STREAMLINE E-INFORMATION SERVICE FOR VIRTUAL USERS: A QUALITY FUNCTION DEPLOYMENT (QFD) APPROACH

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Abstract. Migration from the traditional to web-based library paradigm is usually accompanied by remodelling of many library core activities particularly those associated with user-centred services. In this capacity of the web-based service paradigm, many academic libraries have established networked environments within which many virtual-user communities are forming and growing. Understanding the virtual user's needs in these communities has become the first priority of networked libraries for designing, running and managing effective virtual reference services to meet the increasing expectations of the invisible users. To achieve this, the networked libraries strive to improve their quality of service by applying a wide range of such quality management approaches as quality function deployment (QFD) and LIBQUAL™. QFD initially stresses on driving continuous improvement of the user-oriented services towards end-user satisfaction. The paper attempts to incorporate the QFD to be integrated strategically in designing and managing e-information provision within networked library service environment. The UAE University Library is used as a case study, where the evidence-based librarianship (EBL) approach has been employed in three studies to identify user needs and acceptance of e-services. Based on these studies, the paper presents a model aimed at streamlining e-services for virtual users in ICT-rich learning environments.

Introduction

Perhaps no other factor in the history of the information and communication technology (ICT) has changed the face of information use and delivery as significantly as the swift emergence of the Internet and related web-based applications in academic settings. The evolving genre of the web has engendered new paradigm of e-research community whose hallmark is scholarly use of the web within ICT-rich learning environments. The significant product of the ICT revolution is the networked library.

The networked library has remarkably extended the breadth and scale of scholarly evidence to support innovative learning and research activities. Moreover, the vigorous emergence of delivering the varying library services by electronic means to *invisible* users has catalysed the migration of academics and researchers to scholarly use of the web to change their information behaviour in searching, processing and exchange of research knowledge.

Migration from the traditional to the web-based library e-service paradigm is usually accompanied by remodelling of many core activities of the networked library particularly those associated with the user-centred services. Furthermore, the steady development of virtual reference services within networked library environments has initiated a paucity of scholarly investigations into web-based reference and outreach services. These services are indispensable as means of keeping *invisible* users abreast with the ever growth of scholarly literature.

Networked library functions and academic information requirements are inextricably linked. This statement can be translated into: i- quality of information services, ii- efficiency of delivery system, and iii- satisfaction of information consumers. These components motivated academic libraries in incorporating a wide range of quality management approaches (e.g. *quality function deployment* (QFD), LIBQUAL™) as an effective means of incorporating quality improvement in their user-centred information services. Networked library services can be illustrated as open interrelated systems with input-output interoperability where the library administration should maintain user-oriented collection development and information commons as an input and end-user satisfaction as output (Hsieh; *et al*., 2000).

Purpose and Aim

Even as it faces multiple challenges to manage digital transition, the UAEU library is diligently pursuing the transfer of its core services to web-based platforms. The crux issue addressed is how the library maintains effective quality information management to support adequate e-services within networked environments. This paper attempts to give some insight into how the QFD can be integrated

strategically in designing and managing digital transition for improving the delivery of the academic and research e-information within networked library service environment. The paper benefited from four earlier research works on user studies (Ibrahim, 2004; Selim, 2003; Taha, 2004a, 2004b).
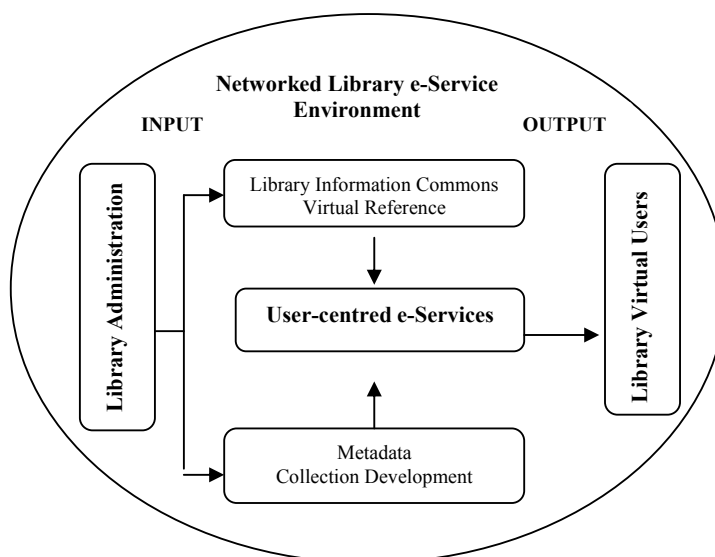

Figure 1. Virtual user-oriented services in networked library environment

Evolving Genre of Quality Function Deployment (QFD)

The QFD was conceived in Japan during the industrial expansion and rapid growth in the 1960s. QFD was first conceptualised in 1966 by Akao and further expanded as a discrete system outgrown from Total Quality Control (TQC) umbrella for integrating end-user requirements into product and service design i.e. listening to the voice of the end-user. In regards to this linkage, QFD was driven by two interrelated objectives (Akao, 1972, 1997), these were:

- To convert the core desire, demand and need of the end-users for interesting products into substitute quality characteristics (SQC) at different stages of design and testing.
- To assure that SQC is properly deployed throughout the processes of manufacturing, production, and delivery of new products or services.

If the producer succeeded in bringing the two objectives together, its product would meet the satisfaction of the end-users (Han *et al*., 2001; ReVelle *et al*., 1997). Moreover, we can view QFD as a fundamental trade-off between the end-users and the producers. The QFD has been experienced a vast range of development and modifications to yield a rigorous analytic tool to understand end-user behaviour for developing comprehensive product and service specifications through creating end-user strategies and developing a mechanism for enabling such strategies (Killen *et al*., 2005).

Networked Library Service Environment: Emergence and Acceptance

The revolution in the digital information and communication technologies (d-ICT) has greatly enhanced the emergence of the networked digital library as a new paradigm of producing, collecting, dissemination and use of digital information. This, in turn, has provided an impetus for fundamental changes in both library functions and services within the virtual library environment (Taha, 2004b).

The library has become a more complicated organisation with the advent of numerous ICT applications into its setting. This newcomer has posed challenges to library managers for revamping the core library services to be adjusted to the new environment and new information needs (Han & Goulding, 2003), as well as foraging effective tools to enhance in managing the digital transition process.

LIBQUAL™ has been widely used for investigating the service quality. The QFD has proved both its applicability and functionality as an effective approach in improving the user-oriented library services through interpretation of end-user desire and interest into product and service initial designs (Chin *et al*, 2001). Davis's Technology Acceptance Model (TAM) has been used by many library

researchers and practitioners to measure digital library acceptance and use (e.g. Taha, 2004a; Thong et al, 2004).
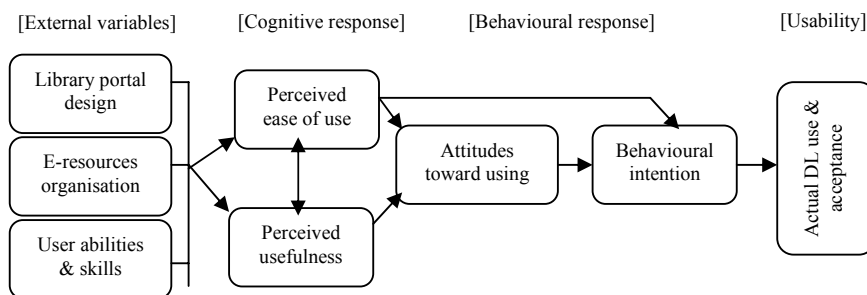

Figure 2. TAM (modified from Davis, 1989)

UAE University Networked Environment: Webbing Virtual Users

The emerging knowledge-oriented society of the UAE has nurtured and maintained the growth of networked learning environment with special emphasis placed on library digitisation. Our concern in this study is the UAEU Libraries Deanship (UAEULD), which consists of off-campus central library, and five on-campus college libraries. The functions and services of these libraries have been webbed to be a networked-based starting place to connect the remote end-users to online-accessible e-resources and e-services.

The UAEULD developed an interactive web portal at http://www.libs.uaeu.ac.ae, which provides users vastly access and several options to search and reach a wide variety of e-resources and online request forms for many e-services. In November 2003, the UAEULD launched *EZProxy* software on the web at http://ezproxy.uaeu.ac.ae to extend the off-campus access to its databases menus beyond library premises and opening hours.

Therefore, UAEULD provides 24/7 online accesses to a number of networked e-information services and resources via two routes (a shown in Figure 4):

- EZProxy helps access to licensed e-resources i.e. authenticated only to UAEU members
- Web portal access to OPAC, access services as circulation, ILL, and open access collection.

The Library integrated system Millennium™ provides bilingual (Arabic/English) search capabilities, whereas the portal offers an option access via either Arabic or English interfaces. Moreover, a nucleus of virtual reference desk has been developed but not functional yet.

Evidence-based User Studies at UAEU: A Review

The approach of the evidence-based user studies has been employed in four user studies at UAE University investigating to what extent the end-users have accepted the use of digital information resources and web-based library services. Ibrahim (2004) found that higher educational background, exposure to IT environment, e-literacy, and English command were the factors that influence the user IT acceptance and preference in using library web-based search systems such as OPAC, databases, etc.

Selim (2003) evaluated through TAM technique the critical factors that guaranteed the success of the web-based learning paradigm in improving academic performance of the students. The critical success factors were found to be: i- cognitive e.g. e-literacy, communication skills, ii- pedagogic e.g. creating interactive course website, iii- IT facilities, iv- administrative support. Taha (2004a) investigated the impact of digital information services on the acceptance of scholarly use of the web and research rigor. Taha (2004b) introduced a model, which aimed at answering the information needs of the *virtual* end-users through the networked channels of the Library digital reference desk.

Virtual **User-in-Context**
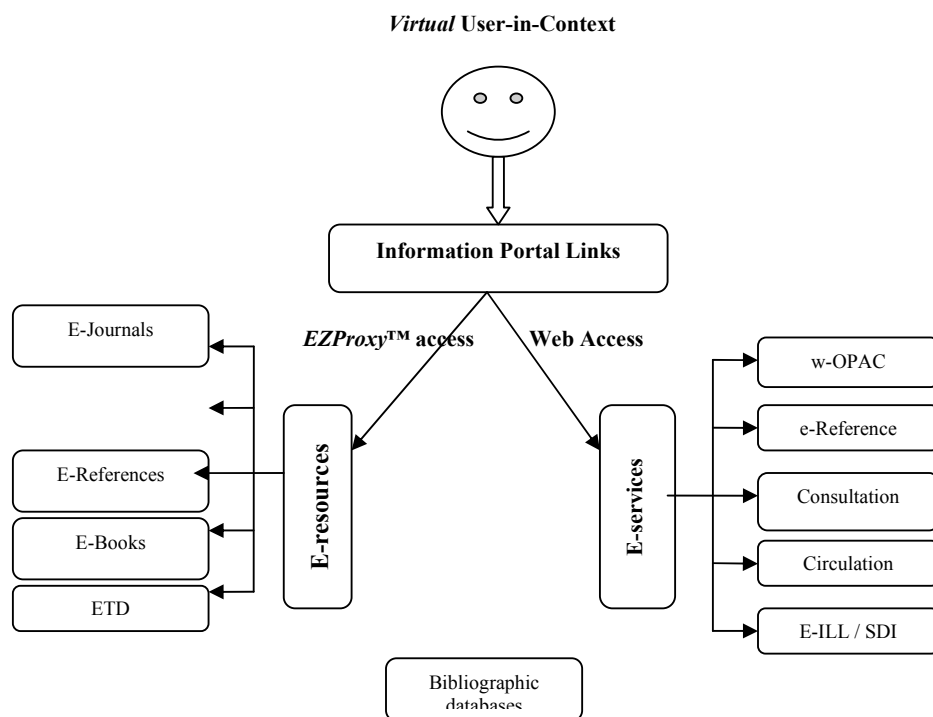
Figure 3. Different online routes to get access to e-resources and e-services at UAEUL

User Requirements: Questionnaire Survey

The networking of library functions has initiated remodelling of the user-centred services. The adjustment of these services to adapt to digital environment needs quality attributes and strategic plan to warrant smooth transition to new library service environment. To gain some insight into the end-user requirements and satisfaction, a questionnaire constructed and tested on Likert's Five Point Scale to evaluate the following variables within the range of extremely negative (1) to extremely positive (5):

- Library IT facilities.
- Search and access to digital resources (ease of use).
- Collection quality and relatedness (perceived usefulness).
- Document delivery and outreach services.
- SDI and awareness services.
- Inquiry services.
- Librarian-user communication.

The questionnaire comprised three core questions to investigate the relationship between the end-user profiles and their information needs and requirements:

- To which e-resources and e-services do you limit initially your portal access in accordance to their significant importance to your current activities?
- How do you evaluate the inquiry and awareness services that provided by reference desk?
- Considering your all experience of UAEUL, how satisfied are you with the available library resources and services?

Data Collection and Analysis

In February 2005, the questionnaires were emailed to target sample of 75 UAEU members whose reach and contacts were obtained from university directory. The participants were fifty faculty and twenty-five graduates in business, science and engineering programmes. All the recipients responded and returned via email completed and valid questionnaires with zero missing.

Access Preference and Significant Importance of E-resources

The initial access to portal information reflected the preference of the end-users towards specific resources. E-journal databases were ranked the top preferable and frequently accessed sources by 100% of the respondents to satisfy their research information needs. The satisfaction items that influenced such preference were ease of browsing, search, and retrieval, along with their coverage of a wide range of research topics. The respondents' requirements were to expand the access to historical archives more backdated than the current one, which start at 1998 onwards. Table.1 illustrates respondents' feedback regarding importance and quality dimensions of e-services and resources.

Table 1. **Importance range and degree of satisfaction of resources and services**

Resource/service	Significance	Satisfaction	%	Satisfaction items
E-journals	Very important	Completely satisfied	97.40	Coverage, accessibility &ease of use, browsing & searchability, retrieval, time-consumed
Index/abstracts	Important	Satisfied	89.75	Coverage, ease of use search strategy, updating, full-text access
Books (printed & electronic	Not important	Unsatisfied	77.35	Coverage, authorship, recency, topical treatment, relevance.
Access services	Some what important	Some what satisfied	94.50	Procedures, adequacy, relevance of acquisition, ease of lending.
Document delivery	Important	Satisfied	84.45	Adequacy of request process, timeliness of delivery, provision of relevant materials, document format.

Enquiry and Awareness Services

The dispersion of UAEU premises over five campuses has increased the importance of the networked library services for remote end-users. The returned questionnaires revealed that enquiry and awareness services have not lived up to user expectations as illustrated in Table.2

Table 2. **Importance range and degree of satisfaction of enquiry and awareness services**

Service	Significance	Satisfaction	%	Satisfaction items
Ask-A-librarian	Important	Completely unsatisfied	96.85	Accuracy & relevance of answer, speed of response & feedback,
SDI & outreach	Very important	Some what satisfied	93.25	Selection of relevant documents, coverage of user interests.
Current awareness	Some what important	Unsatisfied	91.65	Keeping user updated, content of notification, user-librarian contact

Library IT Facilities & Personnel

It is beyond dispute that library IT infrastructures and skilled personnel are the most important components of library quality services. The questionnaires yielded two extreme responses: completely satisfied with available IT-based facilities, in contrast, completely unsatisfied with the abilities and capabilities of the librarians. Table.3 reflects this.

Table 3. **Degree of satisfaction of IT facilities and personnel**

Component	Satisfaction	%	User requirements
IT facilities	Completely satisfied	98	Accessibility, user-friendly OPAC & databases
Librarians	Completely unsatisfied	95	Continuing training & development, hiring qualified, e-literacy, communication skills

Discussion and Concluding Remarks

The questionnaire survey has produced findings in a good agreement with those yielded from the previous mentioned user studies. As a large segment of UAEU academics and researchers community inclined to scholarly use the web and other IT-based resources, the library services should have to adjust to emerging new e-information needs and IT-literate users. QFD technique however would be helpful in maintaining the rigor improvement of library services in accordance to the end-users

requirements and desires. A proposed model is presented to map the user needs into designing or implementing new services using QFD approach.
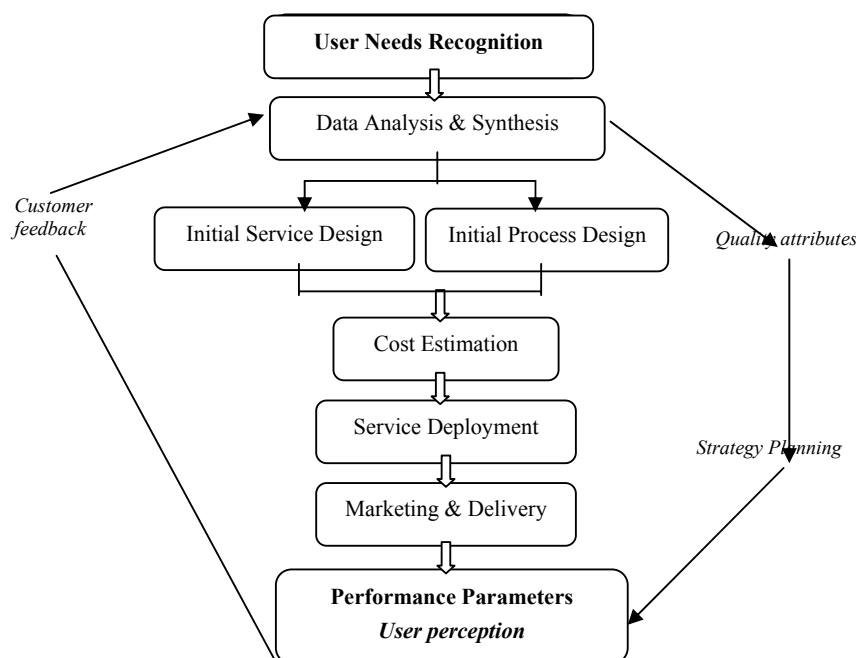
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                    ┌─────────────────────────────┐
                    │   User Needs Recognition    │
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                    │   Data Analysis & Synthesis │
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   Customer
   feedback      ┌──────────────────┐   ┌──────────────────┐   Quality attributes
                 │ Initial Service  │   │ Initial Process  │
                 │     Design       │   │     Design       │
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                    │   Performance Parameters    │
                    │      User perception        │
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Figure 4. Depicts some ingredients involved in QFD for user strategy

The study provides fledged recommendations for responding to the concerns raised by the survey to improve networked library services for the *invisible* end-users:

- Setting service design and planned quality.
- Acquisition of information resources should be relevant to user needs.
- Gaining user acceptance and satisfaction.
- Setting training and continuing education programmes for the librarians.

Acknowledgments

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