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Newspaper Ad Submission and Payment Website Measurement Analysis Using McCall and PIECES

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ABSTRACT

The transition to digital platforms in the media industry requires robust systems to ensure efficiency and user satisfaction. As with Digital Iklan Radar Banjarmasin, the Newspaper ad submission and payment website, there is a need for evaluation to comprehensively ensure software feasibility and quality. This research evaluates the quality of the Newspaper ad submission and payment website using the McCall and PIECES frameworks, comparing their strengths and identifying areas for improvement. This research contributes to determining the most suitable evaluation methods for such types of websites while offering actionable insights for developers to improve the quality of systems and services. Data collection involved online surveys with 106 respondents and 38 Likert-scale questions mapped to McCall and PIECES frameworks. Statistical tests, including validity, reliability, and an independent t-test, were applied to compare results. McCall's evaluation rated the system at 68% (Good), with low scores in Usability (38.5%), Reliability (36.77%), and Efficiency (38.15%), indicating areas needing significant improvement. PIECES evaluation scored 80.4% (Good), with Performance (81%) and Service (82.39%) rated Very Good, though Control and Security (78.55%) required enhancement. Statistical analysis with independent t-test confirmed significant differences between the two methods, indicating that both methods measure aspects of software quality from different perspectives, thus providing complementary insights for evaluation. The study highlights the complementary nature of McCall and PIECES in software quality evaluation. Recommendations include improving usability, system stability, and security for better user experiences. Future research should involve broader demographic samples and different system types to validate findings and enhance generalizability.

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1. INTRODUCTION

Rapid advances in technology have driven significant transformations in various industry sectors, including media [1], [2]. This development is marked by the emergence of Industry 4.0, known as a new phase in the industrial revolution with a focus on the integration of smart technology, automation, and data exchange. [3], [4]. In this era, companies are required to develop innovative solutions oriented towards efficiency, security, and customer-centric services [5], [6], [7], [8]. In the context of the media industry, this transformation is reflected in the shift from traditional print media to digital platforms, including websites for news advertisement submission and payment. This transformation aims to maintain competitiveness, expand audience reach, and improve service efficiency [5], [9].

Advertising is an important part of the media ecosystem to introduce products and services to a wide audience and influence consumer decisions [8], [10], [11]. In the digital age, advertising management has

evolved by utilizing online platforms to deliver messages more effectively and efficiently [7], [10], [11]. One of the relevant innovations in this area is a platform that integrates features such as online submission of advertisements, digital payments through payment gateways, and real-time management of customer datal [12], [13]. PT Duta Banjar, which is part of the national media network Jawa Pos News Network with the parent Jawa daily, has utilized this technology through the Radar Banjarmasin Digital Advertising portal. This portal is a news advertisement submission and payment website built using the Laravel PHP framework, both for the backend and frontend pages. Regardless of how long the process is in designing and creating software, there needs to be an evaluation mechanism to measure whether the software is in accordance with the feasibility standards, so that users, be they companies or customers who use the software, can utilize the technology properly without any problems [14], [15], [16].

Software quality testing has become an important focus in technology development, as system failures can cause financial losses, reputational damage, and data security risks [15], [17]. In this context, the McCall method and the PIECES framework are approaches that are often used to evaluate software quality [18], [19], [20], [21]. The McCall method focuses more on the technical and operational aspects of software, while PIECES emphasizes more on the business perspective, user satisfaction and needs [22]. Some studies have used McCall's method to evaluate technical aspects of software, such as correctness and usability, but often ignore the operational business aspects covered by the PIECES framework [17]. In contrast, studies using the PIECES framework tend to focus only on efficiency and economic impact [22], [23], [24]. However, there are no studies that directly compare the strengths and weaknesses of these two methods, especially in the context of news ad submission and payment systems.

Previous research has applied the McCall and PIECES methods to various systems. The results of these studies produce diverse findings and reflect the strengths of each method. The McCall method is often used to evaluate the technical quality of software, such as in e-voting systems, Metalmen applications, and academic information systems. The findings showed that the Metalmen application achieved 84% system quality with the category "Excellent," although the correctness and efficiency aspects only reached 65% and 66% [25]. In contrast, the Inlis application obtained an overall quality score of 73%, with reliability as the best indicator (73%), and usability the lowest (51%) [26]. Another study on academic information systems showed a "Good Enough" category for correctness (49.2%) and reliability (44.1%) [27].

On the other hand, the PIECES method is more often used to measure business aspects and user satisfaction with information systems, such as in e-commerce applications and academic information systems. Research on the UKSW STARS system, for example, showed a "satisfied" category with an overall average of 4.02, where the service (4.16) and performance (4.14) variables obtained the highest scores [24]. Another study on user satisfaction of an e-order system at a cafe showed that users were "satisfied" after being analyzed by the PIECES method [21]. In addition, in the RKAT academic information system application, the analysis results using the PIECES method and calculation with the IPA method show that the average user satisfaction and the level of importance of system quality information are 93.71% [22].

However, no study has explicitly compared these two methods in the context of evaluating the quality of news ad submission and payment website. Therefore, this study aims to fill the gap by analyzing how the McCall and PIECES methods provide similar or different results, as well as how they can complement each other by providing comprehensive insights.

Based on the explanation described above, this research aims to evaluate the quality of the news advertisement submission and payment website using the McCall and PIECES methods. Specifically, this research will compare the quality of the Digital Iklan Radar Banjarmasin website based on the aspects evaluated by the McCall and PIECES methods. By comparing these two approaches, this research is expected to contribute to determining the most suitable evaluation method for news ad submission and payment website, as well as providing insights and recommendations for developers to improve the quality of the systems and services they offer.

2. METHODS

Quality software is essential in system development, as its quality affects the entire system's performance [28], [29]. To ensure that the software can function properly, it is important to conduct a careful collection of user information needs [18]. A product is considered high-quality if it meets the needs of most users. High quality instills confidence that the product will comply with established quality standards. Testing software quality plays a crucial role in evaluating its accuracy, reliability, and overall performance. [30], [31]. The research flow is shown in Fig. *1* below as a guide in organizing the framework or steps of research implementation.

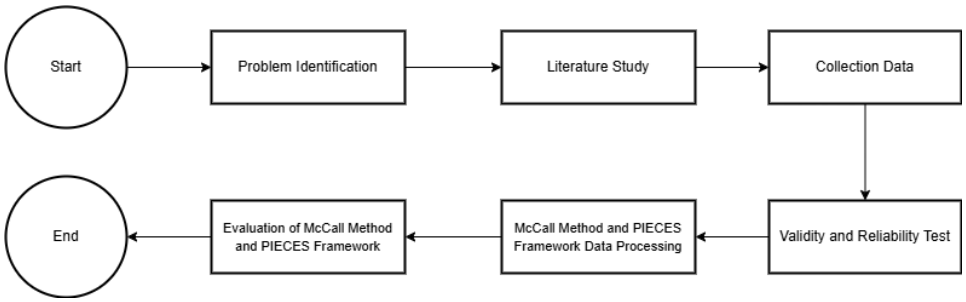

Fig. 1. Research flow

The initial stage of this research began with identifying problems through initial observations. This aims to understand the need for an evaluation mechanism in measuring software conformity with eligibility standards [20]. This evaluation is important so that users, both companies and individuals, can utilize the technology optimally with minimal barriers. In addition, a literature review was conducted to identify theories that support the analysis in this study. To achieve this goal, the review was conducted comprehensively using various sources, including books, peer-reviewed journals, articles, and previous research.

2.1. Data Collection

This research utilizes an online survey approach through the Google Forms platform to support efficient data collection and reach respondents spread across different geographical areas. This method allows for a more representative evaluation of the user experience of the news advertisement submission and payment website. The data used to assess system quality was collected through a questionnaire distribution technique to 106 respondents, with a total of 38 questions covering various relevant indicators.

Respondents in this study had diverse demographic characteristics, not limited to the Banjarbaru and Banjarmasin areas of South Kalimantan, but also including participants from outside the region and outside the Kalimantan. Nevertheless, most respondents were from South Kalimantan. Respondents are mostly end users who are familiar with technology, thus providing relevant insights into the experience of using the website [19], [30]. The criteria for selecting respondents were general, without considering age or occupation variables, to get a broader view of system quality [32].

The questionnaire used in this study consists of 20 question elements that represent the McCall method and 18 question elements from the PIECES framework that have been made based on the assessed components. The McCall method question elements and the PIECES framework measure software quality using a 5-point Likert scale. Respondents' ratings range from 1 (strongly disagree) to 5 (strongly agree) to the given statement [19], [33].

By using Likert scale measurements on the questionnaire, the assessment can produce fairly accurate data. The Likert scale plays a role in measuring the opinions, attitudes, and perceptions of a person or group of people related to a social event that occurs [32], [33], [34].

2.2. Validity and Reliability Test

After completing data collection, the next step is to conduct validity and reliability testing using SPSS version 30.0, a commonly used software for statistical analysis in research [35], [36]. The validity test aims to assess the extent to which the data collected through the questionnaire can be considered accurate and reliable [36], [37], [38]. In addition, this process ensures that the data collected is free from measurement error and reflects reality [39], [40]. This process is tested using Pearson bivariate correlation by comparing the calculated r value with the critical r value. If r count is greater than r critical, then the item is valid. Conversely, if r count is smaller than r critical, the item is considered invalid [41].

Then, the reliability test is used to measure the consistency of the questionnaire as a measurement tool [36], [41]. The reliability test procedure uses Cronbach's Alpha method, where an $\alpha \geq 0.7$ indicates that the questionnaire has a high level of consistency or reliability [37]. The analysis was conducted for all questionnaire items to ensure the reliability of the measuring instrument. This step is important to ensure that the results obtained can be trusted and reflect stable and reliable measurements [42]. Guaranteed validity and reliability provide a strong foundation for proceeding to further stages of data analysis [36].

2.3. McCall

The McCall method is a software testing approach characterized by measurement criteria consisting of three main aspects to assess its quality factors [15], [16], [43]. The first aspect, product transition, encompasses portability, reusability, and interoperability. The second aspect, product revision, covers maintainability, flexibility, and testability. Meanwhile, the third aspect, product operation, involves precision, reliability, efficiency, integrity, and usability [27], [44]. This research will mainly focus on testing the technical aspects of the product. Fidelity relates to the capacity of the software to fulfill predefined functional requirements accurately. Reliability indicates the ability of the software to perform its functions with the required level of accuracy [44]. Efficiency evaluates the utilization of system resources, measuring how effectively the software uses these resources to fulfill its tasks. Integrity assesses the extent to which access to the system can be maintained and protected from potential attacks that could compromise the security of the system. Usability evaluates the ease with which users can interact with the software, examining how accessible and user-friendly it is [17]. The quality factor score (Fa) is determined by calculating the weighted sum of the scores for each sub-indicator. Each sub-indicator (Ci) represents a specific question or statement in the questionnaire that contributes to the overall quality factor. The weight (Wi) reflects the relative importance of each sub-indicator in determining the overall quality factor. This calculation is shown in equation (1) below. The formula used to calculate the value of each sub-indicator is [26], [27]:

$$Fa = W1C1 + W2C2 + W3C3 + \cdots + WnCn \quad (1)$$

Where, Fa is the calculated value of the quality factor. Wn is the weight assigned to the n-th sub-indicator. Cn is the score for the n-th sub-indicator, obtained from questionnaire responses.

After determining the value of a quality factor (Fa), the next step is to calculate its percentage relative to the maximum possible score for that factor. This normalization allows for better interpretation and comparison across different quality factors. The percentage calculation for the functionality aspect of the questionnaire results obtained from 106 respondents was carried out using equation (2) of the following formula [26]:

$$Percentage = \frac{Value\ Obtained}{Maximum\ Value}\ x\ 100\% \quad (2)$$

Where, Value Obtained is The total score obtained for a particular quality factor or sub-indicator, as calculated using equation (1). Maximum Value is the highest possible score that can be achieved for that factor, based on the number of respondents, questionnaire items, and the Likert scale used.

The questionnaire was organized based on the specific factors associated with each quality factor, as shown in Table 1.

Table 1. McCall Instrument

Code	Question Topics	Factors
COR1	I think the features provided by the website suit my needs.	Correctness
COR2	I feel that the results provided by the website are always accurate and in line with the input.	
COR3	I think all the functions on the website run without errors.	
COR4	I feel that the website fulfills its intended use.	
REL1	I found the website to be stable and rarely experienced interruptions during use.	Reliability
REL2	I can rely on this website to complete tasks without any technical issues.	
REL3	I think this website continues to function normally even after prolonged use.	
REL4	I felt that the website was able to recover data quickly after a technical glitch.	
USA1	I find the website interface easy to understand.	Usability
USA2	I find the navigation on this website clear and easy to use.	
USA3	I feel the layout of elements on the website helps me to complete tasks quickly.	
USA4	I think using this website is convenient for new users.	
INT1	I feel that my personal data is secure when using this website.	Integrity
INT2	I feel the system prevents unauthorized access to my information.	
INT3	I do not find the website provides notifications in case of suspicious activity on my account.	
INT4	I believe that the information I provide will not be misused by other parties.	
EFF1	I found the page loading time of this website to be quite fast.	Efficiency
EFF2	I find this website responsive when used for various tasks.	
EFF3	I find my device resources are used efficiently by this website.	
EFF4	I think the processes on this website are designed to minimize unnecessary steps.	

2.4. PIECES Framework

The PIECES method is a framework for analyzing manual and computerized systems [21], [43]. This analysis process involves evaluating consumers as well as internal companies. The PIECES method is used to analyze the current system as well as the proposed new system. This method consists of six supporting components. Performance serves as a variable to assess the functionality of a system, indicating the level of optimization [43]. Information and Data evaluate the volume and clarity of information generated in a single search. Economics analyzes the financial suitability of system implementation in information institutions [19]. Control and Security assesses the level of supervision and measures implemented to ensure the proper functioning of the system [20]. Efficiency evaluates the ability of the system to produce satisfactory output with minimal input [24]. Finally, Service assesses service delivery and identifies potential problems associated with service delivery [23]. The PIECES method is used to classify problems, opportunities, and directions that arise within the scope of system definition, analysis, and design. By utilizing this method, new things can be found that are potentially important considerations in system development [37], [45], [46]. To get the average level of user satisfaction, this study will use a Likert scale according to the answer choices and scores, the following equation (3) is used [20], [21]:

$$Average\ satisfaction = \frac{Total\ User\ Score}{Total\ Questionnaires} \tag{3}$$

Where, Total User Score is the sum of the scores given by all respondents on a particular dimension of PIECES. Total Questionnaires is the total number of questions in that factor multiplied by the number of respondents.

After getting the Average satisfaction score, the next step is to normalize this score into percentage form using the following equation (4):

$$Percentage = \left(\frac{Average\ satisfaction}{Maximum\ Value}\right) x\,100\% \tag{4}$$

Where, Average satisfaction is the total score obtained from users' responses, representing their level of satisfaction with a particular dimension, as calculated using equation (4). Maximum Value is the highest possible score that can be achieved for that dimension, based on the number of respondents, questionnaire items, and the Likert scale used.

The questionnaire was structured based on specific components categorized under each dimension of the PIECES Framework, as shown in Table 2.

Table 2. PIECES Instrument

Code	Question Topics	Dimensions
PER1	I find the website responds quickly to my requests.	Performance
PER2	I find the website handles multiple tasks simultaneously well.	
PER3	I feel the processing time required to complete the task is in line with my expectations.	
INF1	I feel the information presented by this website is accurate and trustworthy.	Information and Data
INF2	I find the data I need easily available on this website.	
INF3	I feel this website helps me make decisions based on the data presented.	
ECO1	I feel this website helps save my operational costs or time.	Economics
ECO2	I believe the benefits I get from this website are worth the cost.	
ECO3	I feel this website helps me avoid unnecessary expenses.	
CON1	I find this website has good access control settings to prevent unauthorized use.	Control and Security
CON2	I believe the security of this website is strong enough to protect my data from outside threats.	
CON3	I feel the control system on this website makes it easy for me to manage my data or activities.	
EFF1	I find the steps required to complete tasks on this website efficient.	Efficiency
EFF2	I feel this website helps me complete work with minimal effort.	
EFF3	I think the workflow on this website is designed to save me time.	
SER1	I feel helped by the services provided by this website, such as the help feature or user guide.	Service
SER2	I think the system supports solving problems I experience quickly.	
SER3	I feel there is sufficient additional support, such as customer service or FAQs.	

2.5. Evaluation

This evaluation stage will describe the research through analysis based on several aspects and factors that serve as guidelines for assessing or testing the quality of the software [47]. In the process of filling out the questionnaire, respondents will rate the quality with Likert scale values to assess their level of satisfaction, as shown in Table 3. The data generated from the questionnaire will be used for calculations using the McCall and PIECES methods. After obtaining the results of the two methods, an evaluation is carried out in the form of a percentage of feasibility quality, as listed in Table 4.

Table 3. Likert Scale

Scale value	Description
5	Strongly agree
4	Agree
3	Neutral
2	Disagree
1	Strongly disagree

Table 4. Percentage of Quality Category

Percentage	Description
81% - 100%	Very good
61% - 80%	Good
41% - 60%	Fair
21% - 40%	Bad
<20%	Very Bad

To statistically compare the results of the two methods, an independent t-test was conducted. Independent t-test is a statistical method used to evaluate whether there is a significant difference between two unrelated groups or conditions [48], [49], [50]. This method is particularly suitable for analyzing data collected from two independent groups, allowing direct comparison of means [51].

In the context of this research, the independent t-test compares the quality scores between McCall and PIECES by comparing the scores of the components evaluated using the McCall and PIECES methods. By applying the independent t-test, this research assesses whether the observed differences between McCall and PIECES scores reflect meaningful differences in software quality. The results provide statistical evidence to support the comparative analysis of these two quality testing methods.

3. RESULTS AND DISCUSSION

In this study, questionnaires were distributed with a total of 106 respondents participating through online platforms. Respondent characteristics were categorized based on age, gender, domicile, and occupation. Table 5 is the result of these demographic characteristics.

Table 5. Participant's Characteristics

Characteristics	Category	Frequency	Percentage
Gender	Male	56	52.83%
	Female	50	47.17%
Age	< 18 years	4	3.77%
	18 – 24 years	88	83.02%
	25 – 34 years	9	8.49%
	> 35 years	5	4.72%
Domicile	Banjarbaru	23	21.7%
	Banjarmasin	9	8.49%
	Martapura	19	17.92%
	Kandangan	15	14.15%
	Outside Kalimantan	14	13.21%
	Etc	26	24.53%
Occupation	Student	61	57.55%
	Swasta	17	16.04%
	PNS/TNI/POLRI	4	3.77%
	Entrepreneur	15	14.15%
	Etc	9	8.49%

3.1. Validity and Reliability Test

The validity and reliability tests in this study were carried out using SPSS software version 30. The validity tests for McCall and PIECES were carried out by modifying the elements based on the data obtained from the questionnaire responses, like the approach used in previous studies [27], [35], [41]. This test involved 106 respondents with a confidence level of 95% (α = 0,05) [17], [36], [37], [40], [41], where the observed correlation value must be greater than the critical r value of 0.193 to be considered valid. The method used in validity testing is Pearson's bivariate correlation, like previous studies [27], [36], [41].

Based on the data presented in Table 6 and Table 7, the validity test results for all elements in McCall and PIECES show that all elements are valid. This is because the observed correlation value is greater than the critical r value from the r table.

Table 6. McCall Validity Result

Correctness			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
COR1	0.717	0.193	valid
COR2	0.674		
COR3	0.672		
COR4	0.719		
Reliability			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
REL1	0.710	0.193	valid
REL2	0.763		
REL3	0.703		
REL4	0.658		
Usability			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
USA1	0.616	0.193	valid
USA2	0.716		
USA3	0.650		
USA4	0.722		
Integrity			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
INT1	0.672	0.193	valid
INT2	0.699		
INT3	0.775		
INT4	0.741		
Efficiency			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
EFF1	0.666	0.193	valid
EFF2	0.745		
EFF3	0.791		
EFF4	0.794		

Table 7. PIECES Validity Result

Performance			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
PER1	0.746	0.193	valid
PER2	0.751		
PER3	0.773		
Information and Data			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
INF1	0.804	0.193	valid
INF2	0.754		
INF3	0.781		

Economics			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
ECO1	0.746		
ECO2	0.704	0.193	valid
ECO3	0.674		
Control and Security			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
CON1	0.791		
CON2	0.806	0.193	valid
CON3	0.848		
Efficiency			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
EFF1	0.829		
EFF2	0.834	0.193	valid
EFF3	0.837		
Service			
Code	**The Observed r Value**	**The Critical r Value**	**Result**
SER1	0.671		
SER2	0.774	0.193	valid
SER3	0.744		

Table 8. McCall Reliability Result

Factors	**Cronbach's Alpha**	**Standard Value**	**Result**
Correctness	0.825		
Reliability	0.848		
Usability	0.869	0.60	Reliable
Integrity	0.816		
Efficiency	0.871		

Table 9. PIECES reliability result

Dimensions	**Cronbach's Alpha**	**Standard Value**	**Result**
Performance	0.775		
Information and Data	0.821		
Economics	0.783	0.60	Reliable
Control and Security	0.866		
Efficiency	0.904		
Service	0.783		

3.2. Evaluation Results Using McCall Method

In the next stage, McCall's test is carried out based on indicators, metrics, criteria weights, and average criteria values that have been calculated using the McCall method. These weights reflect the relative importance of each factor and metric in determining the overall quality of the software, such as previous research [27]. The following is the test form obtained, shown in Table 10.

The total quality (∑) is obtained as follows:

$$\sum = \frac{(0.4xfa1) + (0.3xfa2) + (0.3xfa3) + (0.3xfa4) + (0.4xfa5)}{maximum\ value} x\ 100\%$$

$$\sum = \frac{(0.4x2.19) + (0.3x1.93) + (0.3x1.84) + (0.3x1.91) + (0.4x2.05)}{maximum\ value} x\ 100\%$$

$$\sum = \frac{3.4}{5} x\ 100\%$$

$$\sum = 68\%$$

Based on the test results using the McCall method, the Newspaper Ad Submission and Payment website achieved an overall quality level of 68%, which falls into the Good category according to the Likert scale (61%-80%). Previous research that tested e-voting systems also found the same category of Good with an overall score of 79% [17].

Correctness scored 43.8%, which is in the Fair category, indicating that the main features of the website are sufficient to meet user needs, although there is still room for improvement. Usability at 38.5% falls into the Bad category, indicating that ease of use needs to be improved to better support users. Reliability at 36.77% is also in the Bad category, reflecting system stability that needs to be improved to ensure performance consistency. Efficiency with a score of 38.15% is in the Bad category, indicating that processes and resource usage are still less efficient. Meanwhile, Integrity scored 40.96%, which is close to the Fair category, reflecting a sufficient level of data security but needs to be improved to provide better protection. Overall, the website performs well but requires significant improvement in several factors to provide more optimized user experience Table 10.

Table 10. Website Quality Testing Assessment Results Using McCall

Factors	Metric and Question	Criteria Weight	Average Criteria	Fa	Percentage
Correctness (0.4)	**Completeness**				
	COR1	0.4	4.08		
	COR2	0.4	4.12		
	Consistency			2.19	43.8 %
	COR3	0.4	4.03		
	Traceability				
	COR4	0.4	4.19		
Usability (0.3)	**Communicativeness**				
	USA1	0.4	4.21		
	Training				
	USA2	0.4	4.16	1.93	38.55%
	Operability				
	USA3	0.3	4.04		
	USA4	0.3	4.10		
Reliability (0.3)	**Error Tolerance**				
	REL1	0.4	3.96		
	REL2	0.4	4.03		
	Simplicity			1.84	36.77%
	REL3	0.3	3.96		
	Accuracy				
	REL4	0.3	3.75		
Efficiency (0.3)	**Execution Efficiency**				
	EFF1	0.4	4.16		
	EFF2	0.3	4.06		
	Process Optimization			1.91	38.15%
	EFF3	0.4	4.10		
	Responsiveness				
	EFF4	0.3	4.00		
Integrity (0.4)	**Security**				
	INT1	0.4	3.93		
	INT2	0.4	3.83		
	Notification Mechanism			2.05	40.96%
	INT3	0.4	3.80		
	Data Privacy				
	INT4	0.4	3.81		

3.3. Evaluation Results Using PIECES Framework

Next, quality testing will be carried out using the PIECES framework. This method involves several dimensions used for the calculation process. As shown in Table 11 for more details.

Table 11. Website Quality Testing Assessment Results Using PIECES

Dimensions	Question	5	4	3	2	1	Average satisfaction	Percentage
Performance	PER1	47	41	15	2	1	4.03	81.00%
	PER2	22	55	24	4	1		
	PER3	27	53	22	3	1		
Information and Data	INF1	33	45	20	5	3	3.98	79.69%
	INF2	33	46	22	4	1		
	INF3	31	46	28	1	0		
Economics	ECO1	33	51	18	3	1	4	80.06%
	ECO2	26	53	23	2	2		
	ECO3	35	42	26	2	1		
Control and Security	CON1	27	50	24	4	1	3.93	78.55%
	CON2	27	44	29	6	0		
	CON3	32	48	21	3	2		
Efficiency	EFF1	33	51	17	4	1	4.04	80.69%
	EFP2	28	55	19	3	1		
	EFP3	34	49	20	1	2		
Service	SER1	42	45	15	3	1	4.12	82.39%
	SER2	32	52	20	1	1		
	SER3	43	39	18	6	0		

So, the total quality (∑) is obtained as follows:

$$\sum = \frac{(as1) + (as2) + (as3) + (as4) + (as5) + (as6)}{total\ dimensions\ x\ maximum\ value}\ x\ 100\%$$

$$\sum = \frac{(4.03) + (3.98) + (4) + (3.93) + (4.04) + (4.12)}{total\ dimensions\ x\ maximum\ value}\ x\ 100\%$$

$$\sum = \frac{24.1}{6\ x\ 5}\ x\ 100\%$$

$$\sum = 80.40\%$$

Based on the test results using the PIECES framework, the Newspaper Ad Submission and Payment website achieved an overall quality level of 80.40%, which is included in the Good category based on the Likert scale (61%-80%). In previous studies that tested information systems also got the same overall score of 4.02 or if converted to percent to 80.40% [24].

The Performance aspect scored 81.00%, falling into the Very Good category, indicating the system functions optimally and efficiently. Information and Data scored 79.69% in the Good category, reflecting the clarity and completeness of information that is almost perfect. Economics with a score of 80.06% is in the Good category, indicating the system is quite economical in implementation and maintenance. Control and Security scored 78.55%, remaining in the Good category, but can still be improved for better protection. Efficiency with a score of 80.69% shows efficient performance in producing output with minimal resources. Lastly, Service scored 82.39%, which is categorized as Very Good, reflecting a very satisfying service that can meet user expectations. Overall, this website shows good quality and is close to the Very Good level, with little room for improvement in some dimensions.

Based on the results from McCall and PIECES method, it can be concluded that the Newspaper Ad Submission and Payment Website still has several shortcomings that affect the overall quality. The Usability, Reliability, and Efficiency aspects that received low scores in the McCall method require special attention. It is recommended that developers improve ease of use by improving interface design and navigation, making it more intuitive for users. In addition, system stability needs to be improved through load testing to minimize interruptions during operation. Internal processes should also be optimized to improve efficiency, by utilizing resources more effectively and simplifying unnecessary steps.

3.4. Analysis Using Independent T-Test

After obtaining the evaluation results of each method, then, a comparison is made between the McCall and PIECES values, as shown in Table 12. The purpose of this comparison is to determine whether there are

statistically significant differences between the McCall and PIECES methods and to support a comprehensive evaluation of both methods.

Table 12. Components Values Between McCall Method and PIECES Framework

McCall Method	Value	PIECES Framework	Value
Correctness	2.19	Performance	4.03
Usability	1.93	Information and Data	3.98
Reliability	1.84	Economics	4.00
Integrity	2.05	Control and Security	3.93
Efficiency	1.91	Efficiency	4.04
		Service	4.12

Before carrying out the analysis using the independent t-test, the first step is to test the data distribution using the Kolmogorov-Smirnov test method to ensure that the data to be compared meets the basic assumptions of the independent t-test, as in previous studies [54]. Based on the test results, a significance value of 0.200 was obtained. Because the significance value is greater than 0.05, it can be concluded that the data is normally distributed. The results of the normal distribution test can be seen in Table 13.

Table 13. Normal Distribution Result

McCall Method	Value	PIECES Framework	Value	Mean	Std. Deviation	Significance
Correctness	2.19	Performance	4.03			
Usability	1.93	Information and Data	3.98			
Reliability	1.84	Economics	4.00	0.000	0.439	0.200
Integrity	2.05	Control and Security	3.93			
Efficiency	1.91	Efficiency	4.04			
		Service	4.12			

After that, an independent t-test was used to test the significance of the difference between the two groups of data. The results of the analysis show the mean value, mean difference, standard deviation, t-value, degrees of freedom, and significance value (p-value). The full results of the analysis can be seen in Table 14.

Table 14. Independent T-test Result

Pair	Mean	Std. Error Mean	95% Confidence Interval of the Difference	t	df	Two-Sided p
McCall method – PIECES framework	-2.032	0.062	(-2.174, -1.890)	-32.426	9	< 0.001

The results of statistical analysis show that there is a statistically significant difference between McCall Method and PIECES Framework. This is evidenced by the p-value (Two-Sided) of < 0.001, which is smaller than the significance level used (α=0.05). This difference indicates that both methods measure aspects of software quality from different perspectives, thus providing complementary insights for evaluation.

McCall uses weights to prioritize quality attributes, allowing greater focus on technical aspects that are considered critical. However, the application of these weights is subjective and dependent on the evaluator, which can bias the results. Indicators with low weights tend to be underrepresented in the final score, even though they may be significant to the user experience. In contrast, PIECES adopts an unweight approach, where all indicators have equal contribution based on a Likert scale. This approach is simpler and reflects users' direct perceptions but does not consider the level of urgency of certain attributes in the context of the system. This can lead to PIECES results being less sensitive to the specific needs of the system being evaluated. This difference in approach is one of the main reasons for the significant difference between the results of the two methods.

However, the limitations of this study should also be noted. Most of the respondents were students. This may affect the results as respondents with different professional backgrounds or needs may have perspectives that are not represented in the data. In addition, the study only focused on one specific website, so the results may not be generalized to other systems. Subjectivity in scoring using Likert scales is also a limitation, as results are highly dependent on individual perceptions which may vary.

These limitations provide important insights into future improvements, especially in the context of significant differences between the McCall and PIECES methods. Such differences, in addition to being due to different approaches, may also be influenced by biases arising from the application of weights in McCall and the unweighted approach in PIECES. A broader evaluation with a more diverse demographic of respondents may provide a more representative picture. In addition, testing other systems with different functionality could help validate the consistency of the results and expand the implications of these findings.

4. CONCLUSION

This research aims to evaluate the quality of a newspaper advertisement submission and payment website using the McCall and PIECES methods and to compare the results of these two approaches. Based on the evaluation using the McCall model, the overall quality of the website achieved a score of 68%, classified as Good. However, several aspects, such as Usability (38.5%), Reliability (36.77%), and Efficiency (38.15%), fell into the Bad category, indicating a significant need for improvement in ease of use, system stability, and process efficiency. Conversely, the evaluation using the PIECES framework showed an overall quality score of 80.40%, also classified as Good, with certain aspects such as Performance (81.00%) and Service (82.39%) achieving a Very Good classification. This suggests that the website can deliver satisfactory services and optimal performance, although aspects such as Control and Security (78.55%) still have room for improvement. Statistical analysis using an independent t-test revealed a statistically significant difference between the McCall and PIECES methods, with a p-value of <0.001 (<0.05). This significant difference can be explained by the different weighting and focus of evaluation in the two methods. This finding indicates that the two methods have distinct approaches and focuses on evaluating software quality, thereby providing complementary insights.

This study contributes to the evaluation and improvement of the Newspaper Advertisement Submission and Payment Website by assessing its software quality using the McCall and PIECES methods. However, the study has limitations, including a demographically homogeneous respondent pool (predominantly students) and its focus on a single website, which may affect the generalizability of the findings. The insights gained from this evaluation serve as a foundation for future research on software quality evaluation, particularly in comparing various assessment methods. The findings can also serve as benchmarks for evaluating similar systems, ensuring that critical aspects such as usability, reliability, and efficiency are adequately addressed. In the future, researchers can explore other methods for comparison, such as the modern ISO/IEC 25010 standard, and conduct studies with more diverse respondents and broader system scopes to enhance the validity and applicability of the results.

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