MASTERING THE MYSTERY THROUGH "SAIQ" METRICS OF USER EXPERIENCE IN TELECOLLABORATION BUSINESS SYSTEMS

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ABSTRACT

In the preparation of technology transition, the contextual and alternative definitions of the usability heuristics of multi-faceted role of the best practice methodology of Telecollaboration (TC) business systems that revolve around information and knowledge tangibles give rise to a new measure of System Architecture Independent Quality (SAIQ) metrics. This empirical study considers attributes of usability theory as an engineering problem, and thereby provides a starting point to reformulate the concept of TC from the user perception to embrace the Information and Communications Technology (ICT) initiatives taken in this evolving field. The scope of this paper is to enable the participants of the TC to cope with the successful strategies behind the implication and implementation of the proposed SAIQ metrics through the conceptual model of CeNTIE's (Centre for Networking Technologies for the Information Economy) TC technology transition. This includes detailed observation and analysis through examination of the explanatory power of synergetic use of innovative and value-added TC usability heuristics, through the tradeoffs involved between their alternative and adaptive features for mastering the mysteries of Quality of Experience (QoE) of the users. A critical mass of users is carefully and thoughtfully maintained throughout this study, when integrating other influential areas of complexity, to accompany the proposed measurement and mapping techniques for the pervasive use of the outcome-focused descriptive and prescriptive TC processes. Finally, we discuss on the factors contributing to the early adoption of TC technology transition for the translation of successful survivable cognitive engineering strategies to user acceptance not just to break down the barriers of this emerging paradigm of collaboration, but to assist them with gaining the ever-swifter insights into many reams of TC.

1. INTRODUCTION

People with common or shared goals traditionally meet together in a collaborative forum in a more creative and natural manner that enables them to work towards achieving an enhanced level of performance. This is usually done not just to gauge, but for the better retention of their expected learning outcomes that are complex in nature. But, TC using new technologies would provide remote groups of people an exciting opportunity to speculate, interact and share their explicit knowledge to learn and enable them to move towards a new collaborative paradigm. TC has been identified as one of the next generation Internet applications for users that will provide feedback and improve decision-making and problem-solving skills thereby favorably impacting on their collaborative business outcomes. In comparison with many existing technologies, a new technology that offers new capabilities such as TC software product is still at the initial stage of working toward an overall appreciation of value of this technology. This technology will not just offer the users awareness about the collaboration issues involved but enable them to assess its future strengths, weaknesses and potential opportunities offered. With the Internet being open, largely unregulated, and allowing the unfettered forces of innovation to drive the creation of new applications, this transitional change of TC is moving at a pace dictated by market forces, and that pace is turning out to be a lot slower than the CeNTIE TC project at UTS (University of Technology Sydney) expected. Our experience has led us primarily to consider and merge using usability heuristic principles to narrow the focus of this study which could then be precisely examined more closely hands-on due to the nature of its lower credibility. This gives rise to the necessity of redefinition and reexamination of system architecture dependent/independent quality metrics within the context of TC business system development that can influence quality of experience and responsiveness for the end-user. Given those capabilities, in the first part of this paper we focus on the technology transition problems in TC, that can be translated into "theory of usability heuristics of TC", as an indicator for the pervasive use of an outcome focused collaborative environment, to free the participants from the unconscious constraints for better quality of experience (QoE) during the transfer and diffusion phases. Here we also emphasize collaborative business system models that would enable us to understand the need for answering pre-deployment questions related to appropriate SAIQ, SADQ (System Architecture Dependent Quality) and QoE metrics. In the second part, we propose development of a measurement and mapping methodology for building acceptable and usable TC business systems out of elements, each of which we know has underlying multidimensional usability heuristics principles. In the remainder of this study, we discuss the expected outcomes of combined use of these metrics for the early adoption of next generation collaborative knowledge and information spaces besides overcoming some of the unforeseen issues beyond engineering that could possibly slow down the rollout of technology for distributed environments such as TC.

2. THE MODELS AND METRICS OF TC TECHNOLOGY TRANSITION

2.1 Usability Study

The objective of this study, is to consider usability as an engineering problem for user QoE (Quality of experience), we use the usability heuristics to *cause* the best changes in a uncertain situation similar to TC within the available resources without omitting the business/cognitive aspects involved. As TC technologies are still under trial, it is important to note that the study of usability heuristics during this crucial period of innovative technology transfer and diffusion becomes mandatory. This includes investigation, reexamination, generalization and partition of the most important engineering heuristic subsets through use of conventional strategies to place ourselves in a most intellectually satisfying philosophical position. This gives rise to a new approach of crossing the boundaries between the different fields of study. We are taking into consideration the small subsets of heuristics recommended by Billy Vaughn Koen (2003) for superficial treatment of complexity issues of TC quality of service (TQoS). They are identified as arithmetic, mathematics, deduction, certain, position, logic, truth, progress, causality, consciousness, physical reality, science, perception and argument. *Arithmetic*, the basic foundation of mathematics, will be used for avoiding *incompleteness* and *inconsistency* of models developed that are lacking with the *incoherence* aspect of this study. Whereas, rest of the *mathematics* ultimately depend on the *consistency* of arithmetic used through a series of relative proofs normally made for obtaining certain knowledge. *Deduction* is part of a valid argument while following a specific procedure for issues that are logical and true. The psychological force of finding one concept that is thought at the present time that needs to be absolutely *certain* but not be a doubt. Another important heuristic that we need to know is the *position* of certainty in this study of *uncertainty* principles to avoid potential future *failures*. However, the acceptance of judgments and philosophical concepts depends on *logic* and *truth*s that need to be dealt with the other influential areas. Along with them, *progress* is an important heuristic that needs to be considered with its own problems in philosophy and cognitive engineering. *Causality* is a most valuable heuristic principle to guide cognitive engineering in a direction of promising returns, in the ever progressive development for a radical revision of our attitude toward the problem of physical reality and consciousness of users. In which case, *consciousness* becomes a device for representing a functionally unified system of responses, whereas *physical reality* becomes the conception of objective reality that evaporates into mathematics, which represents knowledge for *behavioral analysis* involved during the TC technology transition. The influence of cognitive engineering *science* on the expected results of this study would have remarkable impact on identifying issues involved in future TC environments. However, careful consideration of its dependency on the development of other heuristics such as *perception* and *arguments* is needed for the accumulation of all uncertainty forces involved. Thus it is expected that the study of usability would enable the participants in a TC business system to carry out the required collaborative tasks successfully and without any major difficulty. The technology transition normally occurs throughout technology/product development from the birth of a technology until its retirement. During the same, technology will be commercially developed and be in use in an organization, and most likely be transitioned at least twice between the phases of research & development (R & D), new product development, and adoption & implementation as it progresses through its lifecycle.

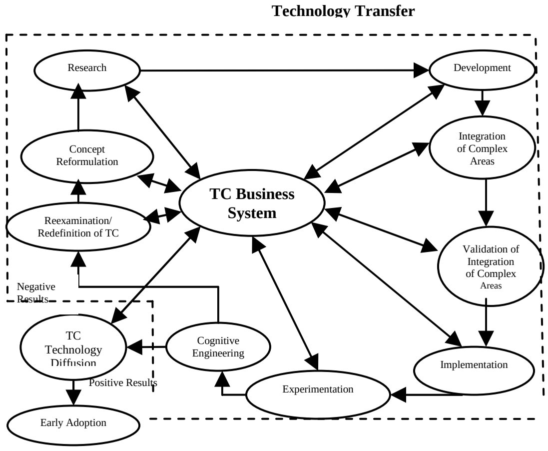

Figure 1. The TC Conceptual Model

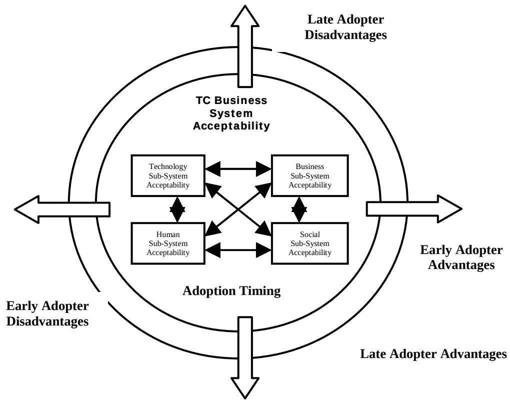

Figure 2. The TC Adoption Model

2.2 The Conceptual Model

The conceptual model of TC Technology Transfer and Diffusion follows eleven broad categories surrounding the TC business system technology. These are research, development, integration of cognitive and non-cognitive complex areas, validation of those complex areas, implementation, experimentation, cognitive engineering, reexamination/ redefinition of concepts, reformulation of concepts, diffusion and early adoption, as shown in Figure 1. It is also shown that the technology transfer, which is a cyclic process that expects the developers of this new technology to consider the most influential elements of this model that could potentially impact on end users besides assisting them either to enhance or inhibit the success through strategic implementations. For one such successful deployment of TC business system with faster, easier and more efficient adoption of the same, assessment of elements and their equivalent metrics are not only important in the transfer process, but also in diffusion (Rogers, 1995). It was our assumption that each and every individual stage of the shown conceptual model exhibits a combination of the attributes of usability heuristics (as mentioned above) with their own defined outcomes. The areas that need to be integrated in a distributed computing environment such as TC are identified as business, Internet, and requirements, behaviors and experience of the end user community which are complex in general to deal with in a careful and considerable manner during the validation of the conceptual model.

2.3 The Role of SAIQ Metrics

Usability of a TC business system can be assessed through system acceptability (which is a combination of social and practical acceptability) as a measure of use of the product through quality of the effectiveness, efficiency and satisfaction with which users achieve specific goals. Effectiveness is the accuracy and completeness with which specified users can achieve specified goals in particular environments, while efficiency is the resources expended in relation to the accuracy and completeness of goals achieved. But satisfaction is the comfort and acceptability of the work system to its users and other people affected by its use (ISO 9241 standard). This gives rise to a need for a new measure of SAIQ metrics for developing and incorporating TC business system for the effectiveness of the participant's collaborative outcomes. Those metrics which contribute to the evaluation of Quality of Experience (QoE) of a given TC Business System include Quality of Business (QoB), Quality of Collaboration (QoC), Quality of Service (QoS) and Quality of Efficiency, Effectiveness and Satisfaction (QoEES). They are basically categorized into performance (QoB, QoE, and QoC) and diagnostic (QoS) metrics (V. Mahadevan, 2004).

Table 1. QoB Metrics for CRM and SCM/ERP

Business Models	QoB Metrics
CRM	• New Customer Conversion rate • Repeat-Customer Conversion Rate • Customer Abandonment Rate • Churn Rate • Percentage of User Sessions that results in a Purchase • Number of Customer Complaints • First Call Close Rate • Percentage of Incidents submitted via Web
SCM & ERP	• Inventory Volume • Sales Volume • Number of Products Produced • Inventory Turnover Ratio • Fill Rate • Number of Stock-outs • Customer Response Time • Supply Chain Cycle Efficiency • Employee Retention Rate (ERP)

Table2. QoC Metrics

QoC (Non-Cognitive Type)	QoC (Cognitive Type)
• Overall Performance • Workload • Schedule Adherence • Flexibility • Level of Engagement • Information acquisition • Information Provision • Transfer of meaning • Agility Brainstorming • Synchronization • Negotiating • Critiquing and Idea Enrichment • Discovering differences • Distributing	• Shared Understanding • Shared Awareness • Judgment • Alignment

The three major sets of business processes, namely Enterprise Resource Planning (ERP), Supply Chain Management (SCM), and Customer Relationship Management (CRM), are taken into consideration for development of QoB metrics. Quality of Business (QoB) refers to the effectiveness of business processes in meeting the desired outcome of an organization which fit into the QoE framework through its effectiveness component. However, the outcomes depend on the quality of technology and collaboration components of TC business system as an indirect way of measuring effectiveness. Table 1 shows the QoB metrics chosen for CRM, SCM and ERP (O'Brien J, and Lefebvre, Elisabeth et al, 2003). From the perspective of the TC Business System, CRM and SCM are linked through ERP and then knowledge management (KM) becomes an integral component to the success of CRM, SCM and ERP. Quality of Collaboration (QoC) refers to evaluation of the participants' performance level when they are working individually or in team, as a measure of collaborative effectiveness from both cognitive and non-cognitive perspectives, as shown in Table 2 (Nobel, 2000). A combination of SAIQ metrics basically provide a high-level measure of the overall performance of TC business systems (that are partly external in nature, and closely related to business needs for the process, user satisfaction and collaborative outcomes, etc), besides measuring the system efficiency through SADQ metrics (that are purely internal in nature in domains such as client, server, Local Area Network and Internet, such as QoS) during the load testing phase. A possible component mapping is also shown in Figure 3, 4 and 5 for Quality of Efficiency, Effectiveness and Satisfaction.

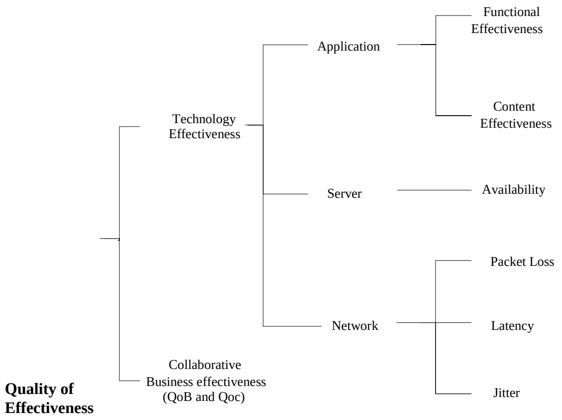

Figure 3. Quality of Effectiveness

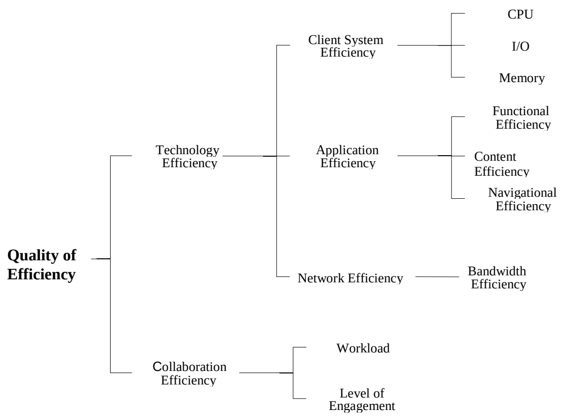

Figure 4. Quality of Efficiency

However, for the measurement of Quality of Experience, the corresponding Quality of Efficiency, Effectiveness and Satisfaction components should have their relevant perception from resources, outcomes and users. To make it happen, QoB and QoC metrics and their impact on QoE through QoEES needs to be verified, validated and calibrated as shown in figure 6. Proper understanding and utilization of those metrics through careful assessment in all eleven stages of the conceptual model is a deciding factor that would facilitate TC technology transfer and diffusion successfully. This includes use of cognitive engineering, an interdisciplinary approach (such as a combination of cognitive psychology, cognitive science, computer science, human-computer interaction, human factors, and related fields, etc) for designing the knowledge and information spaces (such as TC business systems) when they are intended for an enhanced level of usability for early adoption. It is expected that the positive outcomes of our conceptual model will be used for successful diffusion of any new technology and encourage the users to early adoption, as discussed in next section.

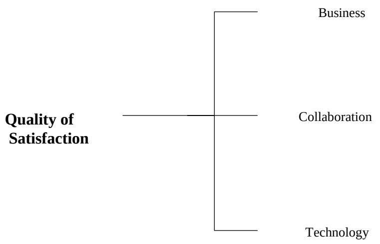

Figure 5. Quality of Satisfaction

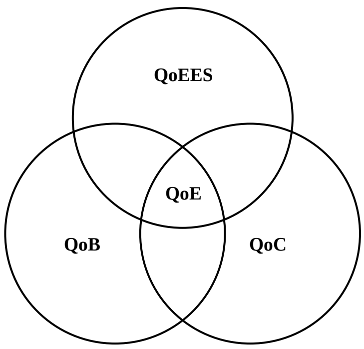

Figure 6. Quality of Experience

2.4 The Adoption Model

The proposed early adoption model is shown in Figure 2. It is also realized that for testing the effectiveness of technology transfer and diffusion, the negative results that are expected would assist us in terms of exposing deficiencies in the acceptance of this innovative technology. This includes assisting us with the reexamination of methodologies/approaches used in this study for the redefinition and reformulation of the concepts of TC business system's acceptability. It is also shown in Figure 2 that the rate of adoption will be greatly influenced by the TC business system's acceptability. TC business system's acceptability is categorized into four sub-systems, which are business, technology, human, and social. It is our intention to show that the rate of adoption is similar to the rate of diffusion, except that it deals with the psychological processes an individual and team goes through. The expected outcomes of this model will include numerous early and late adopter advantages and disadvantages. The early adopter advantages include greater utility with a minimal risk, acquisition/spill over of information, best practices of users in their own expert areas, best ROI (Return on Investment), improved confidence level and self attributes, better enterprise application integration (EAI) and provision of a quantitative measure of the effectiveness of an organization to capitalize on the technology transition and diffusion etc. So, it becomes obvious that the perceptions of innovative TC technology transfer and diffusion now require a greater attention and provision of resources for current and future practices of technology, product and user adoption attributes than ever before. It is also realized that in any competitive environment, good timing is a valuable strategy for successful technology transfer, diffusion and adoption. We would like to emphasize the concept of adoption timing in the technology transfer and diffusion which plays a crucial role in an innovation's ability to progress (Johnson et al., 1997; Rogers, 1995) and our future research includes developmental of an adoption timing model of TC business system under study.

3. CONCLUSION

UTS has always been a leader in the higher education sector, and well known for providing practice based education not only in Australia but globally. It has also been proven in the past that UTS can adapt to alternative perspectives of teaching and learning more readily in the successful facilitation and implementation of technology transfer, and to sustain the transfer of technology. CeNTIE is another classic example of new technology coming at the right time with the provision of infrastructure and research support. This research of pursuing serious investigations of measurement and mapping techniques within the context of inexpensive, reliable and accessible TC environments requires modeling of realistic system and user-behavior, and experience of users at front-end, as well as back-end, systems (V. Mahadevan, 2004). This includes study of the impact of changes in response/reaction time, tactical knowledge/information level, and perceptual skills of system/user performance. However, in reality recognizing and efficiently collating information about similar topics within heterogeneous distributed environments still remains difficult to resolve. Using approaches similar to those described in this study can mitigate some concerns, but it does not provide a solution to other key issues such as costing, privacy, and security, etc. Nonetheless, the authors believe that their preliminary research findings provide an explanatory power of synergistic use of value-added Telecollaboration usability heuristics for use in distributed e-learning communities that are complex in nature.

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