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Determining and Prioritizing UX Factors in Corporate Sales Websites via Fuzzy FUCOM

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Abstract

User Experience (UX) plays a crucial role in ensuring the satisfaction of customers. However, it is an ongoing process that spans anticipated, momentary, and episodic time periods rather than being limited to short durations for any product or system. Due to its broad scope, various components are considered within it. Usability, being at the core, along with usefulness, desirability, accessibility, reliability, user engagement, and hedonic values, is all encompassed by UX. Meeting the requirements of these components with the appropriate factors will yield positive UX results. Moreover, understanding the importance of each factor will ensure the efficient use of time and resources. In this study, corporate sales websites are the focus, and the factors influencing user experience are first identified through a thorough literature review. Subsequently, expert opinions from a major telecommunications company in Türkiye are gathered to prioritize the relevant factors using fuzzy FUCOM, a popular robust technique in the MCDM literature. The identified main factors and their calculated relative importance weights, shown in parentheses, are: information architecture (0.1894), interaction design and process steps (0.2732), screen ergonomics (0.1792), and trust and creation (0.3582).

Keywords
User Experience (UX), Usability, Multi-Criteria Decision Making (MCDM), Fuzzy Logic, FUCOM

1. Introduction

In the era of digitalization, most activities across various systems have moved online. As a result, human-computer interaction has become more crucial than ever. The quality of this interaction plays a significant role in shaping the user experience (UX), which encompasses users' emotions and expectations before use, their satisfaction and engagement during use, and their overall perception, trust, and satisfaction after use. Due to its broad and complex nature, User Experience (UX) encompasses a range of dimensions. However, as Hassenzahl (2004) states, there is still no widely accepted model that clearly defines its key components. Based on the existing literature, several aspects have been identified as influential factors in UX, including usability (ISO 9241-11:2018), usefulness (Davis, 1989), beauty (Hassenzahl, 2004), accessibility (Abascal & Nicolle, 2005), credibility (Fogg & Tseng, 1999), and user engagement (O'Brien & Toms, 2008).

Usability, sometimes used as a synonym for UX, is in fact a fundamental component of it, addressing the pragmatic aspects of user interaction (Hassenzahl, 2008). It focuses on how effectively, efficiently, and satisfactorily users can perform specific tasks (ISO 9241-11:2018). Usability occurs during the actual interaction with a system and thus represents a specific phase within the overall UX timeline. While usability is the key component during use, other UX dimensions — such as beauty, credibility, accessibility, and engagement — are also influenced by how the system is used. Hence, identifying the factors that influence and enhance usability, along with other related UX dimensions, becomes essential and forms the core focus of this study.

Given their significance in the industry, this study focuses specifically on corporate sales websites. According to Alqurni et al. (2018), citing Nielsen (2001), poor usability is responsible for 50% of user abandonment on sales websites. Accordingly, the key factors underlying UX performance are first identified. Then, the prioritization of these factors is carried out using Fuzzy FUCOM, one of the increasingly popular and robust techniques within the MCDM framework. The contributions of this study are twofold. On the practical side, the influential UX factors will be identified, providing guidance for practitioners in designing websites that better satisfy UX dimensions. On the theoretical side, this study represents the first application of Fuzzy FUCOM for prioritizing UX factors within the MCDM literature.

The rest of the paper is organized as follows: Section 2 presents the literature review and the identification of key UX factors. Section 3 explains the steps of Fuzzy FUCOM. The prioritization of UX factors using Fuzzy FUCOM is detailed in Section 4. Finally, Section 5 provides the conclusion, followed by the references.

2. Literature Review and Identification of Key UX Factors

The literature on UX is extensive. However, considering the scope of this study, the review is limited to UX research related to sales websites. The primary aim of the review is to identify the key UX factors. To this end, the literature was examined using keywords such as sales websites, e-commerce, usability, and user experience. Key studies are briefly reviewed based on the common UX factors they incorporate, and the complete set of identified factors is presented in Figure 1.

Information architecture (IA), including various subfactors, is recognized as a UX factor in the reviewed studies. For instance, Agrawal et al. (2019) regard the site map—an element of IA—as a visual representation of the entire website and a tool that facilitates quick and easy navigation. Similarly, Fernandez et al. (2020) in their evaluation of airline websites, Tsiotsou et al. (2010) in their study on retailers' websites, and Flavián et al. (2009) in their review of website success factors also emphasized the importance of site maps. The second subfactor is navigation design, which is highlighted in several studies. Zhou et al. (2018) examined it in the context of art e-commerce, Fernando Moro et al. (2023) addressed it in their review of commercial website quality, Karim (2020) explored its role in e-service quality and customer satisfaction, and Martins et al. (2020) analyzed it through a comparative study of major competing brands' websites. Content structure is identified as the third component of Information Architecture (IA) in several studies, including Sulova's (2019) research on e-commerce website evaluation, Fernandez et al.'s (2020) evaluation of airline websites, and Fernando Moro et al.'s (2023) review of commercial website quality. The fourth sub-component, labeling, is highlighted in studies such as Martinez (2011), which examines the perceived website quality and its effect on purchase intention on private sales sites, and Țugulea and Stoian (2017), who explore website credibility through various facets and dimensions.

Interaction design and process steps are considered another important UX factor, as demonstrated in several studies. Zhou et al. (2018) explored this dimension in the context of user experience characteristics in art e-commerce. Similarly, Putera et al. (2024) mentioned it during the redesign of a company's website. Finally, Sugosha et al. (2021) addressed the design and implementation of UI and UX in online sales applications.

Screen ergonomics is regarded as the third main UX factor, including more subfactors than the other factors. The layout design, being the first subfactor, was mentioned in Neri's (2022) study on factors influencing purchase intention in luxury e-commerce, as well as in the studies of Putera et al. (2024), Passarelli-de-Lima et al. (2025), and Huang et al. (2023). The second subfactor is the positioning of components, which was discussed in Yavari et al.'s (2021) research on user-friendly mass customization toolkits, and also mentioned by Abascal et al. (2005), Olofsson (2005), and Passarelli-de-Lima et al. (2025). The third subfactor of screen ergonomics is the color usage and contrast, addressed in the study of Nwokah and Ntah's (2017) concerning the influence of e-service quality on customer satisfaction, and further elaborated by Rendell et al. (2022), Neri (2022), and Agrawal et al. (2019). Typography and readability comprise the fourth subfactor, as highlighted by Saldivar et al. (2023) in their study on tourism consumers' online purchase intentions, and further supported by findings from Putera et al. (2024), Sugosha et al. (2021), and Zhou (2018). The fifth subfactor is the use of whitespace, utilized in the works of Neri (2022) and Carstens and Patterson (2005). Finally, mobile compatibility is accepted as a significant ergonomic factor in the studies performed by Ke and Wisaeng (2025), Le-Hoang (2020), and Neri (2022).

The final main factor is trust and credibility, addressed in the study of Saldívar et al. (2023), which investigated the factors influencing tourism consumers' online purchase intentions. This factor was also emphasized in the studies of Fakharinejad et al. (2019) and Rendell et al. (2022), where it was regarded as a key determinant of user experience.

Additionally, based on feedback from industry evaluators, the existing subfactor set is expanded. Experts have highlighted key subfactors under the determined main factors. Security certificates/methods, two-factor authentication (such as SMS), GDPR/Personal Data Protection compliance, and permission authorizations are incorporated into the model for trust and credibility main factor. Based on the same expert feedback, the subfactors, including the availability of channels, campaigns, and special offers, as well as personalized processes, are added to the main factor of interaction design and process steps.

All the factors and subfactors of UX are represented hierarchically in Figure 1.

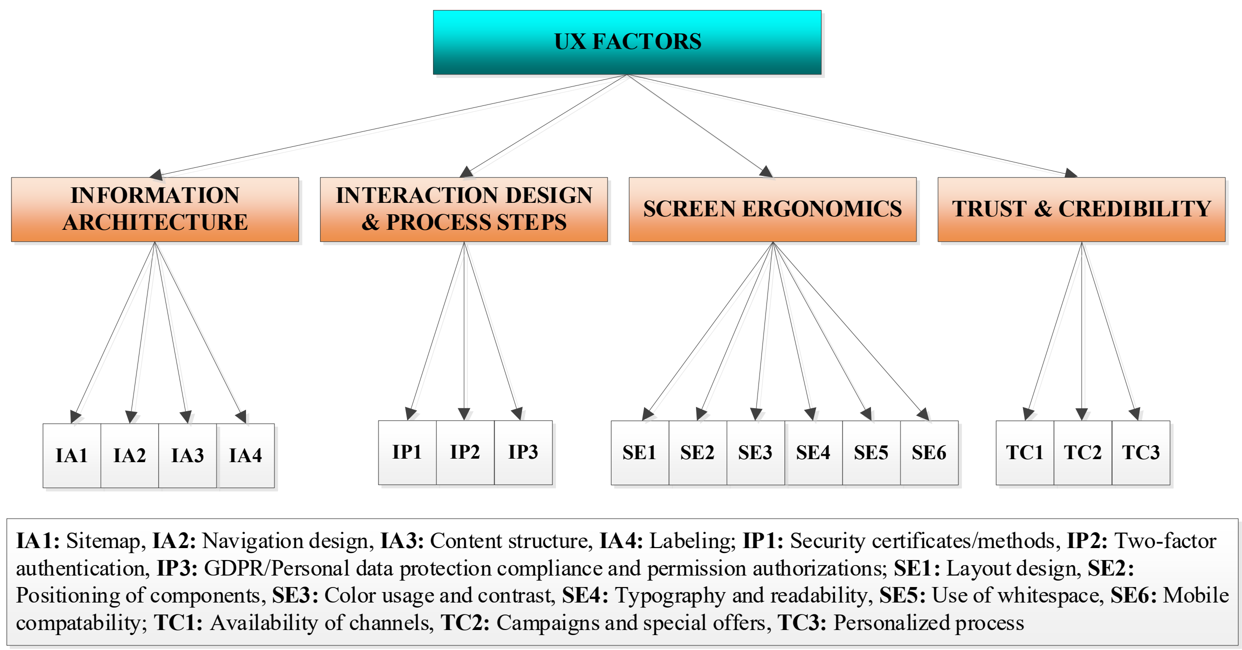

Figure 1. UX factors and subfactors

3. Fuzzy FUCOM

In MCDM problems, determining how much importance to give to each criterion is one of the most important stages of the process. Subjective weighting methods require decision makers (DMs) to express the relative importance levels between criteria through pairwise comparisons. In this context, the impact of one criterion on another is represented by the comparison value; however, because these values are based on experts' intuitive and experiential judgments, rather than precise data, they inherently contain a certain degree of uncertainty.

Fuzzy numbers stand out as an effective tool for modeling uncertainties (Zadeh, 1975) and one of the most frequently preferred methods for quantifying expert judgments is to work with triangular fuzzy numbers (TFNs) (Ecer, 2014). A TFN can be denoted as $T = (l, m, u)$, where $l \leq m \leq u$ and parameters indicate the lower bound value, the center and the upper bound value respectively. Consider two TFNs as $T_1 = (l_1, m_1, u_1)$ and $T_2 = (l_2, m_2, u_2)$ therefore basic operations of two fuzzy sets are presented in equations 1-4 as follows.

$$(l_1, m_1, u_1) + (l_2, m_2, u_2) = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad (1)$$

$$(l_1, m_1, u_1) \times (l_2, m_2, u_2) = (l_1 l_2, m_1 m_2, u_1 u_2) \quad (2)$$

$$(l_1, m_1, u_1) \,/\, (l_2, m_2, u_2) \cong (l_1/u_2, m_1/m_2, u_1/l_2) \quad for\ l_i > 0, m_i > 0, u_i > 0 \quad (3)$$

$$(l_i, m_i, u_i)^{-1} \approx \left(\frac{1}{u_i}, \frac{1}{m_i}, \frac{1}{l_i}\right) for\ l_i > 0, m_i > 0, u_i > 0 \quad (4)$$

In addition to main operations, the graded mean integration representation (GMIR) can be calculated as it is presented in equation 5. Let $a_j = (l_j, m_j, u_j)$ be a TFN in this case GMIR $R(a_j)$ can be calculated as follows:

$$R(a_j) = \frac{l_j + 4m_j + u_j}{6} \quad (5)$$

In order to make it easier for DMs to express fuzzy comparison values, linguistic scales whose numerical equivalents are defined as TFNs are preferred. In this study, a fuzzy linguistic scale was used to represent DMs preferences as presented in Table 1.

Table 1. Fuzzy linguistic scale (Pamucar and Ecer, 2020)

Linguistic terms	**Membership Function**		
	l	***m***	***u***
Equally Important (EI)	1	1	1
Weakly Important (WI)	2/3	1	3/2
Fairly Important (FI)	3/2	2	5/2
Very Important (VI)	5/2	3	7/2
Absolutely Important (AI)	7/2	4	9/2

The pairwise comparison values obtained using fuzzy linguistic scales enable a more flexible and realistic assessment of the relative importance levels between criteria. However, methods that offer both a systematic and consistent weighting process need to be adapted to incorporate DM perceptions into fuzzy logic. In response to this need, the FUCOM in a triangular fuzzy environment approach is used, which was developed by making the classical FUCOM method sensitive to uncertainty (Fazlollahtabar et al., 2019). Below, the FUCOM algorithm is presented in Figure 2.

Step 1 Determine the decision criteria: Suppose that there are n $(j = 1,2,\dots,n)$ criteria that are represented by a set $C = \{C_1, C_2, \dots, C_n\}$.

↓

Step 2 Rank the decision criteria: The criterion expected to have the highest weighting coefficient is placed first, followed by the criteria of decreasing importance. The criterion expected to have the lowest weighting coefficient is placed last. $C_{j(1)} > C_{j(2)} > \dots > C_{j(k)}$ where k represents the rank of the criterion observed. If two or more criteria have the same ranking, the equality sign is placed between the criteria instead of ">"

↓

Step 3 Comparisons of the criteria using TFNs.: The comparison is made by using the first-ranked criterion, which has the highest importance. Thus, fuzzy criterion importance levels $(\widetilde{\omega}_{C_{j(k)}})$ are obtained for all criteria listed in the 2nd step. Since the first-ranked criterion is compared with itself (its importance is assumed to be unitary, $\widetilde{\omega}_{C_{j(1)}} = EI$), comparisons must be made for the remaining n−1 criteria. Based on the identified criteria importance levels, the fuzzy comparative importance level $(\varphi_{k/(k+1)})$ is calculated as follows.

$$\varphi_{k/(k+1)} = \frac{\widetilde{\omega}_{C_{j(k+1)}}}{\widetilde{\omega}_{C_{j(k)}}} = \frac{\left(\widetilde{\omega}^{l}{}_{C_{j(k+1)}}, \widetilde{\omega}^{m}{}_{C_{j(k+1)}}, \widetilde{\omega}^{u}{}_{C_{j(k+1)}}\right)}{\left(\widetilde{\omega}^{l}{}_{C_{j(k)}}, \widetilde{\omega}^{m}{}_{C_{j(k)}}, \widetilde{\omega}^{u}{}_{C_{j(k)}}\right)}$$

Therefore, a fuzzy vector of comparative significance of the evaluation criteria is obtained as $\Phi = (\varphi_{1/2}, \varphi_{2/3}, \dots, \varphi_{k/(k+1)})$ where $\varphi_{k/(k+1)}$ represents the significance that the criterion $C_{j(k)}$ rank has in relation to the criterion of $C_{j(k+1)}$ rank.

↓

Step 4 Calculate the fuzzy weights: The final fuzzy weight coefficients for the criteria $(w_1, w_2, \dots, w_n)^T$ are calculated. These final weight values must meet the following two basic conditions:

Condition 1: The ratio between the weight coefficients of the relevant criteria ($C_{j(k)}$ and $C_{j(k+1)}$ must be equal to the comparative importance degree thus, $\frac{w_k}{w_{k+1}} = \varphi_{k/(k+1)}$

Condition 2: The final weight coefficients must satisfy the transitivity condition. This is expressed in terms of comparative importance as $\varphi_{k/(k+1)} \times \varphi_{(k+1)/(k+2)} = \varphi_{k/(k+2)}$. The same condition must also be met for the weight coefficients: $\frac{w_k}{w_{k+1}} + \frac{w_{k+1}}{w_{k+2}} = \frac{w_k}{w_{k+2}}$. Thus, another fundamental condition that the final weight coefficients must meet is defined as $\frac{w_k}{w_{k+2}} = \varphi_{k/(k+1)} \times \varphi_{(k+1)/(k+2)}$.

When full transitivity between the weight coefficients is achieved, the DMC value, i.e., $\chi = 0$, is satisfied. In this case, the following equations are assumed to be satisfied:
$\frac{w_k}{w_{k+1}} - \varphi_{k/(k+1)} = 0$ and $\frac{w_k}{w_{k+2}} - \varphi_{k/(k+1)} \times \varphi_{(k+1)/(k+2)} = 0$.

↓

Step 5 Construction of the linear model: In order to meet conditions given in 4th step, the values of the weight coefficients $(w_1, w_2, \dots, w_n)^T$ must be determined to satisfy the following inequalities:
$\left|\frac{w_k}{w_{k+1}} - \varphi_{k/(k+1)}\right| \le \chi$ and $\left|\frac{w_k}{w_{k+2}} - \varphi_{k/(k+1)} \times \varphi_{(k+1)/(k+2)}\right| \le \chi$

The goal here is to minimize the value of χ, which represents the inconsistency in the DM's evaluations. In line with these defined conditions, the final nonlinear model can be created to determine the optimal fuzzy weight coefficients of the evaluation criteria.

$$Min\ \chi$$
$$\begin{cases} \left|w_k - w_{k+1} \times \varphi_{k/(k+1)}\right| \le \chi, \forall j \quad ; \left|w_k - w_{k+2} \times \varphi_{k/(k+1)} \times \varphi_{(k+1)/(k+2)}\right| \le \chi, \forall j \\ \sum_{j=1}^{n} w_j = 1, \ \forall j \\ w_j^l \le w_j^m \le w_j^u ; \quad w_j^l \ge 0, \ \forall j ; \ j = 1,2,\dots,n \end{cases}$$

Figure 2. Steps of FUCOM methodology (Pamučar et al.,2018; Pamucar and Ecer, 2020)

4. Prioritization of UX Factors via Fuzzy FUCOM

This study determined the relative importance of evaluation factors for the selection and use of corporate displays in a telecommunications company. For this purpose, the TFNs FUCOM was applied. Using this method, data collected based on expert opinions was analyzed within a fuzzy logic framework, and the weights of each factor were calculated, allowing for a systematic prioritization of the factors to be considered in the evaluation of corporate displays.
The steps detailed below were followed during the implementation process. Initially, evaluation factors were defined and expert opinions were obtained; then, the relative importance of the factors was expressed as fuzzy numbers and processed according to the steps of the TFNs FUCOM method; and finally, the resulting weights were analyzed and the results were interpreted. These steps are presented in detail, step by step, sequentially.

Step 1-Defining the Problem and Listing the Factors: In the first step, the decision-making problem for evaluating corporate displays used in a telecommunications company was clearly defined. A literature review was conducted, and the final factor list, as presented in Figure 1, was developed by considering industry needs and expert opinions.

Step 2- Gathering DM Opinions: To assess the importance of the identified factors, field experts were consulted. Data was collected from seven experts with intimate knowledge of the company's operational processes and technical requirements. Each expert evaluated the relative importance of the identified factors using fuzzy linguistic scale given in Table 1.

Step 3-Application of the TFNs FUCOM Method: This main step is where the TFNs FUCOM method is applied. The sub-steps of this step are explained based on Figure 2 as follows.

Step 3.1 Determine the decision factors: The evaluation factors determined in Step 2, based on literature and expert opinions, were used as a basis. Then the evaluations received from the experts were converted to the form of TFNs for each factor.

Step 3.2 Rank the decision factors: At this stage, the evaluation factors were ranked from highest to lowest in terms of their expected importance. The factor with the highest weighting coefficient was placed first, followed by the factors of lesser importance in descending order. The factor with the lowest weighting coefficient was placed at the end of the list. The main factor rankings submitted by DMs are presented in Table 2 for illustrative purposes.

Table 2. Main factor-based ranking

Factor	*Explanation*	*DM1*	*DM2*	*DM3*	*DM4*	*DM5*	*DM6*	*DM7*
F1	Information Architecture	2	2	1	3	4	4	4
F2	Interaction Design & Process Steps	3	3	3	1	2	1	3
F3	Screen Ergonomics	4	4	4	4	3	3	1
F4	Trust & Credibility	1	1	2	2	1	2	2

Step 3.3 Comparisons of the factors using TFNs: In this step, the relative importance of the factors listed in the previous step was compared. For each pair of factors, expert assessments were obtained regarding the relative importance of each factor. Because these assessments can involve uncertainty and subjectivity, they are expressed as fuzzy numbers. Each TFN represents the minimum (l), most probable (m), and maximum (u) values given in Table 1. In Table 3, main factor comparisons are presented for DM1 and DM3 as an example.

Table 3. Pairwise comparison of main factors for DM1 and DM3

DM1						*DM3*				
Factor Pair	*Evaluation*	*l*	*m*	*u*		*Factor Pair*	*Evaluation*	*l*	*m*	*u*
F4-F1	FI	1.5	2	2.5		F1-F4	EI	1	1	1
F1-F2	VI	2.5	3	3.5		F4-F2	FI	1.5	2	2.5
F2-F3	AI	3.5	4	4.5		F2-F3	VI	2.5	3	3.5

These linguistic or numerical expressions given by the experts were converted into TFNs and the relative importance relationships between all factor pairs were determined. Applying the equation given in step 3 of Figure 2, the comparative significance of the factors has been defined. An example for DM1 is presented in the following equation.

$$\varphi_{F4/F1} = \frac{\tilde{\omega}_{F1}}{\tilde{\omega}_{F4}} = (1.5\,, 2, 2.5)/(1, 1, 1) = (1.5\,, 2\,,\ 2.5) \qquad (6)$$

$$\varphi_{F1/F2} = \frac{\widetilde{\omega}_{F2}}{\widetilde{\omega}_{F1}} = (2.5\ , 3, 3.5)/(1.5\ , 2\ , 2.5) = (1\ , 1.5\ , 2.33) \quad (7)$$

$$\varphi_{F2/F3} = \frac{\widetilde{\omega}_{F3}}{\widetilde{\omega}_{F2}} = (3.5\ , 4\ , 4.5)/(2.5\ , 3, 3.5)\ \ (1\ , 1.33\ , 1.8) \quad (8)$$

All similar calculations were applied to each factor pair, and comparative ratios were generated using equation 3 based on the values obtained through expert opinions.

Step 3.4 Calculate the fuzzy weights: In this phase, the final fuzzy weight coefficients for each factor are calculated using comparisons obtained in the previous steps. These calculated weights are determined to objectively reflect the relative importance of the factors in the decision-making process. There are two basic conditions that final weight values must meet, as presented in Figure 2.

Firstly, the ratio between the weighting coefficients of the relevant factors must be satisfied; secondly, the final weighting coefficients must satisfy the transitivity condition. Thus, the condition that the final weighting coefficients must meet is fulfilled. An example of 2nd condition is presented in the following equation. In the example, the opinions of DM1 are used once again.

$$\frac{w_{F4}}{w_{F2}} = \varphi_{F4/F1} \times \varphi_{F1/F2} = (1.5\ , 2\ ,\ 2.5) \times (1\ , 1.5\ ,\ 2.33) = (1.5, 3, 5.83) \quad (9)$$

$$\frac{w_{F1}}{w_{F3}} = \varphi_{F4/F1} \times \varphi_{F1/F2} = (1\ , 1.5\ ,\ 2.33) \times (1\ , 1.33\ ,\ 1.8) = (1.5, 2, 4.2) \quad (10)$$

All similar calculations were applied to each factor pair, and comparative ratios were generated using equation 2 based on the values obtained through expert opinions.

Step 3.5 Construction of the linear model: To meet the conditions determined in the fourth step, the weight coefficients of the factors are arranged according to specific inequalities. These inequalities aim to maintain the relative importance ranking among the factors and the overall weight condition.

The primary objective in this stage is to minimize the value of χ, which represents the inconsistency in DM' assessments, as much as possible. To this end, the final nonlinear model is created to determine the optimal fuzzy weight coefficients for the factors, considering all constraints and consistency conditions. As an example, the model developed for DM1 for the main factors is presented in Figure 3.

$$Min\ \chi$$

$$\begin{cases}
(w_4^l - w_1^u x\ 1.5) \leq \chi\ ;\ (w_2^l - w_3^u x\ 1) \leq \chi\ ;\ (w_1^l - w_3^u x\ 1) \leq \chi \\
(w_4^l - w_1^u x\ 1.5) \geq -\chi\ ;\ (w_2^l - w_3^u x\ 1) \geq -\chi\ ;\ (w_1^l - w_3^u x\ 1) \geq -\chi \\
(w_4^m - w_1^m x\ 2) \leq \chi\ ;\ (w_2^m - w_3^m x\ 1.33) \leq \chi\ ;\ (w_1^m - w_3^m x\ 2) \leq \chi \\
(w_4^m - w_1^m x\ 2) \geq -\chi\ ;\ (w_2^m - w_3^m x\ 1.33) \geq -\chi\ ;\ (w_1^m - w_3^m x\ 2) \geq -\chi \\
(w_4^u - w_1^l x\ 2.5) \leq \chi\ ;\ (w_2^u - w_3^l x\ 1.8) \leq \chi\ ;\ (w_1^u - w_3^l x\ 4.2) \leq \chi \\
(w_4^u - w_1^l x\ 2.5) \geq -\chi\ ;\ (w_2^u - w_3^l x\ 1.8) \geq -\chi\ ;\ (w_1^u - w_3^l x\ 4.2) \geq -\chi \\
(w_1^l - w_2^u x\ 1) \leq \chi\ ;\ (w_4^l - w_2^u x\ 1.5) \leq \chi \\
(w_1^l - w_2^u x\ 1) \geq -\chi\ ;\ (w_4^l - w_2^u x\ 1.5) \geq -\chi \\
(w_1^m - w_2^m x\ 1.5) \leq \chi\ ;\ (w_4^m - w_2^m x\ 3) \leq \chi \\
(w_1^m - w_2^m x\ 1.5) \geq -\chi\ ;\ (w_4^m - w_2^m x\ 3) \geq -\chi \\
(w_1^u - w_2^l x\ 2.33) \leq \chi\ ;\ (w_4^u - w_2^l x\ 5.83) \leq \chi \\
(w_1^u - w_2^l x\ 2.33) \geq -\chi\ ;\ (w_4^u - w_2^l x\ 5.83) \geq -\chi \\
(w_1^l + 4.w_1^m + w_1^l)/6 + (w_2^l + 4.w_2^m + w_2^l)/6 + (w_3^l + 4.w_3^m + w_3^l)/6 + \\
(w_4^l + 4.w_4^m + w_4^l)/6 = 1 \\
w_1^l \leq w_1^m \leq w_1^u\ ;\ w_2^l \leq w_2^m \leq w_2^u;\ w_3^l \leq w_3^m \leq w_3^u\ ;\ w_4^l \leq w_4^m \leq w_4^u \\
w_1^l;\ w_2^l;\ w_3^l;\ w_4^l\ \geq 0
\end{cases}$$

Figure 3. Model for DM1 main factor evaluations

The model was constructed using data obtained from seven DMs at two levels: first, analysis was conducted on the main factors, then separately on the sub-factors of each main factor. With this approach, evaluations were conducted for each DM at both the main and sub-factor levels, resulting in a total of 35 separate models.

5. Results

The findings obtained from the analyses conducted using the methods and steps described above are presented in this section. In this context, the final weights were calculated using equation 5. In this regard, fuzzy values obtained from the models were converted to final values first at the main factor level, then for the sub-factors of each main factor. Final results are presented in detail in Table 4.

Local weights (the relative importance of each sub-factor within its main factor) were first calculated for the sub-factors, and then these values were converted to global weights. This determined the overall relative importance of each sub-factor within the entire factor hierarchy, ensuring comparability of the results.

Table 4. Final weights for each factor

FACTORS/SUBFACTORS		**DM1**		**DM2**		**DM3**		**DM4**	
F1	**Information Architecture**	**0.2276**		**0.2179**		**0.3449**		**0.2021**	
		Local	**Global**	**Local**	**Global**	**Local**	**Global**	**Local**	**Global**
F11	Sitemap	0.4638	0.1056	0.1824	0.0397	0.2811	0.0969	0.2008	0.0406
F12	Navigation design	0.2179	0.0496	0.3449	0.0752	0.2708	0.0934	0.1602	0.0324
F13	Content structure	0.1511	0.0344	0.3449	0.0752	0.2811	0.0969	0.4370	0.0883
F14	Labeling	0.1671	0.0380	0.1279	0.0279	0.1670	0.0576	0.2021	0.0408
F2	**Interaction Design & Process Steps**	**0.1578**		**0.1511**		**0.1824**		**0.4370**	
		Local	**Global**	**Local**	**Global**	**Local**	**Global**	**Local**	**Global**
F21	Availability of channels such as mobile web	0.2582	0.0408	0.1853	0.0280	0.3996	0.0729	0.6304	0.2755
F22	Campaigns and special offers	0.4945	0.0780	0.2716	0.0410	0.3888	0.0709	0.2101	0.0918
F23	Personalized processes	0.2473	0.0390	0.5431	0.0821	0.2117	0.0386	0.1595	0.0697
F3	**Screen Ergonomics**	**0.1301**		**0.1671**		**0.1279**		**0.1602**	
		Local	**Global**	**Local**	**Global**	**Local**	**Global**	**Local**	**Global**
F31	Layout design	0.1157	0.0151	0.2613	0.0437	0.2279	0.0291	0.2492	0.0399
F32	Positioning of components	0.0881	0.0115	0.2657	0.0444	0.2492	0.0319	0.2279	0.0365
F33	Color usage and contrast	0.0755	0.0098	0.0980	0.0164	0.0914	0.0117	0.0748	0.0120
F34	Typography and readability	0.2572	0.0335	0.0959	0.0160	0.0748	0.0096	0.0914	0.0146
F35	Use of whitespace	0.2224	0.0289	0.1496	0.0250	0.2279	0.0291	0.2279	0.0365
F36	Mobile compatibility	0.2411	0.0314	0.1296	0.0217	0.1287	0.0165	0.1287	0.0206
F4	**Trust & Credibility**	**0.4845**		**0.4638**		**0.3449**		**0.2008**	
		Local	**Global**	**Local**	**Global**	**Local**	**Global**	**Local**	**Global**
F41	Security certificates/methods	0.3364	0.1630	0.2716	0.1260	0.5431	0.1873	0.3982	0.0800
F42	Two-factor authentication (SMS)	0.3273	0.1586	0.5431	0.2519	0.1853	0.0639	0.3982	0.0800
F43	KVKK and consent permissions	0.3364	0.1630	0.1853	0.0860	0.2716	0.0937	0.2035	0.0409
FACTORS/SUBFACTORS		**DM5**		**DM6**		**DM7**			
F1	**Information Architecture**	**0.1020**		**0.1301**		**0.1016**			
		Local	**Global**	**Local**	**Global**	**Local**	**Global**		
F11	Sitemap	0.2997	0.0306	0.3567	0.0464	0.4845	0.0492		
F12	Navigation design	0.2997	0.0306	0.3457	0.0450	0.2276	0.0231		
F13	Content structure	0.2997	0.0306	0.1306	0.0170	0.1578	0.0160		
F14	Labeling	0.1009	0.0103	0.1669	0.0217	0.1301	0.0132		
F2	**Interaction Design & Process Steps**	**0.3664**		**0.4845**		**0.1329**			
		Local	**Global**	**Local**	**Global**	**Local**	**Global**		
F21	Availability of channels such as mobile web	0.1116	0.0409	0.4442	0.2152	0.1116	0.0148		
F22	Campaigns and special offers	0.4442	0.1628	0.4442	0.2152	0.4442	0.0590		
F23	Personalized processes	0.4442	0.1628	0.1116	0.0541	0.4442	0.0590		
F3	**Screen Ergonomics**	**0.1284**		**0.1578**		**0.3828**			
		Local	**Global**	**Local**	**Global**	**Local**	**Global**		
F31	Layout design	0.2591	0.0333	0.2591	0.0409	0.2424	0.0928		
F32	Positioning of components	0.1039	0.0133	0.1039	0.0164	0.0924	0.0354		
F33	Color usage and contrast	0.1140	0.0146	0.1140	0.0180	0.0879	0.0336		
F34	Typography and readability	0.2833	0.0364	0.2833	0.0447	0.2581	0.0988		
F35	Use of whitespace	0.1463	0.0188	0.1463	0.0231	0.2424	0.0928		
F36	Mobile compatibility	0.0933	0.0120	0.0933	0.0147	0.0767	0.0294		
F4	**Trust & Credibility**	**0.4032**		**0.2276**		**0.3828**			
		Local	**Global**	**Local**	**Global**	**Local**	**Global**		
F41	Security certificates/methods	0.2716	0.1095	0.1595	0.0363	0.4280	0.1638		
F42	Two-factor authentication (SMS)	0.5431	0.2190	0.6304	0.1435	0.4280	0.1638		
F43	KVKK and consent permissions	0.1853	0.0747	0.2101	0.0478	0.1440	0.0551		

In the final step of the study, the weights calculated for each of the seven DMs were integrated using the arithmetic mean method. This balanced out any differences that might arise from individual evaluations, and the final importance ratings and rankings of the factors were obtained. In Tables 5 and 6, final weights and prioritization of these factor sets are presented.

Table 5. Prioritization of main factors

F#	Factors	Final Weights	Order
F4	Trust & Credibility	0.3582	1
F2	Interaction Design & Process Steps	0.2732	2
F1	Information Architecture	0.1894	3
F3	Screen Ergonomics	0.1792	4

As can be seen from Table 1, F4: Trust and Reliability (0.3582) is the most essential factor. This demonstrates that ensuring user trust in corporate displays is a top priority. Especially in a sector like telecommunications, where personal data is processed and privacy is critical, if users don't trust screens, the impact of other design elements will be limited. Therefore, security infrastructure, transparent permission processes, and the perception of trustworthiness should be at the core of the screen design strategy.

The second place of F2 factor emphasizes that user experiences with screens should be based on simple, understandable, and seamless flows. Expectations for campaigns, personalized processes, and multiple channels, such as mobile access, ensure that users view corporate screens not only as information sources but also as interaction tools. This finding demonstrates that user experience is the most critical competitive area after establishing trust.

Information architecture's third-place ranking demonstrates the importance of presenting content in a hierarchical, easily accessible, and logically organized manner. While screen ergonomics, ranked last, encompasses elements such as design aesthetics, color contrast, and typography, it demonstrates that these elements are secondary to user expectations of safety and functionality. In other words, aesthetics and visual comfort are secondary, making a difference only after security and ease of use are ensured.

Table 6. Prioritization of sub-factors

F#	Factors/Subfactors	Final Weights	Order
F4	Trust & Credibility	0.3582	1
F42	Two-factor authentication (SMS)	0.1544	1
F41	Security certificates/methods	0.1237	2
F43	KVKK and consent permissions	0.0802	3
F2	Interaction Design & Process Steps	0.2732	2
F22	Campaigns and special offers	0.1027	1
F21	Availability of channels such as mobile web	0.0860	2
F23	Personalized processes	0.0722	3
F1	Information Architecture	0.1894	3
F11	Sitemap	0.0584	1
F13	Content structure	0.0512	2
F12	Navigation design	0.0499	3
F14	Labeling	0.0299	4
F3	Screen Ergonomics	0.1792	4
F31	Layout design	0.0421	1
F35	Use of whitespace	0.0363	2
F34	Typography and readability	0.0362	3
F32	Positioning of components	0.0270	4
F36	Mobile compatibility	0.0209	5
F33	Color usage and contrast	0.0166	6

Within the Trust & Credibility dimension, Two-factor authentication (SMS) received the highest weight of 0.1544, indicating that decision-makers identified it as the most effective trust factor in this dimension. Security certificates/methods ranked second, with a weight of 0.1237, and were recognized but less interactive. In contrast, KVKK and consent permissions received the lowest weight (0.0802), suggesting that regulatory elements are primarily seen as standard practices and contribute little to user experience differentiation.

Findings regarding sub-factors also reveal the internal dynamics of the priorities within the main factors. In the trust and credibility dimension, identity verification and technical security practices have the strongest impact; legal permission processes, while important, play a more supportive role. In interaction design and process steps, value-added campaigns and solutions that enable multi-channel access are prominent, while personalized processes complement this experience. In information architecture, a well-structured content hierarchy and an easy-to-use navigation structure are decisive, while details such as labeling are secondary. In screen ergonomics, an organized layout and balanced use of space are the primary contributors, while typography, mobile compatibility, and color contrast stand out as complementary elements that enhance the visual experience

This overall picture demonstrates that visual and ergonomic improvements provide a valuable layer after the foundations of security and user experience are solidified. These findings demonstrate that design and processes that enhance security and user reliability should be prioritized in corporate display development strategies.

6. Conclusion

This study aimed to identify and prioritize UX factors on corporate sales websites. By incorporating expert opinions into the factor selection and weighting process, based on factors identified through a comprehensive literature review, a multidimensional framework was created that is not limited to ergonomic or technical dimensions. The addition of the sub-factors of trust and credibility, particularly emphasized by evaluators, allowed for a more detailed evaluation of this factor, which is relatively less emphasized in the literature when determining UX factors on websites. This allowed for a more balanced and comprehensive decision-making process.

The findings highlight the importance of integrating diverse perspectives in evaluation processes. Consulting multiple decision-makers and systematically reducing individual biases increased the reliability and robustness of the results. Furthermore, integrating uncertainty and fuzzy data into the model allowed for the management of situations where information was lacking or data was not fully clear. As mentioned in the results section, the most important factors were identified as trust and creativity, which are expected in the telecommunications sector. The remaining key factors were prioritized as Interaction Design & Process Steps, Information Architecture, and Screen Ergonomics, respectively.

Future studies are recommended to apply this model to different sectors, conduct sensitivity analyses across factors, and compare the results with different multi-criteria decision-making methods. Such an approach will not only test the validity and general applicability of the model but also contribute to the multi-criteria decision-making literature.

References

Abascal, J., & Nicolle, C., "Moving towards inclusive design guidelines for socially and ethically aware HCI," *Interacting with Computers*, vol. 17, no. 5, pp. 484–505, 2005, doi:10.1016/j.intcom.2005.03.002.

Agrawal, G., Kumar, D., Singh, M., & Dani, D., "Evaluating accessibility and usability of airline websites," in *Advances in Computing and Data Sciences*, pp. 392–402, Springer, 2019.

Alqurni, J., Alroobaea, R., & Alqahtani, M., "Effect of user sessions on the heuristic usability method," *International Journal of Open Source Software and Processes*, vol. 9, no. 1, pp. 62–81, 2018.

Carstens, D. S., & Patterson, P., "Usability study of travel websites," *Journal of Usability Studies*, vol. 1, no. 1, pp. 47–61, 2005.

Davis, F. D., "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, vol. 13, no. 3, pp. 319–340, 1989, doi:10.2307/249008.

Ecer, F., "A hybrid banking websites quality evaluation model using AHP and COPRAS-G: A Turkey case," *Technological and Economic Development of Economy*, vol. 20, no. 4, pp. 758–782, 2014.

Fakharinejad, H., Sadeghi, H., & Ahmadyan, A., "Assessing critical quality factors in travel websites using analytic hierarchy process," *Journal of Soft Computing & Decision Support Systems*, vol. 6, no. 1, 2019.

Fazlollahtabar, H., Smailbašić, A., & Stević, Ž., "FUCOM method in group decision-making: Selection of forklift in a warehouse," *Decision Making: Applications in Management and Engineering*, vol. 2, no. 1, pp. 49–65, 2019.

Fernández-Uclés, D., Bernal-Jurado, E., Mozas-Moral, A., & Medina-Viruel, M. J., "The importance of websites for organic agri-food producers," *Economic Research – Ekonomska Istraživanja*, vol. 33, no. 1, pp. 2867–2880, 2020.

Fernando Moro, M., Mendonça, A. K. S., Andrade, D. F., & Tezza, R., "Construct and survey of the dimensions used to assess the quality of commercial websites: A systematic review," *Revista FSA*, vol. 20, no. 2, 2023.

Flavián, C., Gurrea, R., & Orús, C., "Web design: A key factor for website success," *Journal of Systems and Information Technology*, vol. 11, no. 2, pp. 168–184, 2009.

Fogg, B. J., & Tseng, H., “The elements of computer credibility,” in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 80–87, ACM, 1999, doi:10.1145/302979.303001.

Hassenzahl, M., “The interplay of beauty, goodness, and usability in interactive products,” *Human–Computer Interaction*, vol. 19, no. 4, pp. 319–349, 2004, doi:10.1207/s15327051hci1904_2.

Hassenzahl, M., “User experience (UX): Towards an experiential perspective on product quality,” in *Proceedings of the 20th International Conference of the Association Francophone d’Interaction Homme–Machine*, pp. 11–15, ACM, 2008, doi:10.1145/1512714.1512717.

Huang, W., Sun, J., Liu, K., Huang, B., & Li, Z., “The MVC model based on the Internet of Things in agricultural product sales platforms,” in *2023 IEEE World Conference on Applied Intelligence and Computing (AIC)*, pp. 880–884, 2023.

ISO, *ISO 9241-11:2018 Ergonomics of human-system interaction—Part 11: Usability: Definitions and concepts*, International Organization for Standardization, 2018.

Karim, R., “Influence of e-service quality on customer satisfaction and word of mouth in app-based service industry: A case of Pathao, Bangladesh,” *Journal of Technology Management and Business*, vol. 7, no. 1, pp. 36–49, 2020.

Ke, Y., & Wisaeng, K., “Factors influencing consumers’ behavior towards Chinese products on e-commerce platforms in Thailand,” *International Journal of Analysis and Applications*, vol. 23, pp. 108–108, 2025.

Le-Hoang, P. V., “The relationship between online convenience, customer satisfaction, buying intention and electronic word-of-mouth,” *Independent Journal of Management & Production*, vol. 11, no. 7, pp. 2943–2966, 2020.

Martinez, B. M., “An analysis of the impacts of consumer shopping characteristics and perceived website quality on purchase intention from a private sales site,” 2011.

Martins, N., Lemos, M., Brandão, D., Raposo, D., Neves, J., & Silva, J., “Lexus used-vehicle online platform: Comparative analysis of major competing brands’ websites,” in *Meeting of Research in Music, Arts and Design*, pp. 243–255, Springer, 2020.

Neri, M., *Fashion e-commerce: A study of the elements determining the profitability of an online sale channel within the fashion industry*, 2022.

Nielsen, J., “Did poor usability kill e-commerce?”, Nielsen Norman Group, 2001.

Nwokah, N. G., & Ntah, S. W., “Website quality and online shopping of e-tail stores in Nigeria,” *Journal of Service Science and Management*, vol. 10, no. 6, p. 497, 2017.

O’Brien, H. L., & Toms, E. G., “What is user engagement? A conceptual framework,” *Journal of the American Society for Information Science and Technology*, vol. 59, no. 6, pp. 938–955, 2008, doi:10.1002/asi.20801.

Olofsson, J., “The web as a complementary marketing tool to small and medium-sized firms’ wholesale activities,” 2005.

Pamučar, D., & Ecer, F., “Prioritizing the weights of evaluation criteria under fuzziness: The FUCOM-F method,” *Facta Universitatis, Series: Mechanical Engineering*, vol. 18, no. 3, pp. 419–437, 2020.

Pamučar, D., Stević, Ž., & Sremac, S., “A new model for determining weight coefficients of criteria in MCDM models: Full consistency method (FUCOM),” *Symmetry*, vol. 10, no. 9, p. 393, 2018.

Passarelli-de-Lima, C. A., Claessens, P. M. E., Gaddi, C. M., Lukasova, K., & Feitosa-Santana, C., “Blue is the preferred color in at least two web contents,” *Displays*, vol. 90, p. 103146, 2025.

Putera, I., Wati, E. N. K., Natasia, S. R., & Laia, Y., “Redesigning UI/UX of the PT MNO company profile website using design thinking,” *JUSIKOM PRIMA*, vol. 7, no. 2, pp. 11–25, 2024.

Rendell, A., Adam, M. T., Eidels, A., & Teubner, T., “Nature imagery in user interface design: Influence on trust and aesthetics,” *Behaviour & Information Technology*, vol. 41, no. 13, pp. 2762–2778, 2022.

Saldívar, A. V. T., Ruiz, E. I. M., & Almazán, D. Á., “Factors influencing tourism consumers’ online purchase intention,” *El Periplo Sustentable*, no. 44, pp. 195–211, 2023.

Sugosha, K. G., Andreswari, R., & Hardiyanti, M., “Design and implementation of UI/UX in online sales applications using UCD,” in *2021 ICACSIS*, pp. 1–5, 2021.

Sulova, S., “A system for e-commerce website evaluation,” *SGEM*, vol. 19, no. 2.1, pp. 25–32, 2019.

Tsiotsou, R. H., Rigopoulou, I. D., & Kehagias, J. D., “Tracing customer orientation and marketing capabilities through retailers’ websites,” *Journal of Targeting, Measurement and Analysis for Marketing*, vol. 18, no. 2, pp. 79–94, 2010.

Țugulea, O., & Stoian, C., “Credibility of websites through facets and dimensions,” *Management & Marketing Journal*, vol. 15, no. 1, 2017.

Yavari, H., Nedaei Fard, A., Campbell, I., & Sinclair, M., “Design guidelines for implementation of user-friendly mass customization toolkits,” *Journal of Design Thinking*, vol. 2, no. 1, pp. 1–8, 2021.

Zadeh, L. A., “The concept of a linguistic variable and its application to approximate reasoning—Part I,” *Information Sciences*, vol. 8, no. 3, pp. 199–249, 1975.

Zhou, H., "Characteristics of user experience in art e-commerce: Case 'Buybuy Art'," retrieved November 28, 2018.

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