participation in IS development could impact quality maintenance by implementing the CRUT model. The components of the CRUT model which are control, reliability, user participation, and training, have the potential of assisting management in adopting the appropriate IS for their organization. Organizational management should plan carefully with IS developers so that they will be able to control and maintain the IS they utilize. By exercising control over their organizations' IS, management will be able to determine which systems are reliable.

Zahedi (1987) stated that IS reliability provides an early caution about the worth of the systems and recognizes problematic areas. As reliable IS are selected, management should consider involving employees in the IS production. When considering how people may benefit from IS development, Barki and Hartwick (1994) observed that involvement in IS production should include direct and indirect activities. These various activities would create room for exploration of how IS users and developers could better manufacture systems that suit organizations' objectives. Providing training for IS users within an organization is pertinent to help define IS users' roles and to determine accountability and understanding of IS.

Additionally, the TQM constructs would enable management to better implement the components of CRUT to suit their organization's IS. The TQM elements, which include integrity, training, employee involvement, and customer focus (ITEC), would not only enable management to maintain the various systems within their organization, but also assist them to control and protect the systems from unauthorized users. The proposed research approach will assist management and researchers in determining if the CRUT and ITEC implementation approach would be a better fit for maintaining their organization's IS.

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