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Quality function deployment method for selected website usability analysis

Metoda rozwinięcia funkcji jakości w analie użyteczności wybranego serwisu internetowego

Abstract

The paper presents an analysis of the usability of a selected web site using the QFD quality method. User requirements and related technical parameters used for creating diagrams of similarities and dependencies have been identified. Diagrams showing user and technical benchmarking as well as graphs of target values evaluated for user requirements and technical parameters were created.

Keywords: QFD method, usability analysis, internet service

Streszczenie

W pracy przedstawiono analizę użyteczności wybranego serwisu internetowego przy wykorzystaniu jakościowej metody QFD. Zidentyfikowano wymagania użytkowników oraz związane z nimi parametry techniczne tworząc diagramy podobieństw i zależności. Opracowano zarówno wykresy przedstawiające wyniki benchmarkingu użytkownika oraz benchmarkingu technicznego, jak i wykresy wartości docelowych obliczone dla wymagań użytkownika i parametrów technicznych.

Słowa kluczowe: metoda QFD, analiza użyteczności, serwis internetowy

1. Introduction

Due to the rapid development of on-line applications, appropriate methods of creating such services have to be used. Until recently, Internet systems played purely informational role, delivering just relevant information. At present, on-line services are rapidly growing and extending areas of application. This requires from websites provision of such services in reasonable time and in a friendly, attractive and competitive form in a highly demanding market. Therefore, the analysis of usability of web-based services which investigate the intuitiveness of navigation, browsing information or providing appropriate information becomes a necessity. Such analysis allows web services to fulfill user requirements and expectations and eliminate the most common errors. Various methods are used in practice, tools and techniques for the evaluation of usefulness of websites. One of them is the qualitative QFD method (Quality Function Deployment), which is a method of identifying user requirements and matching them to technical specifications of Internet services.

2. QFD principles

The QFD method was used for the first time in 1972 at the Kobe shipyard in Japan. Since the 1980s, it has been used in the automotive and electrical industries. Nowadays, when the quality of services is a major customer requirement, quality management tools are also implemented for on-line services. Diagrams linked together which have the structure of a house are the basic tool of the QFD method. Therefore, this method is also recognized as a "quality house" that shows the relationship between the identified user requirements (matrix rows) and the technical parameters of the website (matrix columns). The sequence of the diagrams in the QFD method [1, 2] is as follows: 01 – user requirements, 02 – user requirements importance, 03 – benchmarking of user, 04 – evaluation of relative user requirements importance (Ei), 05 – technical parameters of the service, 06 – diagram dependency of technical parameters, 07 – diagram of dependency user requirements and technical parameter, 08 – determination of technical parameters (Fi), 09 – technical parameter target, 10-technical benchmarking. The number of diagrams may vary depending on the needs and complexity of the website which is investigated. Figure 1 shows the relationships between diagrams in the QFD method.

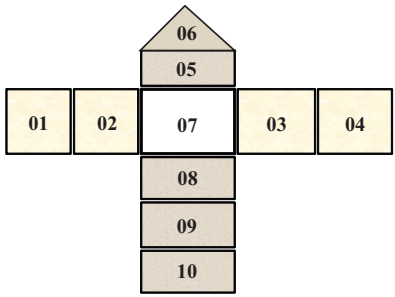

Fig. 1. Diagrams in QFD method

3. QFD usability analysis

QFD usability analysis was performed for the website of the Eye Hospital in Cracow [3]. The analysis was carried out in two stages. The first step was a horizontal analysis of marketing information: user requirements, competitive comparisons and user quality objectives. The second step was a vertical analysis which included technical information: identification of technical parameters, dependence between user requirements and technical parameters as well as determination of user quality objectives from the web designer point of view. At the first stage of the QFD qualitative analysis, user requirements were identified, then selected and grouped into relevant thematic categories (01-similarity diagrams). User requirements have various importance value. Therefore, the importance of user requirements was evaluated (02) by questionnaires. A scale from 1 to 5 was used, where 1-minor requirement, 5- the most important requirement for the user.

Table 1. Similarity diagram and user requirements importance

		01 User requirements	02 Requirements importance
Thematic Categories	I. website esthetics	1. Graphics	3
		2. Colors	3
		3. Clarity	4
		4. Advertisements	3
	II. Easiness of use	5. Information quality	5
		6. Ability to find	3
		7. Browsing	4
		8. Website launch	3
		9. Intuitiveness for elderly people	5
	III. contact	10. Ways of contact	5
		11. Location	4
		12. On-line registration	3
	IV. services	13. News	3
		14. Services	4
		15. Opinions	2

A user benchmark was conducted (03) to evaluate the investigated website (N) against two competitors [4, 5]: Retina (X) and Clinical Eye Hospital (Y) in Warsaw. The evaluation was scored on a scale ranging from 1 to 5, where 1 – requirement completely unfulfilled, 5 –requirement completely met. The fulfillment of user requirements by websites was

presented in the form of graphs in Fig. 2. This allows for observation in which areas the analyzed website is better than competition and which improvement measures need to be taken. In the next step, the priority (relative importance) of each identified requirement was determined. For that purpose, a benchmarking index (04) was elaborated. The following formula for the relative value *Ei* [6] was used:

$$E_i = \frac{D_i}{\sum_{(i=1)}^{n} D_i} \tag{1}$$

where:

E_i – relative importance for *i* requirements,
n – number of user requirements,
D_i – weighted value for *i* requirements evaluated from the formula [6]:

$$D_i = A_i \cdot B_i \cdot C_i \tag{2}$$

where:

A_i – rank of importance of *i* user requirements,
C_i – degree of fulfillment of *i* requirements,
B_i – indicator of the degree of improvement of the fulfillment of *i* requirements calculated according to the formula [6]:

$$B_i = \frac{P_i}{N_i} \tag{3}$$

where:

P_i – targeted level of fulfillment of *i* requirements,
N_i – state of fulfillment of *i* requirements.

A benchmarking chart (particularly the values in the E_i column) was used for determining the objectives of usability quality (from the user's point of view) to improve the analyzed website. The values in the E_i column were given in percentages. At the second stage of the qualitative QFD method (vertical analysis), technical parameters were identified to satisfy user requirements and grouped into thematic categories (05) (Table 2).

At the next step, the direction of improvement (KD) was determined to meet requirements:
1: the greater the parameter is, the better the website will meet user requirements,
–1: the smaller the parameter is, the better the service will meet user requirements,
0: the given parameter must have a specified nominal value to meet user requirements best.

According to the QFD usability analysis, technical parameters are often interrelated, which affects not only on the quality of technical solutions but also user requirements and expectations. Therefore, in the next step of the analysis, the relationships between parameters (06) were determined using the following rules:

- (–) if incrementing one parameter causes the decrease of the second parameter,
- (+) if incrementing one parameter results in the increase of the second parameter,
- if there is no relationship between the parameters, the cell is empty.

Table 2. Similarity diagram for technical parameters of the website

	05				
	Thematic Categories				
		A. Navigation	B. Graphics and esthetics	C. Usability	D. Functions and modules
Technical parameters	1	Browser	Pictures size	Website launch	E-patient
	2	Links	Pictures quality	Advertisements	Contact form
	3	Domain	Correct reading characters	Segmentation	E-registration
	4		Consistencies	Number of advertisements	
	5		Font size		

In the next step of analysis, relations between technical parameters and user requirements (07) were determined. Dependencies were described using numerical values: 0-1-3-9. Value 0 means no dependence, 1 means weak, 3 strong and 9 very strong dependence. The relative importance of the technical parameters (08) was determined by means of the following formula [6]:

$$F_j = \frac{T_j}{\sum_{j=1}^{n} T_j} \tag{4}$$

where:

F_i – relative importance,
m – number of parameters included in diagrams,
T_i – coefficient of importance of technical parameters expressed as [6]:

$$T_j = \sum_{(i=1)}^{n} A_i \cdot Z_{ij} \tag{5}$$

where:

Z_{ij} – coefficient of correlation between *i* requirement and *j* parameter.

The value of F_j in the diagram was expressed in percentage and later it was used to create bar charts representing technical parameters. In the next step, technical values were assigned to the values at which user expectations will be met (09). However, these values must always be real and measurable in the process of improving the website and achievable within a certain timeframe. The investigated website (10) was compared with two competitors. This allows for evaluating the technical level of offered solutions within each of the listed technical parameters. Evaluation rank is numbered from 1 to 5, in a similar way as in the case of user benchmarking. Linear charts describing the status of each service were developed to identify areas for improvement.

4. Graphical presentation of the results

A graphical presentation of results for the qualitative usability analysis QFD is presented in Figure 2. It allows for indicating which user requirements have primary importance and what is the status in the analyzed website. Technical and operational requirements say that the range of offered services, on-line registration and lack of registration form are issues which need to be improved. These are three areas (III contact, IV services, and D – functions and services), where improvement efforts should be taken because they are below the competitive website. In case of the analyzed website, there is no on-line registration while competitive websites have such possibilities. In addition, none of the analyzed websites have a contact form or search engine that would allow the user to find information, which would make the website intuitive and easy to navigate.

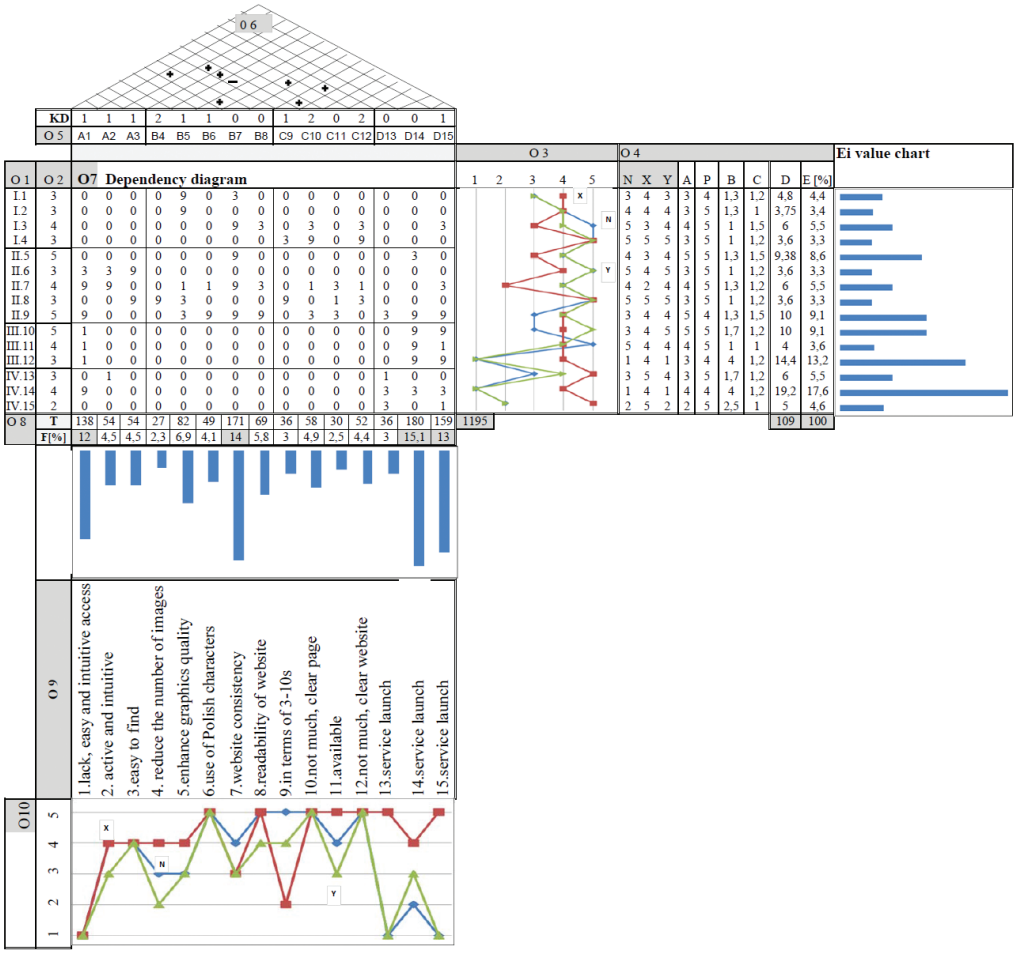

Fig. 2. House of quality, where KD-direction of improvement

5. Summary

The paper presents the application of the QFD method to evaluate the usability of a selected website. During the analysis, user requirements were defined as well as the technical parameters that have influence on these requirements. During the QFD analysis, also competitive websites were tested. After the QFD analysis, areas that require improvement were identified.

Usability analysis methods such as the QFD method can be useful tools for determining the scope of modification and upgrading of web services to meet user requirements and market demands.

References

[1] Hamrol A., Mantura W., *Zarządzanie jakością. Teoria i praktyka*, Wydawnictwo Naukowe PWN, 2006.

[2] *Quality Function Deployment*, http://www.public.iastate.edu (access: 15.01.2017).

[3] www.retina.pl (access: 15.01.2017).

[4] www.spkso.waw.pl (access: 31.01.2017).

[5] Sikorski M. , *Zastosowanie metody QFD do doskonalenia jakości użytkowej wybranego serwisu www*, Politechnika Gdańska, 2003.