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Research.

Gap quality of employee attendance system application using technology acceptance model approach and fuzzy

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Abstract. *The employee attendance system application in an educational institution occupies an important role in providing evaluation and improving performance in addition to being able to improve the transparency of employee and institutional relations. In its use, the employee attendance system must be able to accommodate the needs of its users, namely employees and staffing. This research evaluates user satisfaction over system applications using the Technology Acceptance Model approach. The evaluation was conducted by assessing the level of perception and satisfaction level of 40 users, in this case, employees. The research variable used is perceived usefulness, perceived ease of use (level of ease of use received), and user satisfaction (level of user satisfaction). Computing process was done by fuzzy methods. The results showed that some quality of the application could not meet the expectations of employees at this time. The only variable that met the performance and expectation was perceived ease.*

Key Words : TAM, Employee Attendance System Aplication, GAP Nad Fuzzy Method

Introduction

The importance of employee attendance system application is related to maintaining employee's discipline and also transparency. SINPEG employee's attendance application has been applied for three months in an educational institution located in Bandung City.

This application is used by all employees that need to get information about their monthly accumulated attendance record and has been used effectively and intensively for months. SINPEG is a system that support the conventional system that is already existed in the institution which is called DP 3. The DP 3 is paper-based attendance management system that has eight elements to measure which are trust, obedience loyalty, responsibility, teamwork, leadership, and initiative. SINPEG is expected to be supportive paperless system that increase highly efficiency and accuracy of human resource management performance.

The quality of human resource is one of the important factors to improve productivity and organizational performance. Therefore, commitment, skill, and competency of employee are highly required. On the other hand, employees need to be motivated by rewards to be motivated by clear rewards and punishment if they are not discipline. One of the ways to indicate the commitment is the record of employees'

attendance. However, the record must be transparent and clear for the employees. The quality of application is facing these two sides: clear absence calculation and clear monitoring system.

Literature Review

1. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was first introduced by Fred Davis in 1986. This model was developed based on psychological theories which explained such belief, attitude, intention and behaviour relationship of technology's users. TAM is mainly consisted of two external factors. One is called perceived usefullness (PU), which is defined as a probability that user perceives the technology that will enhance their job performance. The other is called perceived ease of use, which is defined as the degree of user's perspective that means there will be no effort in operating technology. Those two external factors will affect the attitude and behaviour.

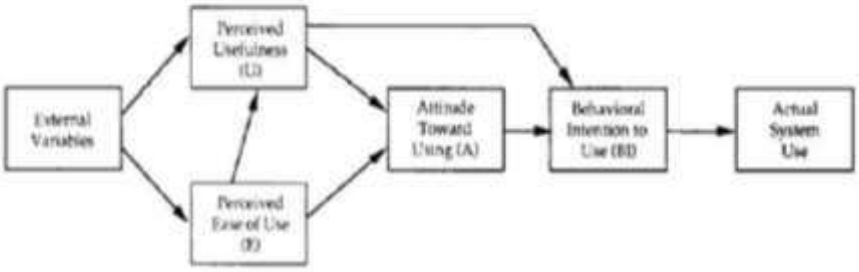

Figure 1.
Fred Davis's Technology Acceptance Model

TAM has been developed by many researches in wide variety area of technology. Long Lie reviewed that the model was developed by Wixom and Todd in 2005, which added factors and variable control, Vekantes and Davis in 2000 that built TAM2 by adding social influences and cognitive instrumental process, and other researcher, such Taylor and Todd in 1995. Surendran also reviewed some model developments which some of them are: Agarwal and Prasad in 1998 modified TAM by adding the construct of compability in the TAM, Moon and Kim in 2001 added variables like experience, self-efficacy, perceived risk and social influence, etc. TAM is a model that has flexibility and is explorable in very wide range of different cases.

This research aims at analysing the gap quality. Therefore, the model would be developed and might be integrated with quality variable which is commonly known as customer satisfaction. User perception and expectation are measured and explored in this variable. Many researchers have developed the model and integrated with quality variable. Quality has wide and various definition. Our focus is quality definition on consumer's perspective. Peter Drucker defines quality as what consumer takes out and is willing to pay for, that is not what 'supplier' puts in. McGill [8] believe that satisfaction is a good measure of a system success. Both of theoritical statement draw a conclusion that the quality can be assumed as customer or user satisfaction.

The perspective used in this definition is assumed to be fit with psychological approach as the origin of TAM. Satisfaction might be a good measurement of quality as Ive's definition [8] that user satisfaction is user's trust if the system meets their information requirements. Some of the researches showed that there were significant correlation between TAM variables and customer satisfaction variables. Here are some of them.

Hou et al. studied on spa industry customer showed that TAM gave a significant effect on the physical and spiritual health satisfaction. The research

framework showed that TAM variables, such as perceived usefulness, perceived ease of use, customer partisipation, and behavior affected customer satisfaction.

Ohk et al. explored the effects of perceived usefullness, perceived ease of use, ease to navigation, and interactivity, on the satisfaction in mobile application. The findings of this research gave clear explanation that technology acceptance influenced the mobile application user satisfaction and their continous intention.

Singh found out some models that correlated linearly between variables in TAM that were represented by perceived usefulness and perceived ease of use and user satisfaction which are current satisfaction and perceived satisfaction with presence of user participation.

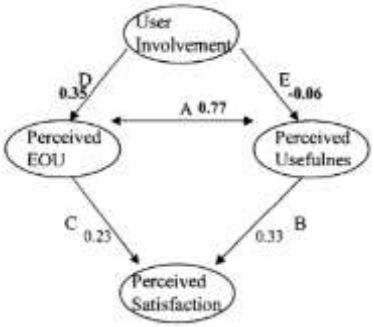

Figure 2.
One of Singh's finding: TAM's two main variables and user satisfaction (Singh. 2005)

Wixom B H, Todd P A investigated models of technology acceptance by exploring the influence system quality to user satisfaction.

Our last research, Indrayani and Suwarman, explored the expectation model of quality using TAM. This research showed that certain linear relationship between TAM and user satisfaction. Investigation took educational institution attendance system gave clear explanation that perceived ease of use influence indirectly to user satisfaction through intervening variables perceived usefulness.

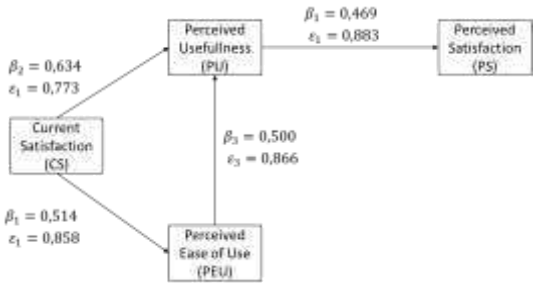

Figure 3
TAM and quality model in expectation of employee on attendance application system

The temporary conclusion was TAM variables had significance correlation with quality variables which were represented by user satisfaction. In this research, those three main variables were investigated by many researchers: perceived usefulness, perceived ease of use and user satisfaction.

2. Fuzzy Methods

Fuzzy Methods was first introduced by Lotfi A Zadeh in 1965. Fuzzy logic is logic of fuzzyness, which found in someone perception. Fuzzy logic can be used in subjective judgemental such as someone who measure written velocity of the very slow, too slow, average, fast and too fast. Fuzzy logic helps us identifying how this

value has some proportion in different judgement, how big the 'fast' is and the 'very fast' is. Fuzzy logic can be applied in systems with uncertainty or imprecisely. This logic were developed based on human language.

The principle of logic can be found in fuzzy set theory. Membership value of fuzzy set is the main characteristics of fuzzy logic which has range 0 to 1.

The membership function and triangular fuzzy number to measure user perception and expectation, and calculate the gap of quality.

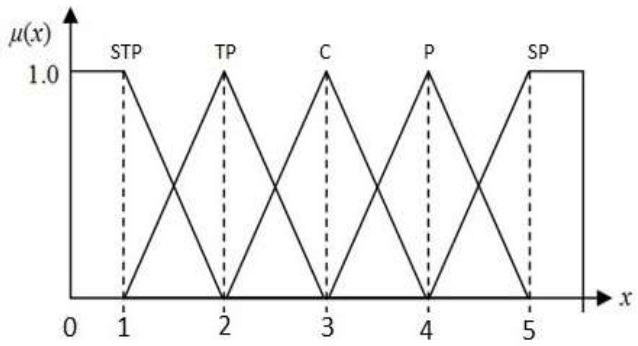

Figure 4
Triangular fuzzy numberto measure perception and expectation [5]

Perception and expectation data were collected by questionnaire. Then mean operational variable-i which has criteria-j was calculated. After that, the maximum number (bi), minimum number (ci), and median number (ai) for each criteria in sample size of every criteria and variable nij could be determined.

$$\text{Minimum number (c)} = \frac{c_{i1} * n_1 + c_{i1} * n_2 + c_{i2} * n_3 + \ldots\ldots c_{i(k-1)} * n_k}{n_1 + n_2 + n_3 + \ldots\ldots nk} \quad (1)$$

$$\text{Median number (a)} = \frac{a_{i1} * n_1 + a_{i2} * n_2 + a_{i3} * n_3 + \ldots\ldots a_{ik} * n_k}{n_1 + n_2 + n_3 + \ldots\ldots n_k} \quad (2)$$

$$\text{Maximum number (b)} = \frac{b_{i2} * n_1 + b_{i3} * n_2 + \ldots\ldots b_{ik} * n_{i(k-1)} + b_{ik} * n_k}{n_1 + n_2 + n_3 + \ldots\ldots n_{(k-1)} + n_{jk}} \quad (3)$$

Last steps is defuzzification step that calculate the mean of every criteria:

$$\mu = \frac{(a+b+c)}{3} \quad (4)$$

This research is focused on the gap study of the application's performance based on employee's perception and expectation. The model of this gap analysis is Technology Acceptance Model, which was introduced by Davis. The computational method to measure the gap is Fuzzy method.

Eventually, the method which can accommodate that categorization is the method of logic fuzzy which is considered as a method that can be used as the alternative one to be implemented in the calculation of the selection test result either at every stage of the selection or at the final result of overall stages. Mulyadi, D. (2018)

The Research Method

This research's interpretation on the quality construct variables has similarity to Singh's findings. This research constructed quality variables into user perception of quality and user expectation to quality. Both (perception and expectation) were explored in two main TAM variables: perceived usefulness (PU) and perceived ease of user (PEU) and the quality variables which is indicated by user satisfaction (US). Then, the gap between perception and expectation was measured to see current quality.

In this research, some hypothesis were formulated based on variables identified empirically from the last researches. According to Singh's works, current satisfaction might have correlation linearly with expected satisfaction, and so do all the variables on both measurement; perception and expectation. The research have to investigate the correlation in the first step to ensure that expected variables and perception variables are independent or dependent. If both are independent, next step is gap analysis. Otherwise, the research will continue the path analysis by involving all variables of perception and expectation models. Gap analysis of last possible research scenario might be unclear because the dependecies of all variables. Gap analysis will be done by applying fuzzy method which result will be presented in cartesian graphic.

The Hypothesis of the research are:

H1 : All expectation and perception variables are positive correlated
H2 : There are significant gap between user perception and expectation

The variables that are investigated in the research are listed in table below.

Table 1
Research variables and items of questionnaire

Construct Variables	Definition	Items	Scale of Perception	Scale of Expectation
PU: Perceived of Usefulness	probability that user perceive the technology will enhance their job performance (Davis, 1989)	PU1: the application will assist employee to get attendance information in very short time		
		PU2: the application improves attendance information delivery		
		PU3: the application assist to calculate attendance in detail faster		
		PU4: the application saves time to get attendace information in detail		
		PU5: the application is usefull for my task		
PEU: Perceived Ease of Use	degree of user's perspective that he operates the technology in free of effort (Davis, 1989)	PEU1: the application is easy to be learned		
		PEU2: no effort to access the information i need by using this application	1= extreemly disagree	1= extreemly unexpected
		PEU3: the application gives clear information	2= disagree	2= unexpected
		PEU4: the application is flexible to use	3=neutral	3=neutral
		PEU5: all the features in application are easy to be used	4=agree	4=expected
			5=extreemly agree	5=extreemly expected
US :User Satisfaction	users beleive the system meets their information requirements (Ives, 1983 on Singh 2005)	US1: overall i am satisfied to use the application		
		US2: i feel confident to use the application		
		US3: I beleive that I always get easiness to get attendance information in detail by using the application		
		US4: I beleive I am provided quick calculation of my attendance by using all procedures in the application		
		US5: I beleive the application increase the transparent information of Departement of Human Resource		

Gap analysis was calculated by fuzzy logic. First, defining triangular fuzzy number based on Likert scale used in this research. Hence, Figure 4 can be applied to define triangular fuzzy number. Table 2 and 3 are triangular fuzzy number for perception and expectation criterias for fuzzy set value 0 to 1.

Table 2
Triangular Fuzzy Number for perception criterias. EDA = Extreemly Disagree; DA= Disagree; N=Neutral; A =Agree; EA = Extreemly Agree

	EDA	DA	N	A	EA
minimum number c	1	1	2	3	4
maximum number b	2	3	4	5	5
median number a	1	2	3	4	5

Table 3
Triangular Fuzzy Number for perception criterias. EUE = Extreemly Unexpected; UE= Unexpected; N=Neutral; E =Expected; EE = Extreemly Expected

	EUE	UE	N	E	EE
minimum number c	1	1	2	3	4
maximum number b	2	3	4	5	5
medium number a	1	2	3	4	5

Calculation of TFN applied the equation (1), (2) and (3) and defuzzification applied the equation (4). Gap will be calculated the differences mean of defuzzification in equation 4 between perception number and expectation number. The gap result also will be presented in graphic. The research involved 40 respondent which is user of the application. This size is total employee in research object (educational institution).

The Result and Discussion

From the result of questionnaires that was spread to the respondents, we tested the validity of questionnaire items using SPSS version 24 based on value of r product moment.

Table 4
Validity test of perception variables

Variables of user perceptions	calculated r	Valid if calculated r>rtable(rtab=0,312) in 5% significance error
PU1	0.416	valid
PU2	0.534	valid
PU3	0.749	valid
PU4	0.730	valid
PU5	0.723	valid
PEU1	0.644	valid
PEU2	0.459	valid
PEU3	0.476	valid
PEU4	0.445	valid
PEU5	0.597	valid
US1	0.595	valid
US2	0.581	valid
US3	0.564	valid

Variables of user perceptions	calculated r	Valid if calculated r>rtable(rtab=0,312) in 5% significance error
US4	0.628	valid
US5	0.592	Valid

The validity test of perception variables shows that at 5% significance error, all the items are valid. The value of all calculated r correlation are > 0.312. The cronbach alpha also measured by SPSS that was found the value was 0.900 which meant all the items reliable (>0.6) to represent the variable.

Table 5
Validity test of expectation variables

Variables of user expectations	calculated r	Valid if calculated r>rtable(rtab=0.312) in 5% significance error
PU1	0.432	valid
PU2	0.376	valid
PU3	0.460	valid
PU4	0.774	valid
PU5	0.628	valid
PEU1	0.787	valid
PEU2	0.757	valid
PEU3	0.633	valid
PEU4	0.616	valid
PEU5	0,555	valid
US1	0.781	valid
US2	0.614	valid
US3	0.864	valid
US4	0.510	valid
US5	0.552	valid

The validity test of perception variables shows that at 5% significance error, all the items are valid. The value of all calculated r correlation are > 0.312. The cronbach alpha also measured by SPSS that was found the value was 0.915 which meant all the items reliable (> 0.6) to represent the variable.

Independency test were tested by correlation test based on Spearman-rho method by using SPSS version 24. The yellow cells in the table below, shows that no significance correlation between expectation and perception. The white cells shows that all variables in each categories (perceptions and expectation) have certain correlations, which fit to theoritical model. By this results, the research can be continued to the gap analysis using fuzzy method. The first hypothesis are rejected or all of perception and expected variables are independent (not correlated)

Table 6
Correlation test of all variables perception and expectation. The method that was applied in this test is spearman rho. The correlation is indicated and significant at the 0.01 level (2-tailed) by three stars upscript.

			perception PU	perception PEU	perception US	Expectation PU	Expectation PEU	Expectation US
Spearman's rho	perception PU	Correlation Coefficient	1,000	,623**	,720**	0,200	0,218	0,223
		Sig. (2-tailed)		0,000	0,000	0,217	0,177	0,167
		N	40	40	40	40	40	40
	perception PEU	Correlation Coefficient	,623**	1,000	,597**	0,072	-0,029	-0,109
		Sig. (2-tailed)	0,000		0,000	0,657	0,858	0,501
		N	40	40	40	40	40	40
	perception US	Correlation Coefficient	,720**	,597**	1,000	0,190	0,200	0,200
		Sig. (2-tailed)	0,000	0,000		0,239	0,216	0,216
		N	40	40	40	40	40	40

By using equation (1), (2), (3) and (4) and the fuzzy number that was defined earlier (table 2 and table 3), we can calculate the TFN and defuzzification belows for perception items and expectation items of each variables.

Table 7
TFN and defuzzification result of perception items

Criteria	TFN			Deffuzification	Rank
	c	a	b		
PU1	3.30	4.28	4.78	4.12	3
PU2	3.15	4.05	4.63	3.94	1
PU3	3.28	4.23	4.73	4.08	2
PU4	3.20	4.15	4.73	4.03	4
PU5	2.90	3.88	4.63	3.80	5

Criteria	TFN			Deffuzification	Rank
	c	a	b		
PEU1	3.20	4.15	4.73	4.03	4
PEU2	3.25	4.25	4.83	4.11	2
PEU3	3.25	4.25	4.88	4.13	1
PEU4	3.08	4.08	4.80	3.98	5
PEU5	3.15	4.15	4.83	4.04	3

Criteria	TFN			Deffuzification	Rank
	c	a	b		
US1	3.05	4.03	4.70	3.93	4
US2	3.05	4.05	4.75	3.95	5
US3	3.20	4.18	4.78	4.05	3
US4	3.23	4.18	4.73	4.04	2
US5	3.33	4.28	4.75	4.12	1

The result on Table 7 shows that the application performed highly in improving attendance information delivery, clear information, and transparency information.

Lowest performance was showed by the overall of usefull, flexibility, and ability to give confidence to the users. The following table is the result of TFN and defuzzification of expectation items.

Table 8
TFN and defuzzification result of expectation items

Criteria	TFN			Deffuzification	Rank
	c	a	b		
PU1	3.53	4.53	4.95	4.33	2
PU2	3.23	4.18	4.80	4.07	4
PU3	3.53	4.53	4.98	4.34	1
PU4	3.33	4.30	4.88	4.17	3
PU5	3.03	4.03	4.73	3.93	5

Criteria	TFN			Deffuzification	Rank
	c	a	b		
PEU1	3.13	4.10	4.80	4.01	3
PEU2	3.18	4.15	4.83	4.05	2
PEU3	3.03	3.98	4.70	3.90	4
PEU4	3.00	3.95	4.65	3.87	5
PEU5	3.35	4.35	4.95	4.22	1

Criteria	TFN			Deffuzification	Rank
	c	a	b		
US1	3.05	4.03	4.75	3.94	5
US2	3.05	4.00	4.65	3.90	4
US3	3.25	4.23	4.83	4.10	3
US4	3.33	4.30	4.85	4.16	2
US5	3.30	4.25	4.78	4.11	1

The result shows that most of the users expect the application ability to assist in calculate number of attendance in detail and faster, easy to use, and increase transparent record or information.

Lowest priority of quality intention were found in overall useful for employee's task, flexibility, and overall satisfaction to use.

Defuzzification results of fuzzy score for perception and expectation items. The differences of both is gap between actual performance and expected performance. Table 9 presents that PU and US did not meet the expected quality, but the PEU did.

Table 9
Gap between items in perception and expectation variables

items	Perception	Expectation	GAP		
	Perceived Usefullness				
PU1	4,12	4,33	-0,22		
PU2	3,94	4,07	-0,13		
PU3	4,08	4,34	-0,27		
PU4	4,03	4,17	-0,14	mean of PU	
PU5	3,80	3,93	-0,13	perception	expectation
Total	19,96	20,83	-0,88	3,99	4,17
	Perceived Ease of Use				
PEU1	4,03	4,01	0,02		
PEU2	4,11	4,05	0,06		
PEU3	4,13	3,90	0,23		
PEU4	3,98	3,87	0,12	mean of PEU	
PEU5	4,04	4,22	-0,17	perception	expectation
Total	20,28	20,04	0,24	4,06	4,01
	User Satisfaction				
US1	3,93	3,94	-0,02		
US2	3,95	3,90	0,05		
US3	4,05	4,10	-0,05		
US4	4,04	4,16	-0,12	mean of US	
US5	4,12	4,11	0,01	perception	expectation
Total	20,08	20,21	-0,13	4,02	4,04

All performance of perceived usefullness showed were below expectation. The overall easiness was also the same. User satisfaction showed that only quality of transparency was higher and it met the expected quality.

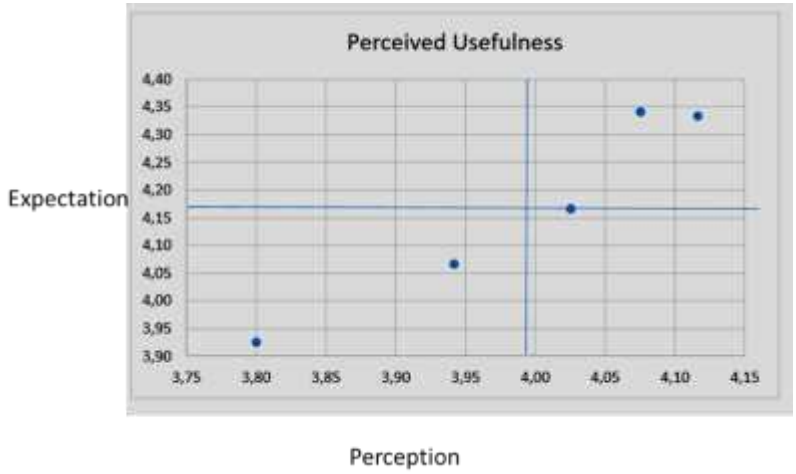

Figure 5
The position of perfomance and expected quality of perceived usefulness

The vertical blue lines represents of average value of perception and the horizontal one is average value of expectation. The result showed that two variables were in low performance and low expected quality, two variables wee in high performance and high expected quality, and one variable is in high performance and average expected quality.

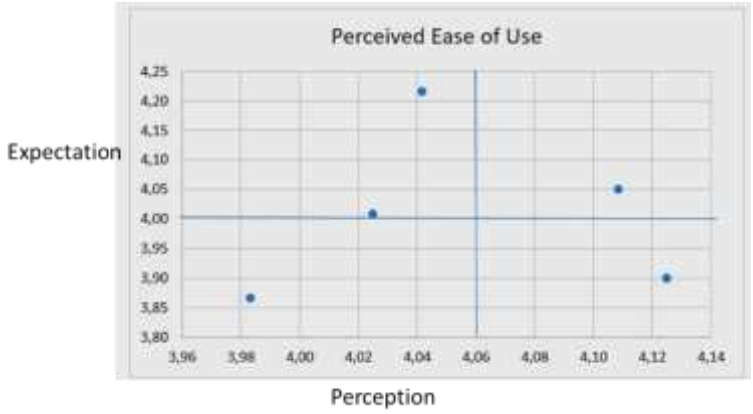

Figure 6
The position of performance and expected quality of perceived ease of use

Position quality in PEU must be focused on two variables which its performance were below than performance average. They represented the easiness to use and easiness to be learned.

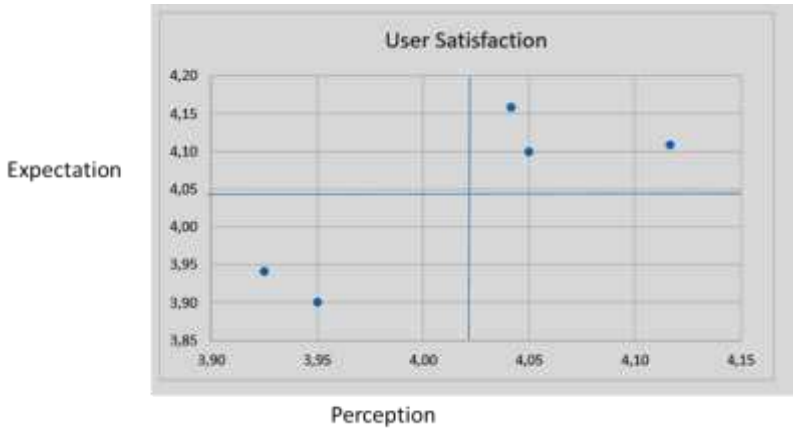

Figure 7
The position of performance and expected quality of perceived of use

Figure 7 presents that all performance and expected quality are in the same range. Two of them were below performance and expected average quality, and three others were above them.

The all gap analysis show that some of the second hypothesis are rejected.

Conclusion and Suggestions

The research results some points as the following below:

Performance and expected quality were independent, this means that employee expectation of quality were not be influenced by recent application performance.

Perceived of usefulness and user satisfaction did notmeet the quality, but perceive ease of use did.

Easiness to use application and easiness to learn how to use were major concern of the application improvement.

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