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A Survey on Cloud Adoption for Software Testing: Integrating Empirical Data with Fuzzy Multicriteria Decision-Making

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Abstract:

With the introduction of cloud computing, the field of software development and testing has experienced substantial changes. The effectiveness and scalability of traditional software testing techniques are challenged by the distributed and more complex nature of contemporary applications. Testing-as-a-Service (TaaS) or Cloud-Based Testing (CBT) is a promising option made possible by cloud computing's scalable on-demand capabilities. CBT has drawbacks in terms of security, privacy, and service quality even with its possible advantages, such as increased productivity and cost-effectiveness. The objective of this research is to close the gap by creating a thorough Cloud Testing Adoption Assessment Model (CTAAM) with the use of fuzzy multicriteria decision-making (FMCDM) techniques and empirical data. The model uses empirical data and expert views to examine and assess the factors impacting cloud adoption in software testing, ultimately aiding decision-making in software development organizations (SDOs).

Keywords: Cloud Computing**,** Software Testing**,** Testing-as-a-Service (TaaS)**,** Fuzzy Multicriteria Decision-Making (FMCDM)**,** Cloud Adoption**,** Empirical Survey and Decision-Making Model.

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Introduction

The software development and testing landscape has seen tremendous transformation in the last ten years due to the rapid advancements in technology. Traditional software testing techniques are getting less effective and more difficult as software applications become more complex, dynamic, and distributed. Industry reports state that comprehensive regression testing takes a significant amount of time and resources for software with large codebases. Many Software Development

Organizations (SDOs) have resorted to automation as a cost-effective and expedient solution to these problems. But keeping up with the essential testing resources and tools continues to be a big task, especially as technologies advance.

With its scalable, on-demand resources, cloud computing (CC) has become a disruptive technology that can be used to overcome the drawbacks of conventional software testing. Organizations can improve productivity, safeguard testing expenses, and increase the effectiveness of their testing processes by employing cloud-based services. Using cloud computing for software testing, also known as Testing-as-a-Service (TaaS) or Cloud-Based Testing (CBT), has many advantages, such as quick adaptability, self-service capabilities, wide network access, measurable services, and access to a large resource pool.

Although there are potential benefits, implementing CBT presents several difficulties regarding security, privacy, flexibility, multitenancy, and quality of service. Due to these obstacles, a thorough analysis and management of the variables impacting cloud adoption for software testing are required. By combining empirical data with fuzzy multicriteria decision-making (FMCDM) methodologies, this work seeks to fill this gap by creating a solid Cloud Testing Adoption Assessment Model (CTAAM).

Whether testing apps hosted in the cloud or offering testing services via the cloud, cloud testing makes use of cloud computing infrastructure to carry out software testing tasks. TaaS, or cognitive behavioural testing, is an approach that has gained popularity because it may provide scalable and affordable testing solutions. Since Tieto initially presented the idea of TaaS in 2009,

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both business and academia have embraced it.

Research on CBT has looked into several topics, such as particular testing formats, architecture, and applicability as demonstrated by case studies and industry surveys. Still lacking, though, is a thorough analysis of the variables affecting software testing's use of the cloud. To close this gap,

this study analyzes the factors that influence and anticipate cloud adoption using FMCDM methodologies, offering a methodical framework for SDO decision-making.

Technical developments, organizational preparedness, economic considerations, service quality, and security issues are some of the aspects that impact the use of cloud computing for software testing. Making informed choices on cloud adoption requires recognizing and prioritizing these aspects. This research systematically collects expert opinions and analyzes these factors using an empirical survey and fuzzy multicriteria decision-making (FMCDM) approaches. With the help of real-world data that guarantees the relevance and accuracy of the components found through a Systematic Literature Review (SLR), the empirical survey is essential for gathering expert opinions and validating those elements.

The survey is an essential component of the research since it aids in ranking the components according to expert consensus. After that, the survey data is analyzed using FMCDM approaches, like Fuzzy TOPSIS, which successfully manage the subjectivity and uncertainties present in expert opinions. FMCDM ensures a thorough and reliable analysis by utilizing fuzzy set theory to translate linguistic concepts into numerical values. This helps to improve the findings' reliability and facilitates the creation of the Cloud Testing Adoption Assessment Model (CTAAM).

The state of software testing now has been greatly influenced by technological improvements. Software testing procedures have become more effective and efficient due to the combined use of automation tools, cloud computing infrastructure, and advanced computing resources. A paradigm change is particularly provided by cloud computing, which offers flexible and

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scalable resources that may be specifically configured to meet the requirements of software testing.

The goals are to use systematic literature studies and empirical surveys to identify and rank the factors influencing software testing companies' adoption of cloud computing. Next, to develop a Cloud Testing Adoption Assessment Model (CTAAM) using fuzzy multicriteria decision-making

techniques (FMCDM). subsequently, to test this approach using case studies from software development companies and expert evaluations.

There's a noticeable lack of thorough research that combines solid analytical models with empirical data to inform decisions, even with the increasing interest in using the cloud for software testing. A dearth of frameworks that take into account the subjectivity and uncertainty included in expert opinions is present in the literature, which has primarily concentrated on cost and risk assessments. Using FMCDM methodologies, this research develops a Cloud Testing Adoption Assessment Model (CTAAM) to fill this gap.

Software testing can benefit from and experience difficulties from the use of cloud computing. Migration to a cloud environment is a complex decision that is influenced by several factors, even though cloud services can considerably improve testing efficiency and reduce expenses. An accurate assessment of the potential for cloud adoption requires a strong framework for decision- making that can manage the subjectivity and ambiguity in expert opinions. By combining empirical data with systematic analysis, this research attempts to close this gap by creating an FMCDM-based model that will assist enterprises in making decisions about cloud adoption for software testing.

Through the integration of FMCDM approaches with empirical surveys, this study offers a useful tool for software testing industry decision-makers and a comprehensive knowledge of the elements impacting cloud adoption.

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Literature Survey:

Martens and Teuteberg (2012) provide a thorough approach for enterprises to evaluate cloud computing services while balancing cost and risk. The authors use quantitative and qualitative analyses to examine financial consequences and potential dangers, and multi-criteria decision- making (MCDM) to evaluate various cloud scenarios. They look at direct and indirect expenses, including total cost of ownership (TCO) and return on investment (ROI), as well as risks including data security, compliance, service availability, and vendor lock-in. The integrated decision-making

methodology assists enterprises in selecting the finest cloud services while taking into account both cost efficiency and risk exposure. A practical case study explains how the framework may be used to help with balanced and strategic cloud adoption decisions. The research finds that this strategy provides a solid platform for making educated cloud computing decisions, thereby improving both financial performance and risk management.

The 2011 paper "A Risk Assessment Framework for evaluating Software-as-a-Service (SaaS) cloud services before adoption" by Bernard provides a framework to assist enterprises in evaluating the risks involved with SaaS service adoption. A methodical procedure for recognizing, assessing, and evaluating these risks is outlined in the framework, which also classifies important risks such as data security, privacy, compliance, service reliability, and vendor dependency. The article includes criteria for classifying and ranking risks in addition to specifics on risk identification and analysis techniques. To control and lower these risks, mitigation techniques are recommended. The framework's usefulness in assisting with safer and better-informed SaaS adoption decisions is demonstrated through a case study.

Khajeh-Hosseini et al. (2012) provide a complete toolkit to help organizations evaluate cloud computing adoption. The toolbox provides tools for assessing business benefits, risk assessment, and cost estimation, as well as a structured framework for analyzing cloud services' strategic, operational, and financial consequences. The toolbox facilitates a

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balanced decision-making process, allowing companies to methodically examine potential risks and benefits. Practical case studies demonstrate its use and efficacy in real-world circumstances. The authors conclude that the toolkit considerably improves the cloud adoption decision-making process, ensuring that decisions are aligned with business goals and increasing the overall evaluation of cloud service impact.

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Büyüközkan and Ruan (2008) investigate a fuzzy multi-criteria decision-making method for appraising software development projects. They present a strategy for dealing with the unpredictability and complexity of software project evaluation that combines fuzzy logic and multi-criteria decision-making techniques. The approach allows decision-makers to convey their

opinions more flexibly and intuitively by incorporating linguistic variables and fuzzy sets. Key achievements include the creation of a hierarchical structure for identifying criteria, the use of linguistic variables to reflect subjective assessments and the implementation of the fuzzy TOPSIS approach for project ranking. The suggested technique provides a systematic framework for project evaluation that takes into account many criteria at the same time while accommodating the ambiguity and imprecision that are common in real-world decision-making settings.

Hicdurmaz (2012) presents a fuzzy multi-criteria decision-making (FMCDM) technique to assist decision-makers in picking software life cycle models while addressing process complexity. The paper creates a structured decision-making framework using FMCDM approaches by combining fuzzy logic to deal with uncertain input. Notable highlights include the approach's applicability to real-life settings, which demonstrates its efficacy in overcoming the problems of software development projects. The findings show that the FMCDM methodology provides decision- makers with a systematic technique for selecting the best life cycle model while taking into account various criteria under uncertainty. This study sheds light on how to improve software development decision-making processes by presenting a structured method of model selection.

Arslan and Aydin (2009) present a new software designed for fuzzy multicriteria decision-making, which provides a solution for navigating complex choice landscapes. It successfully manages imprecise data by utilizing fuzzy logic, resulting in a strong foundation for decision analysis. The paper thoroughly describes the software's theoretical foundations, highlighting its ability to handle language variations and smoothly integrate expert knowledge. Its capacity to produce decision rules using

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fuzzy inference, which ensures adaptation to varied decision settings, is noteworthy. With a user-friendly interface and adjustable choices, the program emerges as a significant instrument for decision-makers, allowing them to confidently address ambiguity and complexity.

The factors impacting cloud computing adoption are carefully examined by Low et al. (2011) in their extensive study. They explore things including perceived hazards, organizational preparedness, and benefits of moving to cloud-based technologies. The study reveals, by painstaking analysis, how several factors such as cost savings, scalability, security concerns, and

technological capabilities interplay to shape corporate attitudes toward cloud adoption. It also emphasizes how important corporate culture, managerial backing, and outside influences are in propelling the adoption process. Through the use of theoretical frameworks and empirical analysis, the research greatly advances our understanding of the opportunities and difficulties that come with implementing cloud technologies in organizational settings, providing insightful knowledge that will be beneficial to both practitioners and academics.

Saya et al. explores the elements influencing cloud computing technology adoption in their 2010 study. They look into how perceptions of technology features and actual cloud adoption options are shaped by institutional pressures. A notable aspect of their work is how they examine how enterprises' perceptions of cloud technology are influenced by institutional factors including industry standards, legal requirements, and competitive dynamics. It is discovered that these factors have a major impact on how the advantages and hazards of adopting cloud computing are viewed, which in turn influences organizational decisions. It emphasizes how crucial it is to comprehend how technological attributes and institutional factors interact to shape adoption patterns. Using survey analysis, the researchers offer valuable insights into the complex relationship between institutional context and cloud computing perceptions. These insights have implications for researchers and practitioners who aim to comprehend and manage cloud adoption strategies in diverse organizational contexts.

The use of fuzzy systems to improve multicriteria decision-making (MCDM) is explored by Santos and Camargo (2010). They clarify that fuzzy logic offers a strong framework for weighing several factors and successfully handles the uncertainties and ambiguities common to decision-making processes. The study discusses fuzzy

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systems' theoretical foundations, approaches for integrating fuzzy logic into MCDM, and real-world examples that highlight their advantages. Key findings show that fuzzy systems outperform standard approaches in managing difficult decisions in terms of accuracy and adaptability. This method works especially well in situations when traditional methods find it difficult to handle aiguity and complexity.

An integrated intuitionistic fuzzy multi-criteria decision-making method is the unique approach to facility placement selection presented by Boran (2011). In handling uncertainty and imprecision, the study highlights the benefits of intuitionistic fuzzy sets over conventional fuzzy sets. An extensive and reliable instrument for decision-making is offered by the suggested framework, which combines intuitionistic fuzzy sets with tried-and-true multicriteria methods. The success of this strategy in practice is demonstrated in a case study that is included in the paper. This integrated strategy is a better option for complicated facility location decisions since the results indicate that it greatly increases decision accuracy and reliability.

To improve supplier selection procedures, Dalalah et al. (2011) created a fuzzy multi-criteria decision-making model. The authors offer a fuzzy logic-based method for assessing suppliers based on many criteria, which addresses the limitations of conventional approaches in handling uncertainty. A more comprehensive and adaptable assessment framework is provided by this method. Along with a case study demonstrating the fuzzy MCDM model's usefulness and practical applicability, the paper describes the implementation procedure of the model. The results show that by successfully handling the complexities and uncertainties involved, the fuzzy model greatly increases the accuracy and dependability of supplier selection.

The financial performance of Turkish manufacturing businesses is assessed in-depth in a study by Yalcin et al. (2012) utilizing fuzzy multi-criteria decision-making (MCDM) techniques. These tackle the shortcomings of conventional methods of financial appraisal, which frequently suffer from vagueness and imprecision. With fuzzy MCDM techniques, the authors suggest a framework for more accurate and

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sophisticated financial evaluations. They provide a thorough evaluation framework with a range of financial ratios and indicators, and they go into detail about the fuzzy MCDM system. Turkish manufacturing enterprises' financial performance is assessed using the model; its use and efficacy are demonstrated through a case study. Based on the efficient management of the inherent complexity and uncertainties, the results show that fuzzy MCDM approaches greatly increase the accuracy and reliability of financial performance evaluations.

3 **Methodology**

The primary objective of this survey is to gather detailed insights from industry experts on the factors influencing cloud adoption in software testing. This information will be crucial for the Fuzzy Multi-Criteria Decision-Making (FMCDM) analysis, enhancing the reliability and applicability of the Cloud Testing Adoption Assessment Model (CTAAM).

3.1 Data Collection

3.1.1 Target Audience:

The purpose of the survey is to collect opinions from a carefully chosen sample of professionals, comprising researchers, industry experts, and consultants with a focus on cloud computing and software testing. These volunteers are not picked at random; rather, they are recruited by strict standards that guarantee their fitness for the research. Every participant receives recognition for their established expertise, significant contributions to industry knowledge, and breadth of experience in the sector. This rigorous screening procedure guarantees that the poll obtains insightful, high-quality responses from people who are well-versed in the fields of cloud computing and software testing. By focusing on this specific group of people, the study hopes to gather insightful data that will help understand the subtleties and reality of the sector.

3.1.2 Purpose and Importance:

The survey has several goals, all of which are essential to the accomplishment of the study. First of all, it acts as a confirmation of the elements found via a thorough Systematic Literature Review (SLR). The survey makes sure that these elements are accurate and relevant by current industry standards, in addition to being theoretically sound, by cross-referencing them with the insights received from industry specialists. To ensure that the study has practical relevance, this validation phase is essential.

The poll gathers real-world data from professionals who are actively involved in software testing and cloud computing, offering practical insights in addition to validation. The usefulness and relevance of the several elements impacting cloud adoption in software testing are made clearer by this data. Formulating methods that work in real-world industry environments requires an understanding of these differences.

The survey also uses sophisticated analytical approaches like fuzzy TOPSIS and fuzzy multi-criteria decision-making (FMCDM). About managing the subjectivities and uncertainties present in expert opinions, these methods are very skilled. These advanced techniques are incorporated into the survey to improve the accuracy and consistency of the results, guaranteeing reliable and useful conclusions. The poll is crucial to improving our knowledge of cloud usage in software testing because it combines validity, useful insight, and thorough analysis.

3.2 **Survey Instrument and Administration**

The survey tool is meticulously constructed to collect thorough and specific data from participants. This design's main component is a structured questionnaire that strikes a balance between qualitative and quantitative data collection techniques.

3.2.1 Formalized Survey:

Quantitative Questions: Likert scale ratings are included in the questionnaire to gauge respondents' level of agreement or importance concerning certain factors. This makes it possible to quantify expert judgments consistently and comparably.

Open-ended questions are included in the questionnaire to supplement the quantitative data with qualitative information. In-depth insights and complex viewpoints from answers are intended to be elicited by these questions, offering a richer context and a deeper comprehension of the pertinent issues.

3.2.2 Method of Sampling:

Purposive sampling is the sampling technique used, an intentional strategy that guarantees the survey reaches people with particular, pertinent experiences. This entails choosing responders with a track record of success in cloud computing and software testing. The survey's ability to focus on these seasoned experts allows it to collect reliable, high-quality information that is directly relevant to the goals of the study.

3.2.3 Executive:

The survey is conducted online using easily navigable platforms like SurveyMonkey and Google Forms. There are various benefits to using this online approach:

Wide-ranging Participation: It allows responders of all backgrounds and locations to take part, regardless of where they stay.

The accessibility of online surveys enables participants to finish the questionnaire whenever it is most convenient for them, perhaps resulting in increased response rates.

Convenience: The digital format makes data collecting and submission procedures easier for participants as well as researchers.

Overall, the survey successfully collects important data from informed professionals because of a well-structured questionnaire, focused sampling and easy online administration. The attainment of the study's objectives and the extraction of significant insights depend on this thorough data collection procedure.

3.3 FMCDM Process

Step-by-Step Analysis:

Fuzzification:

Fuzzification is the process of translating fuzzy numbers into quantitative forms, with terms like "high importance" or "medium risk" remaining unchanged. To convert arbitrary, subjective assessments into a form that can be subjected to mathematical analysis, this step is essential. The definition of linguistic terms is done by membership functions and fuzzy sets. Quantitating subjective evaluations is achievable, for instance, if "high importance" is represented by a fuzzy integer with a defined range and different degrees of membership.

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Construction of Decision Matrix:

The decision matrix is a tabular representation of choices (the factors under evaluation) with rows denoting them and columns denoting criteria (such as cost, importance, and risk). Its goal is to facilitate the analysis that follows by arranging all pertinent facts in an understandable, methodical manner. Values representing each alternative's performance or score about each criterion are entered into each cell in the matrix. In doing so, a thorough dataset is produced for assessment.

ormalization:

Normalization ensures comparability across many criteria by bringing the values in the decision matrix to a similar scale. Since several criteria frequently have disparate units or ranges, direct comparison is challenging. These disparities are eliminated via normalization. The data are rescaled using methods like z-score normalization, which modifies values based on mean and standard deviation, or min-max normalization, which scales values between 0 and 1.

Weight Assignment:

The process of assigning weights entails weighing each criterion's relative significance. Its goal is to guarantee that more important factors will have a bigger impact on the evaluation in the end. Weights can be set using systematic techniques such as the Analytical Hierarchy Process (AHP) or based on expert assessments. Pairwise comparisons are used by AHP to create weights that represent the relative relevance of each criterion.

Aggregation:

Fuzzy scores for every factor are obtained by aggregating the weighted normalized values in the decision matrix. At this stage, data from multiple criteria are combined to create a single assessment for each option. A thorough score for each factor, representing its overall performance across all criteria, is generated by aggregating the weighted normalized values using particular mathematical operators.

Defuzzification:

Defuzzification is the process of turning fuzzy scores into clear, useful figures. Although fuzzy scores offer a more nuanced assessment, decision-makers frequently require precise values to make useful decisions. To convert fuzzy scores into exact numbers, techniques like the mean of maxima method (which averages the maximum membership values) and the centroid method (which finds the fuzzy set's centre of gravity) are employed. Clear ranking and prioritization of options are made easier by these sharp scores.

The FMCDM process systematically converts subjective expert assessments into solid, actionable insights by adhering to these specific processes and emphasizing key aspects. This allows for well-informed and strategic decision-making when it comes to cloud adoption for software testing.

3.4 Data Analysis

3.4.1 Initial Analysis:

Descriptive Statistics: The goal of calculating descriptive statistics is to give a thorough summary of the data that has been gathered, facilitating the understanding of broad trends and patterns within the dataset. This entails utilizing important metrics to summarize the answers. The data points are dispersed around a centre value that is provided by the mean, also known as the arithmetic average. When responses are arranged from least to greatest, the median, or the middle number, provides a measure of central tendency that is unaffected by outliers. Last but not least, the standard deviation illustrates how dispersed the data points are around the mean by measuring the amount of variation or dispersion in the responses. When taken as a whole, these metrics aid in providing a clear image of the data, facilitating more knowledgeable analysis and interpretation.

Factor Validation: The purpose of factor validation is to ensure the reliability and validity of the constructs that are being measured by the survey items. This step is crucial to confirm that the identified factors are indeed reflective of the underlying constructs they are intended to measure. Confirmatory Factor Analysis (CFA) is a statistical technique used to test the hypothesis that the data fits a specified factor structure.

Ranking of Factors: Ranking variables serve to assist in determining which ones, depending on expert consensus, should receive greater attention by prioritizing them based on their perceived relevance and influence. Insights are gathered for this process from subject matter experts who assess and rank the criteria according to their expertise. The rankings are then determined using

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median rankings, which minimize the impact of extreme values and offer a reliable estimate of central importance, and weighted averages, where each expert's contribution may be weighted based on their level of experience. The outcome is a ranking of the elements, emphasizing the ones that the experts believe are most important and serving as an outline for more research and decision-making.

3.4.2 Advanced Analytical Methods:

Fuzzy TOPSIS: Using a combination of distance from an anti-ideal solution and proximity to an ideal solution, fuzzy TOPSIS is a strategy designed to rank factors. The inconsistencies that come with making decisions as humans are appropriately addressed. Estimating the distances using fuzzy mathematics, defining ideal and anti-ideal solutions, and then ranking the elements according to how near the ideal solution corresponds to the steps in the procedure.

Fuzzy AHP: The goal of the Fuzzy Analytic Hierarchy Process (AHP) is to establish the weights given to various criteria in a decision-making framework. It accomplishes this by dividing the decision problem into interconnected levels of criterion and sub-criteria and arranging the criteria hierarchically. The relative importance of each criterion is methodically assessed through pairwise comparisons that make use of fuzzy scales to account for uncertainty and subjective opinions. After these comparisons, weights are determined for each criterion, combining the data to give a thorough picture of each criterion's relative importance in the decision-making process.

Fuzzy Delphi Method: To handle uncertainty, the Fuzzy Delphi Method combines fuzzy logic with the Delphi method's structured communication strategy. Obtaining feedback from a panel of experts via repeated rounds of surveys or questionnaires helps to improve criteria weights and decision matrices. The decision matrix and criterion weights are iteratively adjusted during each round using statistical analysis and feedback. The experts engage in this repeated refinement process until they reach a stable consensus, guaranteeing that the final model appropriately captures their combined knowledge and consensus.

3.5 Integration of Empirical Survey and FMCDM

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A comprehensive method for comprehending the different aspects impacting cloud adoption is to combine FMCDM methodologies with survey data from real-world surveys. By using this approach, made sure that ideas are supported by concrete data and thoroughly examined using FMCDM, which results in the development of a robust Cloud Testing Adoption Assessment Model (CTAAM). This paradigm facilitates the development of successful strategies and well-informed decisions for cloud software testing within enterprises.

Organizations may effectively evaluate several aspects of cloud adoption by using the CTAAM as a strategic framework. Decision-makers can identify the primary motivators, obstacles, and opportunities surrounding cloud adoption by utilizing FMCDM and empirical validation. With the help of this method, enterprises may streamline their testing processes and effectively manage the intricacies of cloud computing. Several measures are used to guarantee the efficacy of the survey component. To make sure that questionnaires are precise and pertinent, pre-testing and pilot surveys are used. It is possible to go further into particular topics and get more insight into responses by conducting follow-up surveys or interviews. Using several data sources to validate and cross-check findings is known as data triangulation, and it improves the credibility of research findings. The methodology may be improved and any problems can be quickly resolved thanks to participants' ongoing feedback during the survey process.

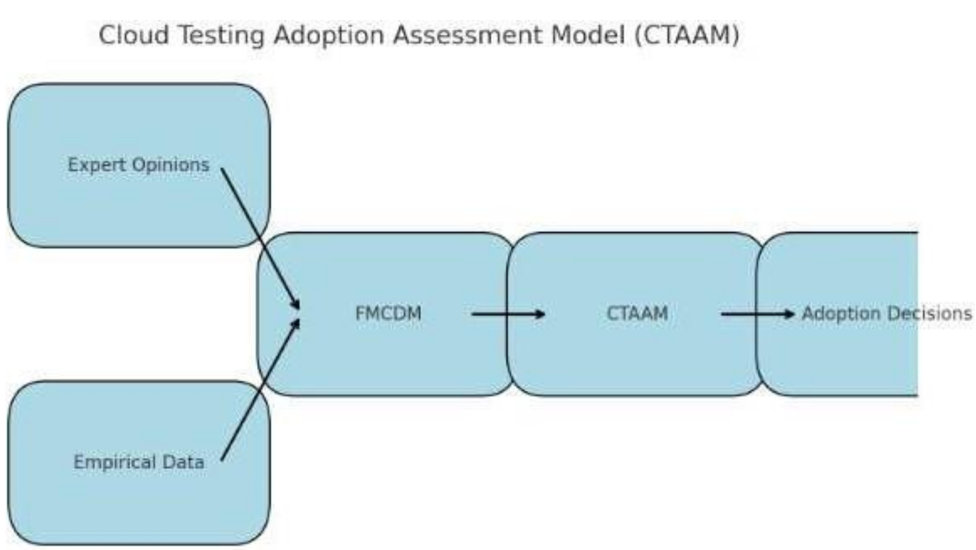

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Fig.1 Cloud Testing Adoption Assessment Model (CTAMM)

Fig.1 diagram represents the Cloud Testing Adoption Assessment Model (CTAAM). It illustrates the flow from expert opinions and empirical data through the Fuzzy Multicriteria Decision- Making (FMCDM) process to generate adoption decisions.

In the final analysis, the integration of FMCDM methods, as represented by the CTAAM, with empirical survey data provides a solid framework for comprehending and managing cloud adoption. Organizations may fully exploit this technique to make informed decisions and execute successful cloud adoption strategies by adhering to best practices in survey design and implementation. By adhering to this detailed methodology and incorporating advanced analytical techniques, the survey analysis will effectively capture and analyze expert opinions. This approach leads to a robust understanding of the factors influencing cloud adoption in software testing, ultimately guiding organizations towards successful cloud-based software testing strategies.

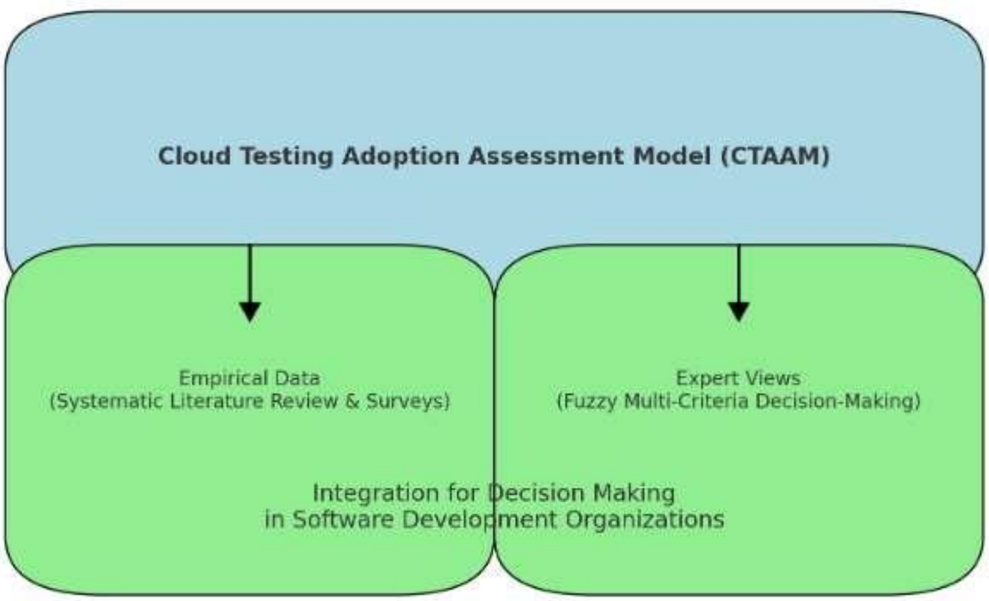

Fig. 2 Cloud Testing Adoption Assessment Model (CTAAM) Framework

In

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software development organizations, fig.2 demonstrates how to use FMCDM methodologies to integrate expert opinions with empirical data to enhance decision-making.

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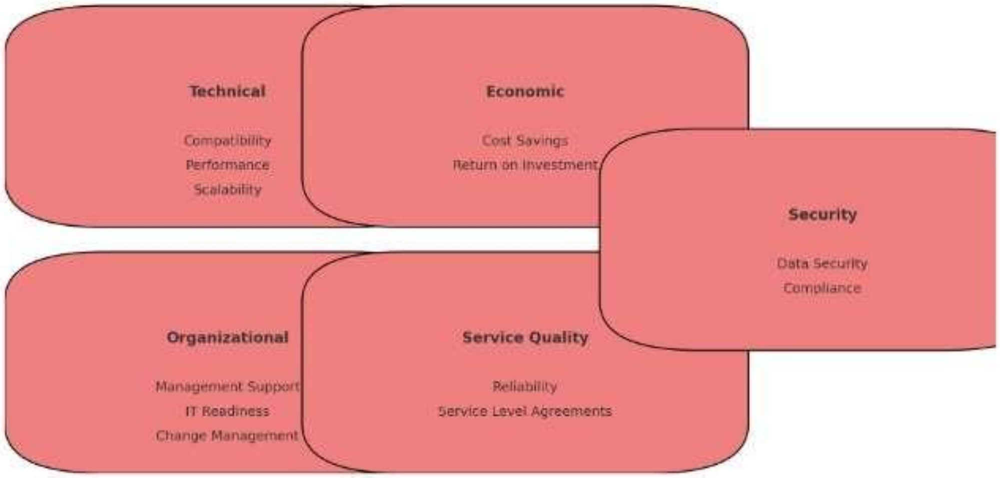

Fig.3 Factors Influencing Cloud Adoption

The various variables impacting cloud adoption are depicted in Figure 3. With certain sub-factors described under each area, it divides the factors into five categories: technical, organizational, economic, service quality, and security.

4. Results and discussion:

Research on Cloud-Based Testing (CBT) that has already been done mostly employs case studies and industry surveys to highlight certain testing formats, architectures, and applicability. There is a distinct deficiency of thorough studies that take into account the several aspects affecting cloud adoption in software testing, though. Prior research has underlined the necessity of scalable and affordable testing solutions; yet, expert opinions and decision-making processes are complicated and ambiguous, and these factors are frequently ignored. A systematic framework for cloud adoption in software testing is developed in this paper by fusing empirical data with FMCDM approaches, thereby filling this gap. SDOs' overall decision-making process is improved by the application of fuzzy set theory, which enables a thorough and trustworthy evaluation of expert viewpoints.

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5. Conclusion:

Offering scalable and effective solutions to satisfy the demands of contemporary applications, cloud-based testing, or CBT, is a notable breakthrough in the field of software testing. The key elements impacting the implementation of CBT are highlighted in this study, including service quality, security concerns, organizational preparedness, technological improvements, and economic reasons. The study creates the Cloud Testing Adoption Assessment Model (CTAAM) by utilizing a blend of FMCDM and empirical survey approaches. With the use of this model, SDOs can assess and successfully apply cloud testing tactics inside a strong framework. By incorporating fuzzy set theory into FMCDM, decision-making processes with inherent uncertainties are addressed and expert viewpoints are nuancedly analyzed. The results highlight the significance of adopting cloud computing methodically, enabling careful and calculated choices in the software testing domain.

References:

1. Martens, B., & Teuteberg, F. (2012). Decision-making in cloud computing environments: A cost and risk-based approach. *Information Systems Frontiers*, *14*, 871-893.
2. Bernard, L. (2011). *A risk assessment framework for evaluating Software-as-a-Service (SaaS) cloud services before adoption*. University of Maryland University College
3. Khajeh-Hosseini, A., Greenwood, D., Smith, J. W., & Sommerville, I. (2012). The cloud adoption toolkit: supporting cloud adoption decisions in the enterprise. *Software: Practice and Experience*, *42*(4), 447-465.
4. Büyüközkan, G., & Ruan, D. (2008). Evaluation of software development projects using a fuzzy multi-criteria decision approach.

ISSN 2347–3657

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Mathematics and Computers in Simulation, *77*(5- 6), 464-475.

5. Hicdurmaz, M. (2012, September). A fuzzy multi-criteria decision-making approach to software life cycle model selection. In *2012 38th Euromicro Conference on Software Engineering and Advanced Applications* (pp. 384-391).
6. Arslan, G., & Aydin, Ö. (2009). A new software development for fuzzy multicriteria decision-making. *Technological and Economic Development of Economy*, *15*(2), 197-212.

7. Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial management & data systems*, *111*(7), 1006-1023.
8. Saya, S., Pee, L. G., & Kankanhalli, A. (2010). The impact of institutional influences on perceived technological characteristics and real options in cloud computing adoption.
9. Santos, F. J., & Camargo, H. A. (2010). Fuzzy systems for multicriteria decision making. *CLEI Electronic Journal*, *13*(3), 1-8.
10. Boran, F. E. (2011). An integrated intuitionistic fuzzy multi-criteria decision-making method for facility location selection. *Mathematical and Computational Applications*, *16*(2), 487-496.
11. Dalalah, D., Hayajneh, M., & Batieha, F. (2011). A fuzzy multi-criteria decision-making model for supplier selection. *Expert systems with applications*, *38*(7), 8384-8391.
12. Yalcin, N., Bayrakdaroglu, A., & Kahraman, C. (2012). Application of fuzzy multi-criteria decision-making methods for financial performance evaluation of Turkish manufacturing industries. *Expert systems with applications*, *39*(1), 350-364.