A decision-making methodology for UI/UX redesign strategy selection and management in fast-evolving product environments

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Abstract
This paper proposes an approach to supporting decision-making regarding the implementation of a web application interface redesign, taking into account ergonomic, technical, and organizational criteria. For this purpose, the Analytic Hierarchy Process (AHP) was applied, which allows for formalizing the selection process among several alternatives. As an example, a situation involving the choice of the optimal method for implementing changes was considered: "Big Bang", Gradual Migration, parallel development, and the use of Feature Flags. Based on the modeling results, the most effective approach turned out to be the use of Feature Flags, which provides flexibility, risk control, and convenience for testing. The application of AHP in web development tasks allows for combining engineering rationale with the principles of ergonomics and high-quality human-computer interaction.

Keywords
analytic hierarchy process, AHP, interface redesign, decision support, ergonomics, human-computer interaction, web development, Feature Flags

1. Introduction

In the current context of digital transformation and increasing competition in the online environment, the ergonomics of web interfaces serve as one of the key factors in ensuring effective human–machine interaction (HMI) [1-3]. Intuitive navigation, a clear interface structure, optimal information presentation, and minimization of cognitive load are fundamental elements that define the quality of user experience [4-6]. Insufficient attention to the ergonomic characteristics of an interface can significantly reduce the efficiency of an information system, cause user frustration, lower user loyalty, and negatively affect the company's image [7,8].

The process of website redesign, especially within a large or commercially significant project, is a multidimensional task that requires consideration of technical and organizational constraints, as well as the psychological factors of the team. The choice of redesign strategy directly affects such indicators as implementation speed, system stability in the production environment, the possibility of parallel development, testing convenience, and the overall stress level of the development team [8].

In practice, decisions about the redesign approach are often made intuitively, based on experience or the current technical situation. However, given the complexity of modern information systems and the high risks associated with interface changes, there is a growing need for the use of formalized decision support methods (DSM). These methods make it possible to take into account multiple criteria and alternatives, increase the transparency of the decision-making process, and ensure that the chosen strategy is well-founded.

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One of the most effective approaches to implementing DSM is the Analytic Hierarchy Process (AHP), which allows comparing alternatives across multiple criteria, including both quantitative and qualitative characteristics. In this study, it was proposed to apply AHP for the formalized selection of a web application interface redesign strategy, focusing on the criteria of ergonomics, stability, and developer convenience. This approach integrates into the overall methodology of managing human–machine interaction sessions and contributes to improving user experience quality in automated information systems.

The novelty of this study lies in the integration of the AHP method with modern DevOps decision-making contexts, a new set of evaluation criteria combining ergonomic and organizational aspects, and the use of sensitivity analysis to confirm model robustness. Unlike previous AHP applications in UX evaluation or project management, this work focuses on redesign strategy selection under continuous delivery conditions, bridging decision analytics with contemporary product development practices.

2. Analysis of existing studies and publications

One of the key challenges in interface development is ensuring a balanced consideration of technical, organizational, and ergonomic factors during decision-making. This is especially relevant in cases of large-scale changes, such as redesign. In this context, there arises a need for formalized methods that allow systematizing the decision-making process and accounting for various alternatives. One of the most widely used tools in such situations is the Analytic Hierarchy Process (AHP), proposed by Thomas Saaty in the 1970s [9].

The AHP method is based on constructing a hierarchical structure of the problem, where the goal occupies the top level, the next levels consist of criteria and subcriteria, and the lowest level represents the decision alternatives (Figure 1). The decision is made through pairwise comparison of the elements at each level according to their relative importance to the higher level, followed by the calculation of global priorities. AHP enables the combination of both quantitative and qualitative assessments, which is particularly important in tasks involving the human factor [10, 11].

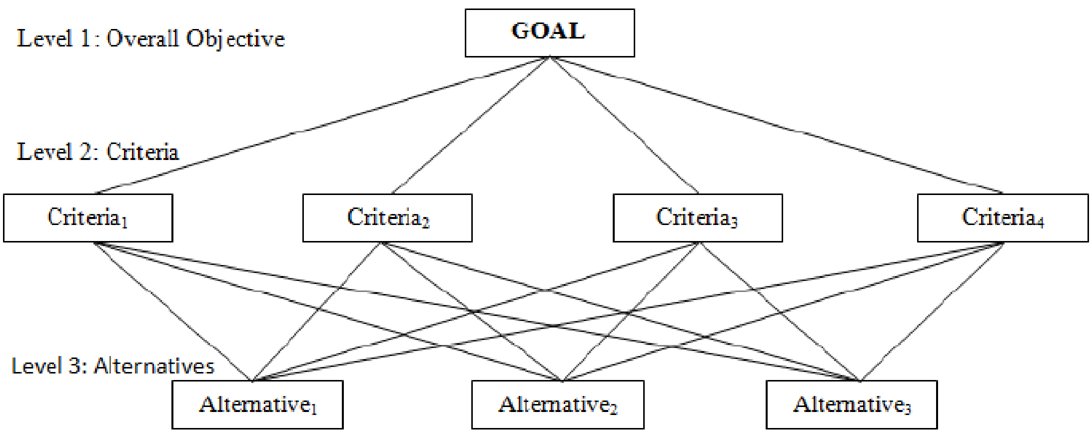


Figure 1: The classical three-level structure of the Analytic Hierarchy Process (AHP).

The application of AHP is widespread in decision support tasks within the field of human–machine interaction (HMI). The AHP methodology is used to select optimal control interfaces, assess cognitive load, and optimize UI components based on user scenarios [11,12]. AHP is also applied in UX design [13], software development [14], project management [15], and even in risk assessment for medical information systems [16].

In the context of ergonomics, the use of AHP makes it possible to formalize complex and subjective evaluations, including:

- interface convenience [17];
- visual load [18];
- function accessibility [12];
- navigation intuitiveness [14].

At the same time, tools for automating AHP are actively evolving within the scientific community. One of the most widely used is the Superdecisions software, developed based on AHP and ANP (Analytic Network Process). It enables the creation of full-scale models with multiple levels, performs priority calculations, consistency checks, and result visualization. Its effectiveness has been confirmed in the design of control systems, logistics, quality management, and, in particular, in UX and interface design tasks [19].

Thus, existing studies demonstrate the relevance of applying the AHP method in complex decision-making scenarios that involve both technical and psychological criteria. In the context of web interface development, this opens up the possibility for a more reasoned and objective approach to implementing changes that directly affect the quality of user interaction with the system.

3. Presentation of the main material and justification of the obtained research results

To demonstrate the capabilities of the Analytic Hierarchy Process (AHP) in supporting decision-making within the field of web development, a case was modeled to select the optimal approach for implementing a large-scale interface redesign of a major web project. The task required considering not only technical feasibility but also factors influencing the ergonomics of user interaction with the system and the organizational aspects of implementing changes.

According to the classical three-level AHP structure, a model was built in Superdecisions (Figure 2):

- Level 1 (Goal): Selection of the optimal strategy for implementing the interface redesign.
- Level 2 (Criteria):
  - Implementation speed;
  - Risk of failures/bugs in production;
  - Possibility of parallel development;
  - Convenience for testing;
  - Minimal stress for the team.
- Level 3 (Alternatives):
  - Refactoring the entire interface at once (“Big Bang”);
  - Gradual Migration in parts;
  - Parallel development in a new branch;
  - Use of Feature Flags.

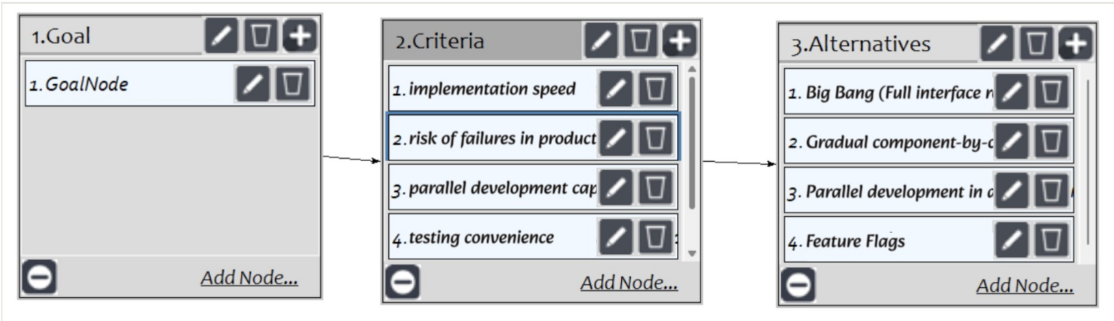


Figure 2: AHP model structure created in SuperDecisions for redesign strategy selection.

The criteria were evaluated pairwise, taking into account their impact on the overall success of the redesign (Figure 3). Special attention was given to production risks, which are often a critical factor in large projects. The importance of the team's psychological comfort was also assessed – a factor that is often overlooked but has a significant impact on implementation quality.

The pairwise comparisons were carried out by a panel of five experts, including UI/UX designers, front-end engineers, and project managers, each with over five years of experience in web application development. Individual judgments were aggregated using the geometric mean method, following Saaty's recommendations, to obtain a consolidated comparison matrix that represents a collective expert perspective.

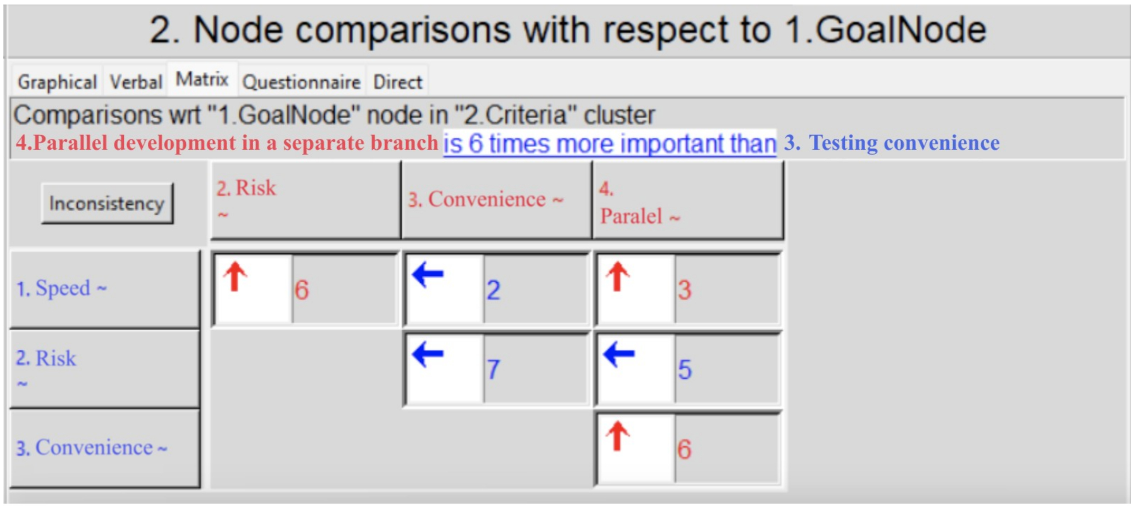


Figure 3: Pairwise comparison matrix and normalized weights for evaluation criteria.

For each criterion, a detailed pairwise comparison of the alternatives was conducted (Figure 4), taking into account both subjective assessments and experience from implementing similar approaches in real development conditions.

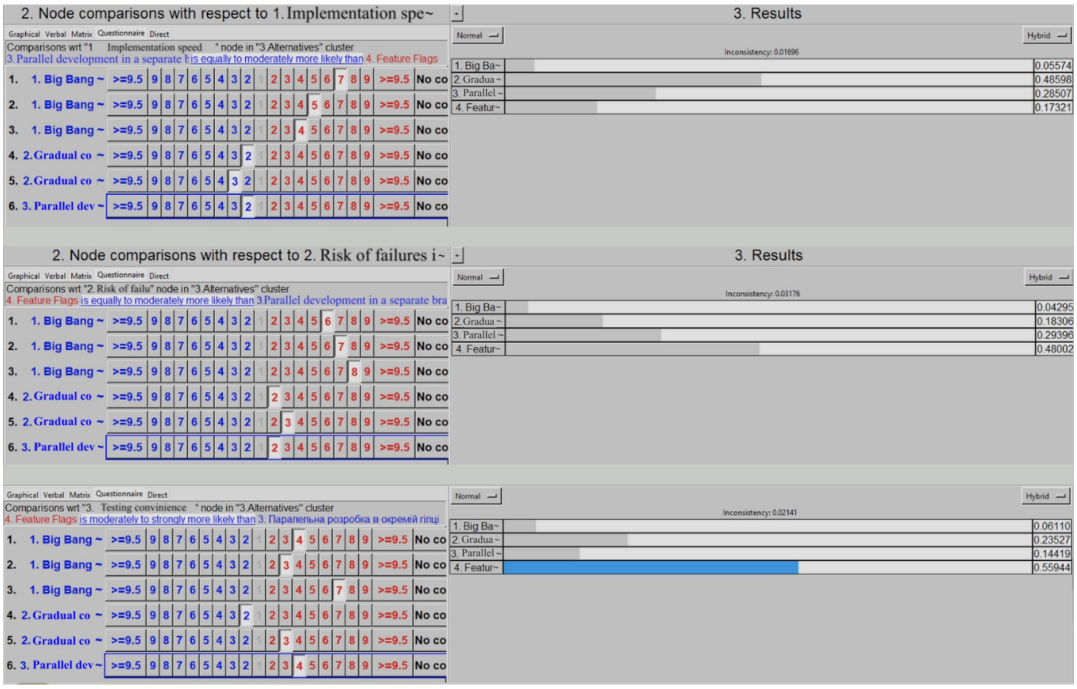


Figure 4: Pairwise comparison of redesign alternatives with respect to Testing Convenience.

Based on the weighted evaluations of the criteria and alternatives, the AHP model made it possible to obtain global priorities for each approach. The highest weight was assigned to the "Use of Feature Flags" alternative (Figure 5), which allows gradually enabling the new design for selected users or parts of the interface without a full rollout.

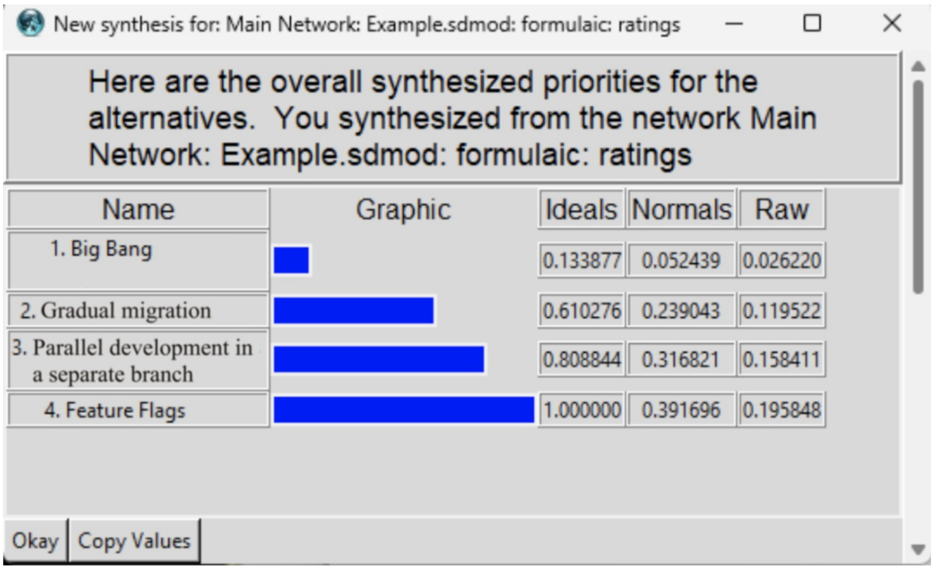


Figure 5: Global priority values for each redesign strategy.

This approach demonstrated advantages in the following criteria:

- Risk of failures: minimized, as new functionality is controlled;
- Testing convenience: each stage can be easily verified independently;
- Team stress: reduced due to the absence of pressure from a "single large release."

To increase the reliability of the modeling results, a sensitivity analysis was conducted, allowing the assessment of the stability of the chosen decision when varying the weighting coefficients of the criteria.

To ensure the reproducibility of the study, the full pairwise comparison matrices, priority vectors, and consistency ratios should be provided as supplementary materials or in an appendix. This will enable other researchers and practitioners to replicate the calculations and verify the consistency of judgments made during model construction.

In the study, the criterion "Risk of failures" was selected as a key factor that could potentially have a decisive impact on the outcome. Its weight was adjusted using the tool embedded in the software, which generates a corresponding diagram showing changes in alternative priorities.

When the weight of the "Risk of failures" criterion is increased or decreased (Figure 6), the relative priorities of the alternatives change. However, even with a significant increase in the weight of this criterion, the "Feature Flags" alternative retains the highest priority. This indicates the stability of the chosen option and confirms the reliability of the obtained results.

Quantitatively, the sensitivity analysis showed that the ranking of alternatives remains unchanged as long as the weight of the 'Risk of failures' criterion stays within the range of 0.22–0.38. Beyond this range, the 'Gradual Migration' alternative begins to approach or slightly surpass the Feature Flags option. This stability interval demonstrates that the final decision is robust to moderate variations in expert opinions.

Although the AHP method introduces a structured comparison process, it inevitably contains a degree of subjectivity, as it depends on human judgments. To mitigate bias, several practical techniques can be applied, for example, using multiple raters, conducting Delphi rounds to reach consensus, or applying fuzzy-AHP formulations that capture uncertainty in linguistic evaluations. Incorporating such mechanisms enhances reliability and makes the results more defensible in collaborative team environments.

Visualizing such an analysis allows for an intuitive assessment of the impact of individual criteria on the final decision, which is especially useful when making strategic decisions under conditions of uncertainty.

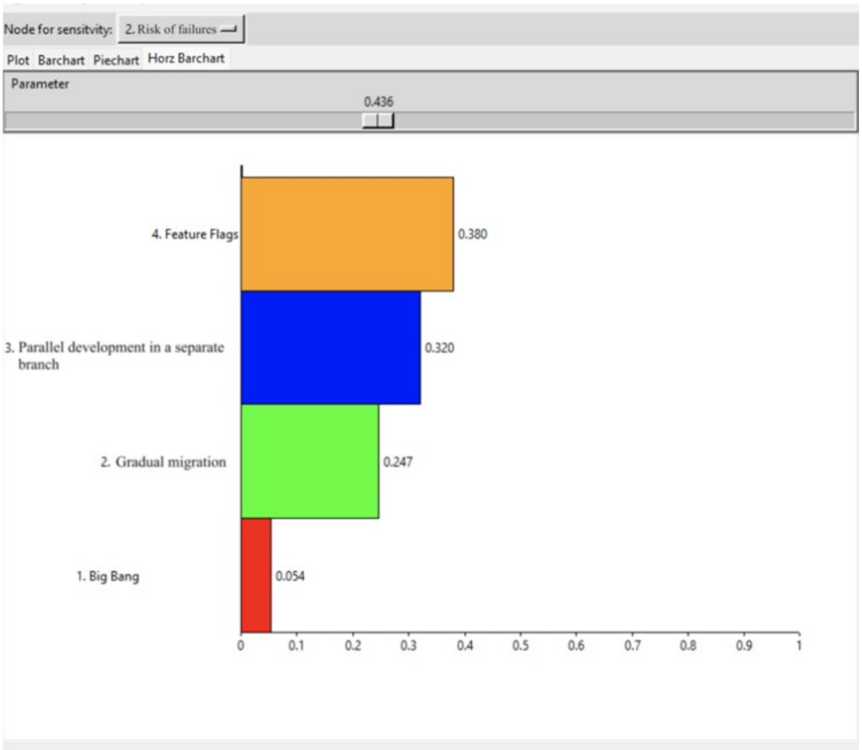
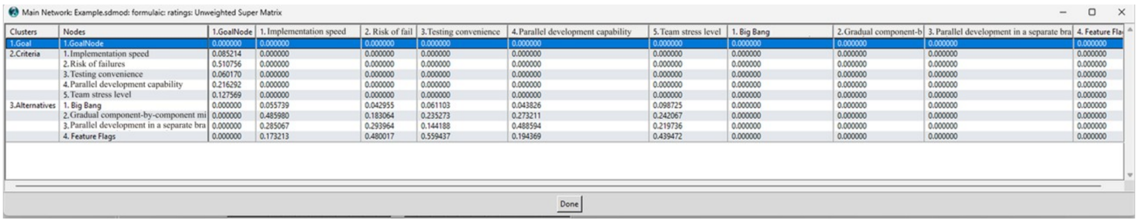


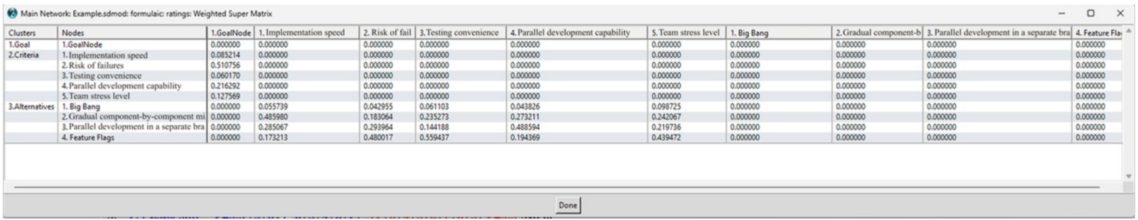
Figure 6: Sensitivity graph showing changes in alternative priorities based on the weight of the "Risk of failure" criterion.

Additionally, the unified supermatrices (weighted, unweighted, and limit) were analyzed (Figures. 7, 8, 9), which allowed for checking the consistency of the model and assessing the impact of feedback relationships between criteria. This is particularly important in real-world conditions, where, for example, the risk of failures affects team stress, or the possibility of parallel development influences implementation speed.



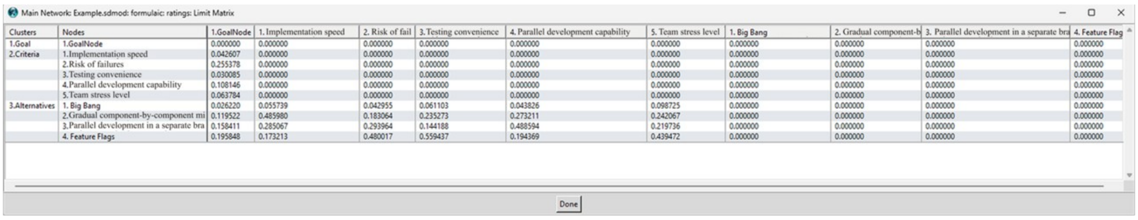
Clusters	Nodes	1.GoalNode	1. Implementation speed	2. Risk of fail	3.Testing convenience	4.Parallel development capability	5.Team stress level	1. Big Bang	2.Gradual component-b	3. Parallel development in a separate bra	4. Feature Fla
1.Goal	1.GoalNode	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2.Criteria	1.Implementation speed	0.085214	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2.Risk of failures	0.510756	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	3.Testing convenience	0.060170	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	4.Parallel development capability	0.216292	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	5.Team stress level	0.127569	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3.Alternatives	1. Big Bang	0.000000	0.055739	0.042955	0.061103	0.043826	0.098725	0.000000	0.000000	0.000000	0.000000
	2.Gradual component-by-component mi	0.000000	0.485980	0.183064	0.235273	0.273211	0.242067	0.000000	0.000000	0.000000	0.000000
	3.Parallel development in a separate bra	0.000000	0.285067	0.293964	0.144188	0.488594	0.219736	0.000000	0.000000	0.000000	0.000000
	4. Feature Flags	0.000000	0.173213	0.480017	0.559437	0.194369	0.439472	0.000000	0.000000	0.000000	0.000000

Figure 7: Unweighted Super matrix.



Clusters	Nodes	1.GoalNode	1. Implementation speed	2. Risk of fail	3.Testing convenience	4.Parallel development capability	5.Team stress level	1. Big Bang	2.Gradual component-b	3. Parallel development in a separate bra	4. Feature Fla
1.Goal	1.GoalNode	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2.Criteria	1.Implementation speed	0.085214	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2.Risk of failures	0.510756	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	3.Testing convenience	0.060170	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	4.Parallel development capability	0.216292	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	5.Team stress level	0.127569	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3.Alternatives	1. Big Bang	0.000000	0.055739	0.042955	0.061103	0.043826	0.098725	0.000000	0.000000	0.000000	0.000000
	2.Gradual component-by-component mi	0.000000	0.485980	0.183064	0.235273	0.273211	0.242067	0.000000	0.000000	0.000000	0.000000
	3.Parallel development in a separate bra	0.000000	0.285067	0.293964	0.144188	0.488594	0.219736	0.000000	0.000000	0.000000	0.000000
	4. Feature Flags	0.000000	0.173213	0.480017	0.559437	0.194369	0.439472	0.000000	0.000000	0.000000	0.000000

Figure 8: Weighted Super matrix



Clusters	Nodes	1.GoalNode	1. Implementation speed	2. Risk of fail	3.Testing convenience	4. Parallel development capability	5. Team stress level	1. Big Bang	2. Gradual component-b	3. Parallel development in a separate bra	4. Feature Flag
1.Goal	1.GoalNode	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2.Criteria	1.Implementation speed	0.042607	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	2.Risk of failures	0.255378	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	3.Testing convenience	0.030085	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	4.Parallel development capability	0.108146	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	5.Team stress level	0.063784	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3.Alternatives	1. Big Bang	0.026220	0.055739	0.042955	0.061103	0.043826	0.098725	0.000000	0.000000	0.000000	0.000000
	2.Gradual component-by-component mi	0.119522	0.485980	0.183064	0.235273	0.273211	0.242067	0.000000	0.000000	0.000000	0.000000
	3.Parallel development in a separate bra	0.158411	0.285067	0.293964	0.144188	0.488594	0.219736	0.000000	0.000000	0.000000	0.000000
	4. Feature Flags	0.195848	0.173213	0.480017	0.559437	0.194369	0.439472	0.000000	0.000000	0.000000	0.000000

Figure 9: Limit Matrix.

The application of AHP in this task demonstrated the ability to effectively consider multiple factors when selecting a redesign strategy, directly impacting HMI ergonomics, user satisfaction, and the stability of the information system. This approach can be easily adapted for other types of decisions in UI/UX design [20].

The selection of evaluation criteria for the redesign task was based on both ergonomic principles of user interface interaction and practical aspects of team-based development. Each criterion plays a key role in the overall effectiveness of implementing changes.

Implementation speed assesses how quickly the team can make changes without disrupting the core functionality of the site. For example, a Big Bang approach allows immediate full-scale changes but requires significant preparation time. Feature Flags and Gradual Migration allow partial implementation, though the process may be extended [21,22].

In addition to these four redesign approaches, modern release management practices such as canary releases, A/B interface testing, and blue-green deployment are increasingly applied in web development. These techniques allow the gradual exposure of interface changes to limited user segments, the experimental comparison of multiple interface versions, and the creation of parallel environments to ensure zero-downtime rollouts. Their inclusion expands the decision space and reflects the evolution of deployment strategies in agile and DevOps-oriented teams.

Risk of failures/bugs in production is one of the most critical criteria in real projects. Large-scale changes carry a high likelihood of errors that may go beyond controlled environments. Feature Flags scored highest here, as they allow limited rollout of new functionality.

Possibility of parallel development is important for teams working in multiple branches simultaneously. Parallel branch development clearly excels in this aspect, although it requires more complex future merges.

Ability to test each new interface component in isolation reduces risks and the load on the QA team. Again, Feature Flags proved the most adaptable, as they allow testing inactive components in a live environment.

Psychological state of the development team is critically important for long-term projects [23, 24]. A full interface overhaul, as in the Big Bang approach, generates high stress and responsibility, whereas phased approaches allow the team to adapt and gradually integrate changes into their regular workflow.

4. Conclusion

The article examined an example of applying the Analytic Hierarchy Process (AHP) as an effective decision support tool during the implementation of a large-scale web application interface redesign. The constructed model allowed for consideration of a range of important criteria, both ergonomic (testing convenience, minimization of cognitive load) and organizational (risk of failures, team stress, possibility of parallel development).

Using Superdecisions software, a multi-level model was built with subsequent pairwise comparisons of criteria and alternatives. The modeling results indicated that the most effective redesign strategy under the selected conditions is gradual implementation using Feature Flags. This approach reduces the risk of errors in the production environment, improves control over the update process, provides flexibility for the development team, and enables high-quality, incremental testing of new components.

To empirically validate the proposed methodology, a pilot implementation can be conducted in a real product development team. Key quantitative indicators such as deployment frequency, mean time to restore service, number of post-release bugs, and team satisfaction levels should be measured before and after applying the AHP-based decision framework. Such data would provide an objective assessment of the method's impact on delivery speed, product quality, and team well-being, strengthening the practical significance of the research results.

The results demonstrate not only an example of a specific choice but also the broader methodological value of AHP in tasks that combine technical and human factors. Particular attention should be paid to the potential integration of this approach into an overall human–machine interaction management system, where it is important to consider both user behavior and system performance parameters from the developers' perspective.

Overall, the application of AHP in web development holds significant potential as a tool for formalizing decisions in complex, team-based projects, improving the quality of user interface interaction, and serving as part of broader UX methodologies in automated information systems.

As shown in these studies [25-28], the application of AHP positively impacts decision-making in team-based projects, enhances user interface interaction quality, and contributes to greater efficiency in automated information systems.

Future research could focus on automating the AHP model-building process, integrating it into DevOps workflows, using real UX metrics [29] (e.g., time-on-task, error rate) to refine criteria, and scaling models to the level of an entire information system.

5. Practical implementation checklist

1. Participants: include a UX designer, front-end developer, QA engineer, and product manager;
2. Steps:
   1. Define redesign goal and alternatives (e.g., Gradual Migration, Feature Flags);
   2. Select 4–6 key evaluation criteria relevant to project context;
   3. Collect expert pairwise comparisons (individually or in a workshop);

4. Calculate weights and consistency ratios using Super Decisions or equivalent tools;
5. Review sensitivity plots and confirm ranking stability;
6. Integrate chosen strategy into DevOps and feature-flag workflows for controlled deployment;

3. Recommended outputs: summary of criteria priorities, selected strategy justification, and lessons learned for future releases.

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Declaration on Generative AI

The authors have not employed any Generative AI tools.

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