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Abstract: Internet technology has been used by most of the organisations in the world today. One of the primary vehicles of information gathering and dissemination in today's world is organisational website. This research evaluates the performance of the present TV3 (a popular private television station in Malaysia) website. By means of an online survey and a few focus group discussions, it also identifies the website viewer requirements and their corresponding importance level. Subsequently, the technical requirements are identified that can fulfill the viewer requirements. A House of Quality (HOQ) is built to find the relationship between the viewer and technical requirements. The Quality Function Deployment (QFD) exercise provides the prioritised technical requirements, which is expected to guide the TV3 website development and maintenance team in its future website redesigning project. The findings of the research are also expected to provide some insight in other organisations in similar need.

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1   Introduction

A website is a place where people can obtain information about something in which they are interested. Today, internet technology has made websites a major source of any type of information. In other words, whenever people need to find some information in the area of A to Z, they are turning more and more to the internet in lieu of any other source. The internet offers capabilities similar to those of newspapers (i.e. text and graphics), radio (i.e. audio) and TV (i.e. video), all in one package (Karayanni and Baltas, 2003). Websites can influence several aspects of the value proposition, as they enable direct interaction, have virtually no variable costs, and compared to traditional media, are more flexible and superior in targeting the users (Huizingh, 2002). Consequently, organisations across the world are paying increasing attention to the website design, up-to-date contents, ease of navigation and the ability to interact online.

TV3, a private television channel in Malaysia, is the most popular free-to-air TV station in Malaysia. By having a high quality website, it may further help to extend its brand equity, coverage, and corporate image. Johnson and Griffith (2002) mention that a well-designed website helps reinforce the firm's brand equity, while a poorly designed website can devalue the established brand equity.

The TV3 website has been revamped and redesigned four times in the span of eight years since it was first launched in 1997. The revamp exercise was based on TV3's plan to have a fresh look on the website as well as to add on more interactivity and contents for viewers. At TV3, Management Information System (MIS) department is responsible for developing and maintaining the website.

At every revamping exercise of the website, the objective was to satisfy the viewers' requirements as much as possible. After the last 2004 revamp exercise, the management hoped to get all the positive comments from the viewers. This was because management spent considerable amount of money to pay the outside vendor who helped TV3 to revamp the website. However, contrary to management's expectation, it received many negative feedbacks from the viewers via emails and phone calls. Among the comments are: Information is not up-to-date, TV programme schedule provides irrelevant synopsis, no video or live streaming of TV3 programmes and the website is not user-friendly.

It was strongly felt that there were bigger issues that needed to be addressed first before going to redesign the website in future. Before any future redesigning exercise takes place, an evaluation of the website will help TV3 to identify and understand the important factors that can contribute to enhance its quality and to become a high quality website. This evaluation and analysis will assist TV3 to recognise the viewer requirements and to find ways how TV3 can satisfy these requirements. In this background, the present study is conducted whose objectives are the following:

- to evaluate the present performance of TV3 website

- to identify and prioritise viewer requirements to further improve the effectiveness of the website

- to identify and prioritise the technical requirements that can fulfill the viewers' requirements.

In the evaluation phase, particular emphasis was placed on the usability of the website. Usability is a broad concept in system design and is defined differently by different Human Computer Interface (HCI) scholars (Hassan and Li, 2005). There are a few basic principles that relate to the web environment such as user-friendly navigation, up-to-date information, minimal download time, relevance to users and high quality content. The present research will identify whether the usability of TV3 website has met its viewer expectations.

Quality Function Deployment was identified as an appropriate methodology to address the above objectives (particularly, the latter two) of the present research. The following section provides a brief account of previous work related to the present topic of investigation.

2   Literature review

Website effectiveness is dependent on its ease-of-use navigation, content and design of usability features and acceptable loading time for the site to appear on the screen. The real challenge is to identify and develop design factors that can

1   make a website usable and serviceable, avoiding users frustration or dissatisfaction

2   create more stimulating, visually pleasing, comprehensive and commercially viable websites

3   help attract users to a website, maintain their interest in the website, and encourage them to return to the website again (Zhang and Dran, 2000).

Johnson and Griffith (2002) mention that satisfied website viewers may come again to view the website, may stay longer at the site and may inform others about the site. In order to generate satisfied users, the authors propose that the website design must stand up to basic design standards – quality photographs, well-written content, clearly defined navigators and professionally designed graphic art.

Chase (2004) finds that a sizeable percentage of firms create their websites and then ignore them for long period, leaving the information stale and outdated. Fu et al. (2002) mention that the major objective of having a website is to satisfy the users requirements and to make them logging on frequently. As the interest of its users change over time, a website that does not change itself will become outdated and less useful.

Brick and mortar businesses have several strategies to ensure that their customers return to their store and make more purchases. Excellent services are crucial in order to retain customers. This is also true for the companies who are engaged in e-commerce. A poorly designed layout and out-of-date content website gives negative impression to the customers. Therefore, companies need to have a website that live up to customers' expectations (Iwaarden et al., 2003). Donthu (2001) mentions that just as service quality differentiates the winners from the losers in traditional retailing, website quality differentiates the winners from the losers online.

Kim, Shaw and Schneider (2003) conducted a study in benchmarking website design within industry groups and identified six criteria for website evaluation: business function, corporate credibility, contents reliability, website attractiveness, systematic structure and navigation. Based on these six criteria, the authors evaluated 245 Korean websites within 12 industry groups. The survey instrument consisted of students who enrolled in an introductory Information System course and they were asked to select 20 websites in three or four industries of their choice. Their research has shown that the online malls have a mean value of 3.96, which is significantly higher than the overall average. The authors concluded that the websites of online malls were better than any other industry.

Hassan and Li (2005) have developed a model to evaluate the usability and extent usefulness of websites. The model considers the following seven factors: screen appearance, content, accessibility, navigation, media use, interactivity and consistency. The model was applied to test the usability of the websites of four political parties in Malaysia: *Barisan Nasional* (BN), *Parti Islam Semalaysia* (PAS), Democratic Action Party (DAP) and *Angkatan Belia Islam Malaysia* (ABIM). In another study, Otto et al., (2000) investigated the relationship between web page download time and various elements of user satisfaction including content, format, ease of use, appeal of graphics, etc. In their research, they took a sample of 60 college sophomores who registered an introductory MIS course. The authors found out that the loading time of 15 sec. or less did not have an adverse effect on user satisfaction.

3   Quality Function of Deployment

Quality Function of Deployment (QFD) is a tool for designing manufacturing (service) processes in response to customers needs by translating what the customers want into what the organisation produces. Two Japanese Professors namely, Professor Shigeru Mizuno and Professor Yoji Akao jointly developed QFD in late 1960s. Their purpose was to develop the quality assurance method that would incorporate customers' needs into the design of a product before it was manufactured. Before the development of QFD, quality control methods were primarily aimed at fixing a problem during or after manufacturing of the product.

QFD was first applied at the Kobe Shipyards of Mitsubishi Heavy Industry in designing of an oil tanker in 1972. Toyota used the tool in 1977 in designing a new van. The application saved Toyota's start-up cost for the van significantly. QFD was introduced to USA in 1983 when US Society for Quality Control published Akao's work in Quality Progress. In the same year, Cambridge Research (now Kaizen Institute) invited Akao to give a seminar on QFD in Chicago. After this seminar, before the US executives, Akao delivered a series of talks sponsored by Bob King and GOAL/QPC in Boston. Because of QFD's flexibility, comprehensiveness, in US the methodology drew widespread attention from the business community that were facing tough Japanese competition.

Apart from Japan, Akao and Mazur (2003) claimed that QFD is successful in Argentina, Chile, Columbia and many other Latin-American countries. Not only that, the tool has also been widely used in European countries such as Italy, UK, Sweden, Germany, Austria, Spain, France, Denmark and the Netherlands. Other than Europe, Latin-America, USA and Japan, QFD has gained interest in South Africa, Iran, Malaysia, Thailand and Indonesia.

The major vehicle through which QFD is implemented is House of Quality (HOQ). The diagram is known as HOQ because its architecture is similar to a house. Like a normal house (which has foundation, walls and roof), HOQ has a number of components, which are:

- customer requirements

- technical requirements

- relationship between customer and technical requirements

- relationship among technical requirements

- prioritised customer requirements

- prioritised technical requirements.

Of the above components, prioritised technical requirements form the foundation of the house. Customer requirements and prioritised customer requirements form the walls. Relationships between customer and technical requirements form the main body of the house. Relationships among technical requirements form the roof of the house. Technical requirements form the ceiling of the house. The general architecture of the house has been shown in Figure 1.

Figure 1   General architecture of a house of quality
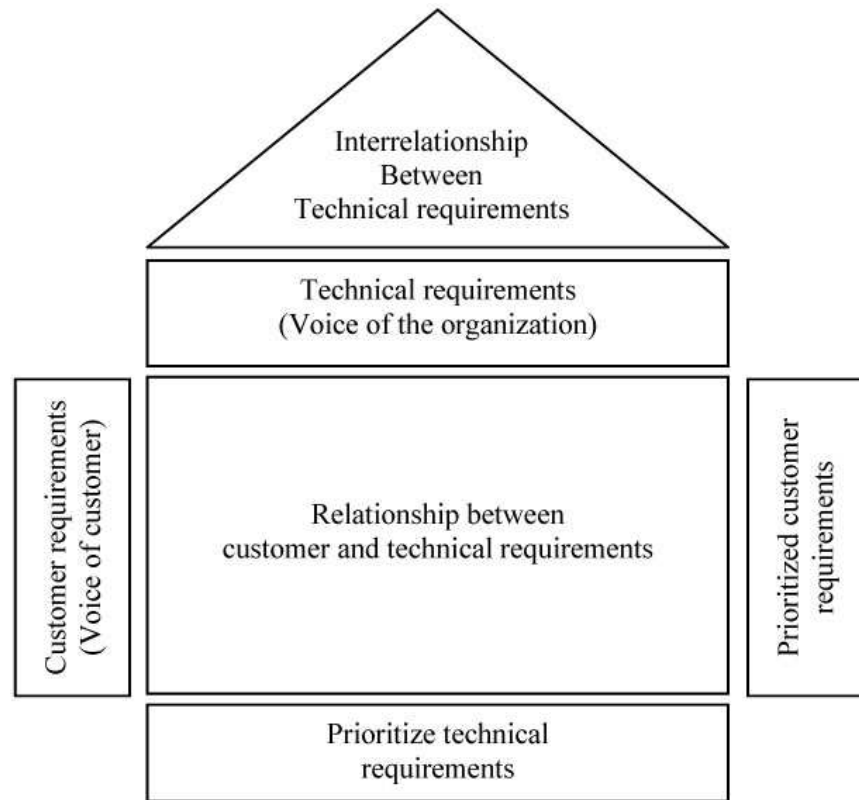
3.1   QFD Applications

QFD has been applied in many industries, e.g., communication (Kim, Park and Seo, 1997), Construction (Rahman, Kwan and Woods, 1999), Finance (Partovi, 1999), Education (Motwani et al., 1996), Information Technology (Tan, Xie and Chia, 1998; Haag et al., 1996), Marketing (Mohr-Jackson, 1996; Lu and Kuei, 1995). Quality Function Deployment Institute (QFDI) www.qfdi.org based in the USA states that:

> "Quality Function Deployment (QFD) is the only comprehensive quality system aimed specifically at satisfying the customer throughout the development and business process".

Every year QFDI organises an international symposium and invites companies throughout the world, which have applied QFD. Past conferences have been held in USA, Japan, Sweden, Germany, Australia, Brazil and Turkey. The following companies have attended the symposium and have shared their experiences in using QFD: General Motors, Ford, Mazda, Motorola, Xerox, Kodak, IBM, P&G, HP, AT&T, Boeing, Nokia, Texas Instruments, etc. Following are some of the common reasons stated by the companies in favour of using QFD:

- with QFD we can prioritise our goals and objectives to select the best strategies, technologies and vendors

- international business is our future. QFD lighted the path to foreign markets

- to lower cost and increase reliability, we want to reuse as many common parts as possible. QFD has given us the means to differentiate components where there is customer value, and communise those that are invisible to the user

- to develop a hybridised product from two of our best selling lines, QFD helps us include the most important features from each

- we configured our space-age robotics into an award-winning attraction at Jurassic Park, QFD brought it to life.

Following are some of the benefits shared by the users of the QFD:

- customer satisfaction

- reduction of product development cycle time

- fewer engineering changes in the later stage

- reduced chance of oversight during the design process

- an environment of teamwork

- consensus decisions.

Here we provide a review of some specific, relevant applications. Hamilton and Selen (2004) conducted a study by using a concept of integrated services in meeting the user needs. Their approach was to find ways on how integrated services can be delivered over the web in a service chain that involved multiple partners. In this study, QFD methodology was applied to a real estate service environment in Australia.

A framework for customised web interfacing in the service chain was developed by Fine as mentioned by Hamilton and Selen (2004). There are three categories in web interfacing:

1   web interface

2   web design processes and functionalities

3   service chain.

These functionalities are then translated into technical web design features and web design functions. A three-step procedure is also involved:

1   linking customer needs to website functionalities

2   linking website functionalities to collaborating service chain partners

3   build, structure and deploy information throughout the service chain.

Barnes and Vidgen (2003) evaluated quality of a Forum on Strategic Management Knowledge Exchange (FSMKE) website before and after the redesign exercise. The authors used WebQual as the survey instrument, and they analysed and compared data with the user perception before and after the redesign process took place. Using the

WebQual survey questionnaires, the authors considered four factors for evaluation, namely usability, information quality, service interaction and overall look of website. By using the method, FSMKE was able to identify areas for improvement and as a result, the WebQual index was increased by 20 points after the website redesign exercise. Users' feedbacks indicated that the site quality improved significantly.

Using ServQual (tangibles, reliability, responsiveness, assurance and empathy), Iwaarden et al. (2003) identified perceived important quality characteristics for using websites. They identified the following characteristics as the most important: fast access, easier navigation and presentation of complete overview before making the purchase decision, and the simplicity in the registration process.

4   Research methodology

We used two approaches for data collection, namely online survey and focus groups. A questionnaire was developed that consisted of three parts: Part A: demographic information – gender, age group, higher level of education, marital status, number of children and MyTV3 membership. Part B: rating a number of statements using 1–5 points Likert scale (1 = strongly disagree, 5 = strongly agree). Part C: rating a number of factors from least important to extremely important (1 = least important, 10 = extremely important) (Besterfield et al., 2003). At the end, the respondents were also asked to provide additional comments.

The questionnaire was posted at http://survey.tv3.com.my and kept for three weeks. Invitations were sent out to about 2000 people who were randomly selected from TV3 audience database. However, only 209 completed questionnaires were received out of which exactly 200 were valid.

Conducting focus group sessions with the respondents also collected data. For focus group sessions, the respondents were selected from the researchers' contact database and acquaintances. The researchers managed to get 30 respondents for the focus group sessions. Since it was difficult to gather all of them in one session due to schedule clashes, the researchers decided to arrange about 5–10 people per session. Before the session started, a clear explanation was given on the objectives of conducting the session and how to answer each question. The respondents were required to answer all the questions in the survey form. The demographic information of the valid respondents is provided in the Table 1. SPSS version 11 was used to compute frequencies, descriptive statistics and also to run *t*-test.

The focus groups sessions enabled the researchers to meet face-to-face and had a two-way conversation with the respondents. The respondents could express their opinions and thoughts directly to the researchers. Survey alone was not sufficient enough to listen to the viewers' comments and suggestions, as most of the respondents did not express their opinion on the questionnaire.

Table 1   Respondents' demographic information

Variable	Frequency	% t
Gender		
Male	110	47.8
Female	120	52.2
Race		
Malay	190	82.6
Chinese	17	7.4
Indian	10	4.3
Others	13	5.7
Age Group (years)		
14 or below	8	3.5
15–19	15	6.5
20–29	127	55.2
30–39	64	27.8
40–49	13	5.7
50 and above	3	1.3
Highest level of education		
UPSR	8	3.5
PMR	5	2.2
SPM	34	14.8
Certificate	15	6.5
Diploma	73	31.7
Degree	69	30.0
Master	19	8.3
PhD	1	.4
Other professional certificate	6	2.6
Marital status		
Single	132	57.4
Married	96	41.7
Divorced	2	0.9
No. of children		
None	144	62.6
1–2	64	27.8
3–5	19	8.3
6 or more	3	1.3
Are you a MyTV3 member?		
Yes	103	44.8
No	127	55.2

From the SPSS results, TV3 website viewer requirements are listed in order of importance as given by respondents on the basis of mean values. Out of the 20 requirements, only the top 15 are used to develop the HOQ. Having obtained the prioritised viewer requirements, we embarked upon finding the prioritised voice of the organisation as mentioned before. The voices of the organisation or technical requirements are those that satisfy the viewer requirements. These were identified based upon the interview with TV3 internet team members including web programmers and designers. A matrix showing the relationship between viewer and technical requirements is used to represent graphically the degree of influence between each technical requirement and each viewer requirement. Usually, three symbols are used to represent the relationships. These are shown below:

Symbol	Meaning	Weight
*	Strong relationship	9
#	Medium relationship	3
@	Weak relationship	1

If any technical requirement is not related with any of the viewer requirements, then the corresponding cell in the relationship matrix is kept blank. Once we have identified all possible relationships between every pair of viewer and technical requirements, we can determine the weights of all the technical requirements. The formula to compute the weights is:

$$t_j = \sum_{i=1}^{n} c_i r_{ij} \quad , \quad j = 1, 2, \ldots, n \tag{1}$$

where

t_j = weight of the jth technical requirement

c_i = weight of the ith viewer requirement

i_{ij} = weight of the relationship between ith viewer requirement and jth technical requirement.

5   Data collection and analysis

As it is mentioned before, the respondents were asked to rate the present performance level of TV3 website on various issues. The issues were divided into three categories: usability, information quality and interactivity. The mean, standard deviation, t-value, p-value, and 95% confidence interval for each statement are provided in Table 2.

A hypothetical test was performed for every statement in Table 2. Since the statements were evaluated using 1–5 Likert scale having neutral value equal to 3, we considered the following null and alternative hypotheses:

$H_0 : \mu = 3$

$H_1 : \mu > 3$

Table 2   Present performance level of TV3 website

No.	Statement	Mean	Std. Dev	t	p-value	Confidence interval
Usability						
1	I find the site easy to operate	3.85	0.778	16.502	0.000	(3.75, 3.96)
2	I find the site has consistent page layout	3.74	0.794	14.146	0.000	(3.64, 3.85)
3	My interaction with the site is clear and understandable	3.60	1.019	8.948	0.000	(3.47, 3.74)
4	I find the site easy to navigate	3.75	0.966	11.765	0.000	(3.63, 3.88)
5	I find the site download time acceptable	3.43	1.042	6.177	0.000	(3.29, 3.56)
6	The site provides local search facility	3.53	0.954	8.312	0.000	(3.54, 3.80)
7	The site has an attractive appearance	3.67	0.974	10.362	0.000	(3.62, 3.81)
8	The navigation links are stated in every page	3.71	0.722	14.943	0.000	(3.58, 3.82)
9	The design is appropriate to the type of the site	3.70	0.911	11.582	0.000	(3.38, 3.65)
10	The site provides audio-video streaming	3.52	0.999	7.706	0.000	(3.25, 3.53)
11	The site does not use too much animation, flash, graphics and images	3.39	1.079	5.427	0.000	(3.54, 3.79)
Information quality						
12	The site provides accurate information	3.66	0.955	10.472	0.000	(3.28, 3.56)
13	Information is always updated in the site	3.42	1.035	6.105	0.000	(3.59, 3.83)
14	The site presents the information in an appropriate format	3.71	0.913	11.676	0.000	(3.75, 3.95)
Interactivity						
15	I can send my feedback about the site	3.85	0.750	17.056	0.000	(3.75, 3.95)
16	I can participate in forum, poll, chat, contest and e-survey	3.80	0.869	13.993	0.000	(3.69, 3.92)
17	I can play online games and puzzles	3.70	0.894	11.782	0.000	(3.58, 3.82)
18	I can send greetings to my friends and families	3.81	0.804	15.265	0.000	(3.71, 3.92)
19	The site provides e-classified, tell-a-friend, FAQs and desktop wallpapers and screen savers	3.88	0.738	17.848	0.000	(3.78, 3.97)
20	The site provides value added features for MyTV3 community	3.68	1.029	9.916	0.000	(3.55, 3.82)

From the tabulated p-value for all the statements, clearly all the null hypotheses are to be rejected. This confirms that the mean values for all the statements are more than 3. This indicates that the current performance of TV3 website is acceptable to the viewers, in general. However, it is to be noted that a large number of the respondents (103 out of 230 were MyTV3 members) were TV3 loyal fans. Therefore, TV3 cannot be too complacent at this stage. Furthermore, it needs to pay attention to the constructive comments provided by some of the respondents. They recommended that TV3 website be improved at least to be at par with other well known websites such as AXN, CBS, ABC, and Astro. Some of them have suggested that TV3 website needs to be redesigned to have better

looks and make the navigation easier. Further, some of them were not happy with too much usage of flash and animation. Also, according to some of them, the site was taking too much time to appear on the screen.

Twenty requirements were identified from TV3 website users' point of view and the respondents were requested to assign importance level using 1–10 scale. The results are shown in Table 3. From the weights assigned, we pick up the top 15 viewer requirements as shown in Table 4.

Table 3   Viewer requirements and their corresponding importance level

No.	Statement	n	Mean	Std. Dev	Rank
Usability					
1	Easy to operate	230	7.72	2.020	11
2	Consistent page layout	230	7.33	1.875	16
3	Clarity and understandability in interaction with the site	230	8.11	1.714	6
4	Easy to navigate	230	8.17	1.877	5
5	Loading time for the site to appear on the screen	230	7.97	2.004	8
6	Local search facility in the site	230	7.64	1.914	12
7	An attractive appearance	230	7.87	1.960	9
8	Navigation links in every page	230	7.44	1.943	14
9	Website design	230	7.83	1.926	10
10	Availability of audio-video on demand and Live Net cast streaming	230	7.60	2.059	13
11	Moderate usage of animation, flash, graphics and images	230	7.37	1.977	15
12	Availability in two languages- Bahasa Melayu and English	230	8.22	2.083	4
Information quality					
13	Accurate information	230	8.84	1.703	2
14	Updating information on time	230	8.90	1.645	1
15	Presents the information in an appropriate format and languages	230	8.53	1.864	3
Interactivity					
16	Possibility of sending feedback through the website	230	8.01	1.956	7
17	Facility to participate in forum, poll, chat, contest and e-survey	230	7.32	2.154	17
18	Playing online games and puzzles	230	5.81	2.493	20
19	Facility to send greetings	230	6.43	2.450	19
20	Other extra features	230	6.64	2.487	18

Table 4   Top 15 viewer requirements and their corresponding weights

Code no.	Viewer requirements	Weight
J1	Updating information on time	8.90
J2	Accurate information	8.84
J3	Presents the information in an appropriate format	8.53
J4	Availability in two languages – Bahasa Melayu and English	8.22
J5	Easy to navigate	8.17
J6	Clarity and understandability in interaction with the site	8.11
J7	Possibility of sending feedback through the website	8.01
J8	Loading time for the site to appear on the screen	7.97
J9	An attractive appearance	7.87
J10	Website design	7.83
J11	Easy to operate	7.72
J12	Local search facility in the site	7.64
J13	Availability of audio–video on demand and Live Net cast streaming	7.60
J14	Navigation links in every page	7.44
J15	Moderate usage of animation, flash, graphics and images	7.37

Altogether 74 technical requirements were identified in consultation with the IT personnel working in TV3. These are divided into six categories: Network, Server, Backup, Security, Application and Programming Language, and Web Design and User Interface. Details are shown in Table 5.

Table 5   List of technical requirements

Network
1   Giga byte ethernet network
2   Broadband network
3   Wireless technology
Server
4   Media streaming server (audio/video)
5   Database server
6   Test server
7   Live server
8   Graphic server
9   Cache server
10   User authentication server
11   E-mail server

Table 5   List of technical requirements (continued)

Back up

12	Continuous back up (mirror)
13	Write script to have an automatic backup
14	Use tape or other medium of backup

Security

15	Multi level access
16	Use of id and user password for authentication and authorisation
17	Data encryption
18	Programming security
19	Firewall
20	Secure Socket Layer (SSL)

Application and Programming Language

21	Use HTML (Hyper Text Mark up Language)
22	Use SQL (Structured Query Language)
23	Use ASP (Active Server Page)
24	Use PHP (Hypertext Preprocessor)
25	Use Java ASP
26	Use Java Scripting
27	Use XML (Extensible Mark up Language)
28	Use XHTML (Extensible Hyper Text Mark up Language)
29	Use CSS (Cascade Style Sheet)
30	Use Content Management System (CMS)
31	Use Real Player Encoder or Windows Media Encoder
32	Beta Player Machine
33	DV Storm
34	Use Adobe Photoshop, Illustrator, Image Ready
35	Use Macromedia Flash/ Swish/ Dreamweaver
36	Use SVG (Scalable Vector Graphics)
37	Use SMIL (Synchronised Multimedia Integration Language)
38	Multicast Streaming
39	Minimise flash file of up to 25 Kb
40	Bilingual copywriter
41	Link to the database
42	Reliable, efficient and responsible officer to monitor, provide and key-in the information
43	Double checking the information before uploading
44	Preview or test the website before uploading
45	Time table and duty roster to update the information
46	Manual or SOP (Standard Operating Procedure) on how to update the information

Table 5   List of technical requirements (continued)

Web design and User Interface

47	Font size of 9 points or less for footer text such as copyright notices
48	Navigation link of up to 3 words per link
49	Use color to distinguish visited and unvisited links
50	Make 'Search' box available for the entire site
51	Layout design follows the eye-tracking routine (Z-pattern)
52	Navigation bar placed at upper left corner, upper right corner or top horizontal bar of the screen
53	Navigation links must be less than 10 categories
54	Use pull down menu for sub-navigation links
55	Navigation links must be short, simple and easy to understand
56	Place only one graphical (banner) ads on one page
57	Contents and images are not too cluttered on one page
58	Only one dominant image on one page
59	Use meaningful graphics that relate to the contents
60	Avoid using too many frames on one page
61	Use font that easy to read such as Times New Roman, Century Gothic, Arial, Helvetica, Sans Serif
62	Avoid horizontal scrolling
63	Create url or domain name less than 75 characters
64	Never have a link that point to the current page
65	Make it easy to access anything recently featured on the homepage
66	Archive old contents
67	Include a short site description in the window title
68	Include a tagline that explicitly summarises what the site or company does
69	Text must be easy for the users to scan and read
70	Use subheads, bulleted lists, highlighted keywords, short paragraphs, the inverted pyramid, and a simple writing style
71	Write a window title with good visibility in search engines and bookmarks
72	Group all corporate information in one distinct area
73	Guide users a clear starting point for the site's top high-priority tasks they will undertake when visiting the site
74	Provide a site map

After identification of viewer and technical requirements, we constructed the HOQ. With the help of few IT professionals working at MIS department of TV3, we established the relationship matrix for both types of requirements. Due to large number of technical requirements, we divided the whole HOQ diagram into three parts, which are shown in Figure 2a–c.

Figure 2 (a)   HOQ for the viewer requirements and technical requirements (network, server, backup, and security).

Legend:

Strong	*	9
Moderate	#	3
Weak	@	1

WHATs	Importance of the WHATs	Row number	Network			Server										Backup			Security					
			Gigabyte Ethernet Network	Broadband network	Wireless technology	Media streaming server (Audio/Video)	Database server	Web server	i) Rest Server	ii) Live Server	iii) Graphic Server	iv) Cache Server	v) User Authentication Server	vi) E-mail Server	Continuous back up (mirror)	Write script to have an automatic backup	Use tape or other medium back-up	Multi-level access	Use of id and password for authentication and authorization	Programming Security	Data encryption	Firewall	Secure Socket Layer
J1 Updating info on time	8.90	1		*		*	*			*	*		*		*		*		*				*	
J2 Accurate information	8.84	2				*	*			*	*		*		*		*		*				*	
J3 Presents the information in an appropriate format	8.53	3							*	*														
J4 Availability in two languages-BM and English	8.22	4								*							*							
J5 Easy to navigate	8.17	5																						
J6 Clarity and understandability in interaction with the site	8.11	6																						
J7 Possibility of sending feedback through the web site	8.01	7		@			*		*	*	*	*	*		*									
J8 Loading time for the site to appear on the screen	7.97	8		*					*	*	*	*	*										*	
J9 An attractive appearance	7.87	9		*						*	*	*												
J10 Web site design	7.83	10		*						*	*	*												
J11 Easy to operate	7.72	11							*															
J12 Local search facility in the site	7.64	12		*						*		*												
J13 Availability of audio-video on demand and Live Net cast streaming	7.60	13		*		*			*	*	*	*			*		*						*	
J14 Navigation links on every page	7.44	14																						
J15 Moderate usage of animation, flash, graphics, and images	7.37	15		*						*	*	*												
Weight			0	505	0	149	152		210	799	439	346	152	0	502	0	222	80	160	0	0	300	0
Column Number			1	2	3	4	5		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ranking of the technical requirements			55	7	65	53	51		48	2	14	35	51	65	39	65	47	57	50	65	65	42	65

Figure 2 (b) HOQ for the viewer requirements and technical requirements (Application and Programming language).

Legend:

	Symbol	Value
Strong	*	9
Moderate	#	3
Weak	@	1

House of Quality — Application and Programming Language

	Viewer requirements	Row number	Importance of the WHATs	Use HTML (Hyper text Mark-up Language)	Use SQL (Structured Query Language)	Use PHP (PHP: Hypertext Preprocessor)	Use ASP (Active Server Pages)	Use Java ASP	Use Java Scripting	Use XML (Extensible Mark up Language)	Use XHTML (Extensible Hypertext Mark up Language)	Use CSS (Cascade Style Sheet)	Use CMS (Content Management System)	Use Real Player Encoder or Windows Media Encoder	Beta Player Machine	DV Storm	Use Adobe Photoshop, Illustrator, Image Ready	Use Macromedia Flash/ Dreamweaver	Use SVG (Scalable Vector Graphics)	Use SMIL (Synchronized Multimedia Integration Language)	Multicast streaming	Bilingual copywriter	Link to the database	Reliable & efficient officer to provide, monitor and key-in info	Quality checking the information before uploading	Preview or test the web site before launching	Time table and duty roster to update information	Manual or SOP on updating information	Minimize flash file of up to 25kb
J1	Updating info on time	1	8.90	*		*	*		#	*	@	*	*				#	#	#	#			#	*	*		*	*	*
J2	Accurate information	2	8.84						*	*	#	*					#	#	#	#			#	*			*	*	*
J3	Presents the information in an appropriate format	3	8.53	*		*	*		*	*	@	*	*				#	#	#	#		*		*	*			*	
J4	Availability in two languages-BM and English	4	8.22	*		*	*																	*	#		*	*	
J5	Easy to navigate	5	8.17																										
J6	Clarity and understandability in interaction with the site	6	8.11										@																
J7	Possibility of sending feedback through the web site	7	8.01	*		*	*		*								#	*	*	#			*	*			*		
J8	Loading time for the site to appear on the screen	8	7.97							#							#			#									*
J9	An attractive appearance	9	7.87							*							#	*	*	*									
J10	Web site design	10	7.83	*		*	*		*			*	@				*	*	*	*			*						*
J11	Easy to operate	11	7.72																										
J12	Local search facility in the site	12	7.64	*		*	*																*	*	*		*	*	
J13	Availability of audio-video on demand and Live Net cast streaming	13	7.60											*	*	*	*	*	*	*	*		*	*	*	*	*	*	*
J14	Navigation links on every page	14	7.44	*		*	*		*	*		*					*	*	*	*									
J15	Moderate usage of animation, flash, graphics, and images	15	7.37										@																*
	Weight			439	0	439	439	0	334	326	43	369	238	68	68	68	261	356	356	377	68	74	121	374	255	139	302	302	209
	Column Number			21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
	Ranking of the technical requirements			15	65	15	15	65	36	37	64	27	46	60	60	60	44	32	32	25	60	58	56	26	45	54	39	39	49

Figure 2 (c)   HOQ for the viewer requirements and technical requirements (Web design and user interface).

Legend:

Strong	*	9
Moderate	#	3
Weak	@	1

Viewer requirements (Web Design and User Interface):

Row	Viewer requirement	Importance of the WILVATS
J1	Updating info on time	8.90
J2	Accurate information	8.84
J3	Presents the information in an appropriate format	8.53
J4	Availability in two languages-BM and English	8.22
J5	Easy to navigate	8.17
J6	Clarity and understandability in interaction with the site	8.11
J7	Possibility of sending feedback through the web site	8.01
J8	Loading time for the site to appear on the screen	7.97
J9	An attractive appearance	7.87
J10	Web site design	7.83
J11	Easy to operate	7.72
J12	Local search facility in the site	7.64
J13	Availability of audio-video on demand and Live Net cast, streaming	7.60
J14	Navigation links on every page	7.44
J15	Moderate usage of animation, flash, graphics and images	7.37

Technical requirements summary:

Technical requirement	Weight	Column Number	Ranking of the technical requirements
Font sizes of 9 points or less for footer text such as copyright notices	366	47	28
Navigation link of up to 3 words per link	282	48	43
Use color to distinguish visited and unvisited link	493	49	11
Make 'search' box available for the entire site	447	50	12
Layout design follows the eye-tracking routine (Z pattern)	357	51	30
Navigation bar placed at upper left corner, upper right corner or top horizontal bar of the screen	501	52	8
Navigation links must be less than 10 categories	305	53	38
Use pull down menu for sub-navigation links	305	54	38
Navigation links must be short, simple and easy to understand	351	55	34
Place only one graphical (banner) ads on one page	399	56	20
Contents and images are not too cluttered on one page	500	57	9
Only one dominant image on one page	382	58	23
Use meaningful graphics that relate to the contents	500	59	9
Avoid using too many frames on one page	434	60	18
Use font that easy to read like Times New Roman, Century Gothic, Arial, Helvetica, Sans Serif	365	61	29
Avoid of horizontal scrolling	357	62	30
Create URL or domain name less than 75 characters	70	63	59
Never have a link that point to the current page	377	64	24
Make it easy to access anything recently featured on the homepage	1002	65	1
Archive old contents	384	66	22
Include a short site description in the window title	556	67	6
Include a tagline that explicitly summarizes what the site or company does	123	68	55
Text must be easy for the users to scan and read	588	69	3
Use subheads, bulleted lists, highlighted keywords, short paragraphs, the inverted pyramid, and a	588	70	3
Write a window title with good visibility in search engines and bookmarks	407	71	20
Group all corporate information in one distinct area	443	72	13
Guide users a clear starting point for the site's top high-priority tasks they will undertake when	588	73	5
Provide a site map	433	74	19

The weight of every technical requirement is calculated using formula (1) in the Section 4. For example, the weight of 'broadband network' is shown below.

$$9(8.9) + 1(8.01) + 9(7.97) + 9(7.87) + 9(7.83) + 9(7.64) + 9(7.60) + 9(7.37) = 504.63$$

In Figure 2, the weights of the technical requirements are rounded off to the nearest integers. From the HOQ, the combination of Figure 2a–c, the 'Make it easy to access anything recently featured on the homepage' under the Web Design and User Interface category ranks as the most important technical requirement that enhance the viewer satisfaction. The second most important technical requirement is 'Live Server' under the Server category. The third important voice of the organisation are 'Text must be easy for the users to scan and read' and 'Use subheads, bulleted lists, highlighted keywords, short paragraphs, the inverted pyramid, and a simple writing style'. Both belong to the Web Design and User Interface category. TV3 also needs to ensure that the website is always accessible, 24 hours a day, 7 days a week, and 365 days a year. Therefore, Live Server is very important to ensure that the website is always available online. Viewers also like to scan first before reading the text on the website. Therefore, the type and size of font used, and how it is formatted or organised is very important for easy navigation. From these rankings, the MIS team of TV3 will be able to focus on the important areas to satisfy the viewer expectations. Table 6 shows the technical requirements that receive highest weight belonging to each of these six categories of technical requirements.

Table 6   Technical requirements that receive highest weight belonging to each of the categories

No.	Technical requirement	Category	Overall rank	Weight
1	Broadband network	Network	7	504.63
2	Live server	Server	2	799.02
3	Continuous back up (mirror)	Backup	39	302.04
4	Firewall	Security	42	299.79
5	Use HTML, use PHP, and use ASP	Application and programming language	15	438.66
6	Make it easy to access anything recently featured on the homepage	Web design and user interface	1	1002.42

It is to be noted that, in the category of Application and Programming Language, there are three technical requirements that receive the same highest weight. From the 74 technical requirements, only the top thirty technical requirements are listed in Table 7. Most of these technical requirements belong to Web Design and User Interface category. This indicates that TV3 internet team should focus more on the Web Design and User Interface in order to have a user-friendly, easy-to-navigate, and attractive website.

Table 7   Top 30 technical requirements

No.	Technical requirement	Category	Rank	Weights
1	Make it easy to access anything recently featured on the homepage	Web design and user interface	1	1002.42
2	Live server	Server	2	799.02
3	Text must be easy for the users to scan and read	Web design and user interface	3	588.15
4	Use subheads, bulleted lists, highlighted keywords, short paragraphs, the inverted pyramid and a simple writing style	Do	3	588.15
5	Guide users a clear starting point for the site's top high-priority tasks they will undertake when visiting the site	Do	5	587.61
6	Include a short site description in the window title	Do	6	555.75
7	Broadband network	Network	7	504.63
8	Navigation bar placed at upper left corner, upper right corner or top horizontal bar of the screen	Web design and user interface	8	501.03
9	Use meaningful graphics that relate to the contents	Do	9	500.40
10	Contents and images are not too cluttered on one page	Do	9	500.40
11	Use color to distinguish visited and unvisited links	Do	11	492.66
12	Make 'Search' box available for the entire site	Do	12	447.24
13	Group all corporate information in one distinct area	Do	13	443.34
14	Graphic server	Server	14	439.02
15	Use ASP (Active Server Page)	Application and programming language	15	438.66
16	Use HTML (Hypertext Mark up Language)	Do	15	438.66
17	Use PHP (Hypertext Preprocessor)	Do	15	438.66
18	Avoid using too many frames on one page	Web design and user interface	18	434.07
19	Provide a site map	Do	19	432.54
20	Write a window title with good visibility in search engines and bookmarks	Do	20	407.01
21	Place only one graphical (banner) ads on one page	Do	21	399.48
22	Archive old contents	Do	22	384.45
23	Only one dominant image on one page	Do	23	382.26
24	Never have a link that point to the current page	Do	24	377.04
25	Use SMIL (Synchronised Multimedia Integration Language)	Application and programming	25	376.89
26	Reliable and efficient officer to provide, monitor, and key-in info	Do	26	374.13
27	Use CSS (Cascade style sheet)	Do	27	368.64
28	Font sizes of 9 points or less for footer text such as copyright notices	Web design and user interface	28	366.19
29	Use font that easy to read such as Times New Roman, Century Gothic, Arial, Helvetica and Sans Serif	Do	29	365.04
30	Avoid horizontal scrolling	Do	30	357.30

6 Conclusions

Website is an important channel of any organisation through which it disseminates information about the organisation. Every website has its intended viewers and they have their own requirements. To maximise the viewer satisfaction, organisations are expected to pay adequate attention to fulfill their expectations/requirements. As it has been mentioned in the paper, though TV3 website has been revamped a number of times, but still many viewers provided negative comments. This is apparently due to the fact that viewers' articulated requirements were not considered seriously in any of the previous design exercises. The present research is claimed to be a systematic attempt to apply QFD to enhance the overall effectiveness of the TV3 website. The research has found the important viewer requirements and prioritised technical requirements that are purported to satisfy the viewer requirements. TV3 website management team is expected to take the findings of this research in its future redesigning exercise of the website and this may push them one step forward to fulfilling their vision to have the best private TV station in Malaysia. The findings of the research are equally useful to other similar organisations in course of maintaining an effective and user-friendly website.

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