Improving Customer Profitability Analysis Dashboard Usability Using Quality Function Deployment with PIECES and IPA Framework: a Case Study at Bank Rakyat Indonesia

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Abstract. One of Indonesia leading financial institution, Bank Rakyat Indonesia already have a descriptive analytics and monitoring tools in form of CPA Dashboard. By the time, CPA Dashboard has already been improved several times, in which focused only on financial components. However, the system's unique user log data shows that only about 57 percent of registered users were actively accessed the system. It is suspected that the improvement processes carried out have not yet fulfil business user needs. This research aims to break the gap between user's experience and expectations. The user's needs collected with PIECES framework and analyzed with the IPA framework. The result of this analysis will be created as an input of QFD model. The PIECES framework is used because of its characteristics that suitable to be implemented on banking industry system analysis, while IPA framework is chosen because of its capability to compare the system performance against user's needs, the QFD model is used to build a structured foundation of continuous improvement process. All and all, the resulting output of this research could be used as a development business requirement document for the upcoming improvement iteration journey to elevate the usage of CPA Dashboard.

Keywords: System Usability Scale, System Performance Analysis, System Feature Importance.

1 Introduction

Customer Profitability Analysis (CPA) Dashboard is a tool to measure and monitor customer's profitability and contribution toward Bank Rakyat Indonesia (BRI) wholesale business. This year remarks the 4th year since the dashboard first launched. While every year the product owner held some enhancement, historical data shows that the enhancement done were only focused on feature and financial components

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replenishment. Early usability check for the dashboard shows that the dashboard is used effectively by just 57% of total registered user, accordingly, by utilizing System Usability Scale (SUS) survey framework, it is believed that the usability score of the system is stood on the 57,78 score in marginal low status [1].

This research aims to enhance the dashboard's usage and ease of use for all registered users. There are three main frameworks used, the first visible one is the Performance, Information & Data, Economics & Efficiency, Control & Security, Effectivity and Service (PIECES) framework to analyze the six business aspects in the system as well as to measure user satisfaction of system's performance. Another framework used is the Importance Performance Analysis (IPA) to measure and identify user's need and their take on the system's current feature. The IPA framework will then create a four-quadrant diagram to show any aspects that can be improved by the product owner. The last and most important one is the House of Quality in Quality Function Deployment (QFD). As the practice shown over the years, QFD is used worldwide and believed to be the bridge between product or service owner and their users or customers. Successfully implementing QFD could enhance and leverage the overall system quality as well as the system's usability over time.

2 Literature Review

System usability is one crucial thing to design user experience in application and system development to ensure the interaction between system and its users are effectively conducted. On the other hand, system usability could also elevate user's satisfaction toward the system. While satisfaction is one thing, efficiency could also play a big role in user's point of view in using the system. A devoted system user need not only a robust system but also a system that could possibly save their time and resource. A positive user experience could also improve and create a positive image on the system's company. Measuring system usability could be done by utilizing System Usability Scale (SUS), a framework developed by John Brooke in 1986. SUS is an assessment questionnaire consisting of ten likert-scale based questions covering subjective point of view to a system usability. The endpoint of SUS is a sole score to point out the system usability is stand on whether good (score >= 80,3), average (score 68-80,2) and need improvement (score <68) status [1].

PIECES is a framework used to classify problems, opportunity and direction in analysis and system design definition so that it could create new possible things which could be used as a consideration in system's continuous improvement process [2]. The PIECES framework was introduced first in 1977 by Thomas L. Saaty and Alexander B. Clarke in "The Design of Large-Scale Systems: A Decomposition and Coordination Approach". The framework contains six measurement variable such as Performance (P), Information and Data (I), Economics and Effectivity (E1), Control and Security (C), Efficiency (E2) as well as Service (S). The PIECES framework could provide an important perspective to the whole system effectivity so support the system usability analysis. Although, PIECES is unable to provide a specific usability information such as learnability scale or error prevention, however, it can offer a wider point of view on overall impact on user satisfaction and productivity.

Importance Performance Analysis (IPA), a framework developed by Martilla and James in 1977, is depicted as a diagram-based tools to create a comparison between the importance and performance of each system attribute [3]. The main goal of IPA implementation is to identify the system's attribute as well as their importance analysis. this could give an illustration on how a product or service is rated whether it was underperformed or even exceed user's expectations. The IPA diagram-quadrant consist of system feature importance scale on vertical axis and system performance satisfaction on horizontal axis thus creating a four-quadrant diagram. Each quadrant held a status of feature or aspects lied there. Fig. 1 shows the IPA Framework diagram.

Quality Function Deployment (QFD) is an array of process and tools to effectively define the customer's needs in form of voice of customer and transform it to become a technical specification as well as production plan to fulfil the needs itself. The QFD model provide matrices to facilitate the problem-solving steps. First introduced by Yoji Akao of Mitsubishi corporation Japan in 1960s, QFD has become rapid sensation and quickly enters the USA and widely adapted by major automotive and electronics companies. Customer satisfaction is one thing that QFD focused on. The first QFD matrix is the House of Quality (HoQ), it identifies the customer's needs and send it to the planning phase. The technical response follows the process, accommodating the technical answer the company need to provide. Relationship score, technical correlation and technical importance are also created to provide detailed information about the end state of the HoQ.

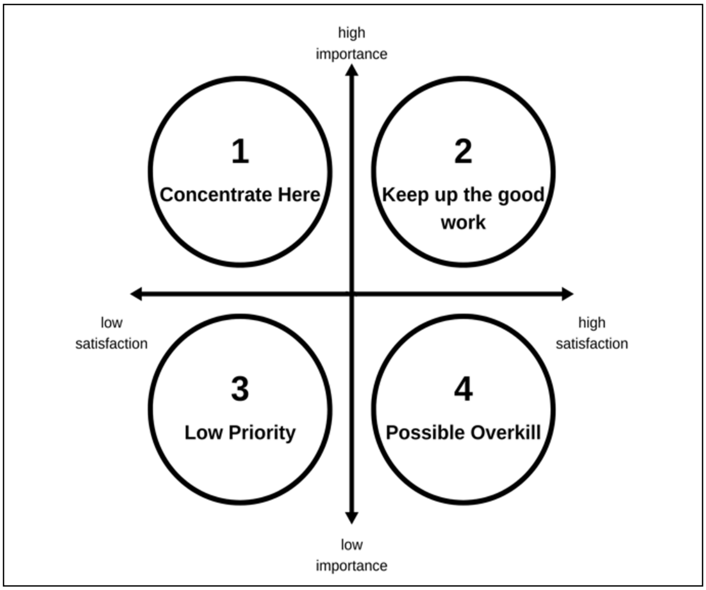

Fig. 1. Importance Performance Analysis (IPA) Framework Diagram

There are quite some of previous research implemented at least two of those three frameworks simultaneously to create system or service quality improvement, but none of the utilizing all three frameworks altogether [4] [5] [6] [7]. This research intends to integrate the PIECES, IPA as well as House of Quality from QFD Model to create deeper and comprehensive result on how system continuous improvement conducted by considering the voice of customer as one its key factor. While PIECES and IPA could measure the user's satisfaction and expectation, the HoQ of QFD could benefit from those two to create data-driven input statement.

3 Methodology

This research begins with identifying the respondents to be given the questionnaire. The respondents were defined based on population of all registered CPA Dashboard users. Population itself is a common area which consist as objects or subjects that having specific characteristics. The population was set to be studied and to be concluded [8]. There were 98 respondents varies in multiple division and corporate title throughout the company. Demographically, based on gender classifications, those 98 people consists of 71% male employees and 29% female employees. From the age range, 15% of the respondents were aged 22-25 years old, the next 21% were 26-30 years old, almost half of them (58%) were 31-35 years old, and the rest were more than 35 years old.

Once the target respondents set, the list of questions could also be created. The questionnaire for this research is based on the PIECES variables framework. There should be at least one questions created for every aspect variable from the PIECES framework. The Performance (P) aspect could contain how well the system works so far, this includes the system's response time, data processing duration as well as the ease of operating the system. The Information and Data (I) aspect could declare some information correlation within system. Economics and Effectivity (E1) state how the system contribute to the economics value and its impact to business continuity. Some statement about the system's ability to control the data and its compliance with the data privacy principle could be included in the Control and Security (C) aspect. For Efficiency (E2) aspect, there will be some measurement on the systems for the devoted users. While being last, the Services (S) aspect could show the measurement of each service or features available in the system and service provider, we talk about the product owner and system's owners.

The questions will be asked two times with the first being in the "Strongly Disagree" (1) to "Strongly Agree" (5) likert-scale to fill in the PIECES score, while the later will be in the "Strongly Not Important" (1) to "Strongly Important" (5) likert-scale to complete the IPA framework score. The comparation between PIECES and IPA Framework likert-scale is shown in Table 1.

Table 1. PIECES-IPA Score Scale

PIECES Scale	IPA Scale	Score
Strongly Disagree	Strongly Not Important	1
Disagree	Not Important	2
Neutral	Neutral	3
Agree	Important	4
Strongly Agree	Strongly Important	5

After the information on the PIECES and IPA frameworks are gathered for all the required respondents, there will be a validity and reliability check to ensure all the response are valid and suitable to be further analyzed. The validity check is done by calculating the correlation coefficient and compare it the r-table. The coefficient should be greater than the r-table so that the questionnaire response could be stated as a valid response. Hereinafter, the reliability check is used to compute whether the questionnaire response could be believed to be a research material, contain no tendentious answers, and no central tendencies detected. The Cronbach Alpha statistic test is commonly used to provide the reliability check result. A variable is believed to be reliable if the Cronbach Alpha value returned is greater than 0,60 [9].

The PIECES framework responsible in deciding the value of system satisfaction score. Each of the score range in every aspect of PIECES should then be multiplied with its score-emergence frequency to create the calculated score of each aspect as shown in equation (1). The total score of each aspect's calculated score divided by the total of frequency resulting in the aspect score as stated in the equation (2) below. The value of system satisfaction score is the average of each aspect's score. This value could be a representative whether the system is already satisfying the users or otherwise could be improved more.

$$\textit{Calculated Score (c)} = \textit{Score Range (i)} \times \textit{Freq (f)} \quad (1)$$

$$\textit{Aspect Score (n)} = \Sigma c / \Sigma f \quad (2)$$

Further in, after ensuring all response answers are valid and reliable, the House of Quality model could also begin to take shape. The first being identifying all indicators from the previous PIECES and IPA questionnaire as a voice of customer input. On the planning matrix, the average score collected for each indicator stated by PIECES and IPA framework earlier on will be an important key to calculate the Improvement Ratio and Sales Point value. These values will be base of raw weight as well as customer goal rank calculation, which conclude the planning matrix of HoQ-QFD. An HoQ model would be incomplete without technical response and its technical correlation. The technical response should be matched with its corresponding indicators to create relationship points. On the other hand, each of the technical response should be paired with other technical response to create a response relation. This step helps the product or service owner in grouping the development or improvement phase later. By the end of the model, there should be a prioritization of technical response to be done in the next development iteration, as well as the indicators rank or customer goal rank to become an insight on how the system should fit the customer's expectation.

4 Analysis and Result

4.1 PIECES Framework – Satisfaction and Perception Measurement

Table 2 contains a list of all the questions based on PIECES framework generated for this research that consist of 4 questions on Performance aspect, 6 questions on Information and Data aspect, 3 questions on Economics and Efficiency aspect, 3 questions on Control and Security aspect, 2 question on Effectivity aspect and 3 questions on Services aspect. All 21 questions have been delivered to 167 registered CPA Dashboard users in which 98 of them are the active users. All 98 active users are considered qualified respondents.

Table 2. PIECES-IPA Question List

Aspect	Indicator Code	Indicators / Instruments
Performance (P)	PR01	The data on CPA Dashboard is served in no time and easy to be accessed
	PR02	CPA Dashboard could accommodate such vast CPA Data volume
	PR03	Monthly data update on CPA Dashboard is done quickly and already fit my needs
	PR04	Quite rarely CPA Dashboard happen to be in error state
Information and Data (I)	ID05	The accuracy of data on CPA Dashboard was remarkable and fit perfectly with business notes
	ID06	CPA Dashboard is relevant to be used for quite a lot of profitability analysis
	ID07	CPA Dashboard is well integrated with all the data source
	ID08	CPA Dashboard could be used to determining business KPI, KPI fulfilment, as well as performance monitoring tools
	ID09	CPA Dashboard is easy to understand
	ID10	Supporting ad hoc-data is available and fit my needs perfectly
Economics and Efficiency (E1)	EE11	Profitability analysis using CPA Dashboard could increase revenue or lessen cost

	EE12	CPA Dashboard could be used to maintain customer's financial posts
	EE13	Online use of CPA Dashboard could reduce ad hoc-data request in form of offline file
Control and Security (C)	CS14	CPA Dashboard has already equipped with user access matrix so that the data security is not compromised
	CS15	CPA Dashboard has already followed the data privacy principal and protocols
	CS16	There is an established control in parameter inputs on the CPA Dashboard to prevent human errors.
Effectivity (E2)	EF17	The usage of CPA Dashboard is significantly reducing the time needed by user to collect data
	EF18	The usage of CPA Dashboard is significantly reducing the time needed by user to fulfil business KPI
Services (S)	SR19	Monthly-basis CPA data glossary has already helped user to understand CPA data more
	SR20	Enterprise Data Management (EDM) Division is responsive enough to answer user's questions regarding CPA Dashboard cases
	SR21	Enterprise Data Management (EDM) Division can solve user's problem regarding CPA Dashboard cases

The qualified respondents need to answer all the question based on their subjective view on whether the statements are suitable for their favour in scale of one to five, representing the agree or disagreement toward the statement. After all responses were collected, the responses are required to be valid and reliable. This could be done by validity and reliability check with result written in Table 3.

Table 3. PIECES Response Validity & Reliability Check

Indicator Code	Sum of pts (*x)	Avg of pts (x)	Correlation	Variance
PR01	355	3,622	0,704	0,732
PR02	361	3,684	0,684	0,445
PR03	326	3,327	0,652	0,779
PR04	316	3,225	0,728	0,774
ID05	316	3,225	0,819	0,774
ID06	327	3,337	0,792	0,741
ID07	321	3,276	0,746	0,841
ID08	329	3,357	0,788	0,747
ID09	352	3,592	0,840	0,430

ID10	338	3,449	0,813	0,559
EE11	349	3,561	0,850	0,434
EE12	349	3,561	0,787	0,434
EE13	354	3,612	0,724	0,487
CS14	351	3,582	0,841	0,493
CS15	363	3,704	0,746	0,375
CS16	345	3,520	0,741	0,458
EF17	363	3,704	0,729	0,355
EF18	366	3,735	0,718	0,341
SR19	360	3,674	0,824	0,387
SR20	365	3,725	0,719	0,552
SR21	362	3,694	0,774	0,462
			Total variance per-instrument	11,603
			Variance of subtotal per-respondent	138,344

Based on the validity and reliability check, each of indicator's correlation value is greater than 0,167 – which is the r-table for one-way significancy test with 5% significancy and degree of freedom of 96 – hence the whole indicator's response data stated as Valid. Furthermore, based on the variance value for every indicator, the Cronbach Alpha coefficient could also be calculated with the result of 0,925 using formula as shown in equation (3):

$$\alpha_u = [k / k\text{-}1][1\text{-}(\Sigma S_I^2 / S_I^2)] \tag{3}$$

α_u = questionnaire instruments reliability coefficient
k = number of questionnaire questions
ΣS_I^2 = total of variance score of valid instruments
S_I^2 = variance of instrument's total score

The calculation result is greater than 0,60, so that the questionnaire instruments can be noted as reliable.

As the questionnaire result has already passed the validity and reliability check, it can be processed furthermore to calculate the PIECES score. First step of calculating PIECES score is to count the frequency (*f*) of likert-scale score for each PIECES aspect. Next, multiply the frequency with its correspondence response score (*i*) to get the calculated score (*c*). The division between summary of calculated score and frequency produce the value of aspect score (*n*). The PIECES score is the average of aspect score for each aspect. Table 4 has a complete-detailed view of this calculation.

Table 4. PIECES Score Calculation

	(P)		(I)		(E1)	
i	f	c	f	c	f	c
1	9	9	10	10	1	1
2	35	70	78	156	11	22
3	142	426	209	627	115	345
4	177	708	265	1060	151	604
5	29	145	26	130	16	80
Total	392	**1358**	588	**1983**	294	**1052**
n		**3,46**		**3,37**		**3,58**

	(C)		(E2)		(S)	
i	f	c	f	c	f	c
1	2	2	0	0	1	1
2	10	20	0	0	8	16
3	105	315	69	207	96	288
4	163	652	113	452	163	652
5	14	70	14	70	26	130
Total	294	**1059**	196	**729**	294	**1087**
n		**3,60**		**3,72**		**3,70**
PIECES			**3,57**			

Based on the PIECES calculation, the final PIECES score is 3,57 which stood on the Satisfactory category based on the PIECES Score Category in Table 5. Note that the average of points (x) from Table 3 will be carried over to the IPA quadrant production and HoQ-QFD calculation.

Table 5. PIECES Score Category

Score	Category
< 1,79	Very unsatisfactory
1,80 – 2,59	Unsatisfactory
2,60 – 3,39	Quite satisfactory
3,40 – 4,19	Satisfactory
> 4,20	Very satisfactory

4.2 IPA Framework – Importance and Expectation Measurement

Using the PIECES' questions, the IPA framework calculation could also be carried out by switching the predicate of the likert-scale as shown in Table 1. The same question list will provide two different point of view which could be used as comparison. While PIECES measure the satisfactory measurement of the system's performance and ability, the IPA framework measure importance of the system's feature as well as user's expectation toward the system. Still, with the same pool of respondents to answer the questions. After the responses were collected, again, the validity and reliability check should also be conducted. Table 6 offers the result of response as well as the correlation and variance value to be used as response validity and reliability check.

Table 6. IPA Response Validity & Reliability Check

Indicator Code	Sum of pts (*y)	Avg of pts (y)	Correlation	Variance
PR01	366	3,735	0,7849	0,403
PR02	369	3,765	0,8215	0,346
PR03	349	3,561	0,8465	0,455
PR04	343	3,500	0,6942	0,624
ID05	347	3,541	0,8584	0,560
ID06	344	3,510	0,8529	0,562
ID07	349	3,561	0,8461	0,682
ID08	351	3,582	0,8192	0,617
ID09	363	3,704	0,8411	0,520
ID10	357	3,643	0,9034	0,541
EE11	358	3,653	0,9279	0,456
EE12	355	3,622	0,8858	0,505
EE13	361	3,684	0,8773	0,445
CS14	360	3,674	0,8891	0,428
CS15	364	3,714	0,8958	0,433
CS16	356	3,633	0,8186	0,544
EF17	368	3,755	0,8774	0,434
EF18	366	3,735	0,8506	0,403
SR19	360	3,674	0,9104	0,511
SR20	366	3,735	0,8131	0,506
SR21	364	3,714	0,7997	0,639
			Total variance per-instrument	10,615
			Variance of subtotal per-respondent	158,751

The same treatment as the PIECES response is applied to the IPA response. All correlation value of all indicators satisfies the rule of greater than r-table of 0,167, so that the response is declared as Valid. Subsequently, the reliability coefficient is as high as 0,942 well above the threshold of 0,60, hence the questionnaire is reliable to be carried on being a research material.

After securing the value for each of PIECES and IPA response, the IPA quadrant could be created. First thing to do is to locate each indicator into the plain quadrant. For each average value from PIECES and IPA framework of the same indicator consecutively become the x-axis and y-axis for its respective indicator. By doing so, the quadrant assignment could also be done. On the other hand, the intersection point will be the average value from each of indicator's average value. This information could be seen in Table 7 where each instrument has their own respective coordinate in the quadrant as well as the intersection point coordinate.

Table 7. Intersection Point & Quadrant Assignment

Indicator Code	Average Value of		Quadrant
	Perception (x)	Expectation (y)	
PR01	3,622	3,735	Q - 2
PR02	3,684	3,765	Q - 2
PR03	3,327	3,561	Q - 3
PR04	3,225	3,500	Q - 3
ID05	3,225	3,541	Q - 3
ID06	3,337	3,510	Q - 3
ID07	3,276	3,561	Q - 3
ID08	3,357	3,582	Q - 3
ID09	3,592	3,704	Q - 2
ID10	3,449	3,643	Q - 3
EE11	3,561	3,653	Q - 2
EE12	3,561	3,622	Q - 4
EE13	3,612	3,684	Q - 2
CS14	3,582	3,674	Q - 2
CS15	3,704	3,714	Q - 2
CS16	3,520	3,633	Q - 3
EF17	3,704	3,755	Q - 2
EF18	3,735	3,735	Q - 2
SR19	3,674	3,674	Q - 2
SR20	3,725	3,735	Q - 2
SR21	3,694	3,714	Q - 2
Intersection Point	3,532	3,652	

The intersection point divides the diagram into four quadrants. Each indicator is assigned to their respective quadrant based on their *x* and *y* axis. Those quadrants will then classify the indicators or instruments into the suitable category as shown in Fig. 2.

Based on the quadrant, there are quite a lot of instruments in the Q-2 and Q-3. The Q-2 indicates that the instruments sat in there was quite good and fit the expectation and needed to be maintained. For the Q-3, there is possibility that the instruments assigned was not the user's main priority, could also called a nice-to-have feature. There is one instrument in the Q-4, which is dubbed as "Possible Overkill", this shows that the instrument is too good to be true as it was also not the user's main interest. No indicators in the Q-1 indicates that there is no urgent improvement needed for the indicators provided. Note that this quadrant assignment will be carried on in HoQ-QFD goal-calculation.

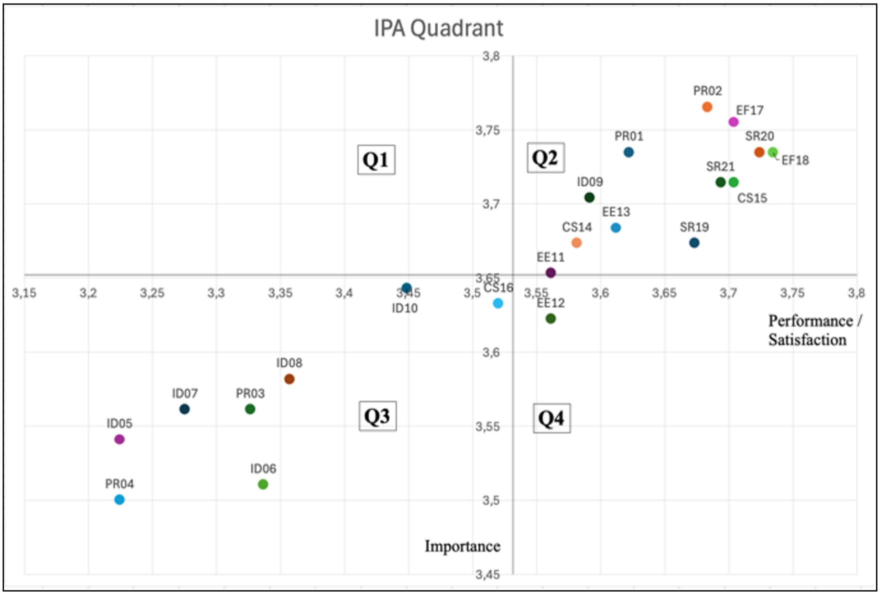

Fig. 2. IPA Quadrant Assignment

4.3 House of Quality – Quality Function Deployment

Following PIECES and IPA analysis is the establishment of House of Quality (HoQ) on Quality Function Deployment (QFD) model. There are several matrices on the QFD model, with HoQ being the first and the most important one. HoQ organization is consisted of six major parts. The House of Quality model is well illustrated in Fig. 3.

The first part of the HoQ is the Customer Needs and Benefit Section. This part contains brief description of customer's needs. A list of instruments in the PIECES and IPA framework questionnaire represents those needs.

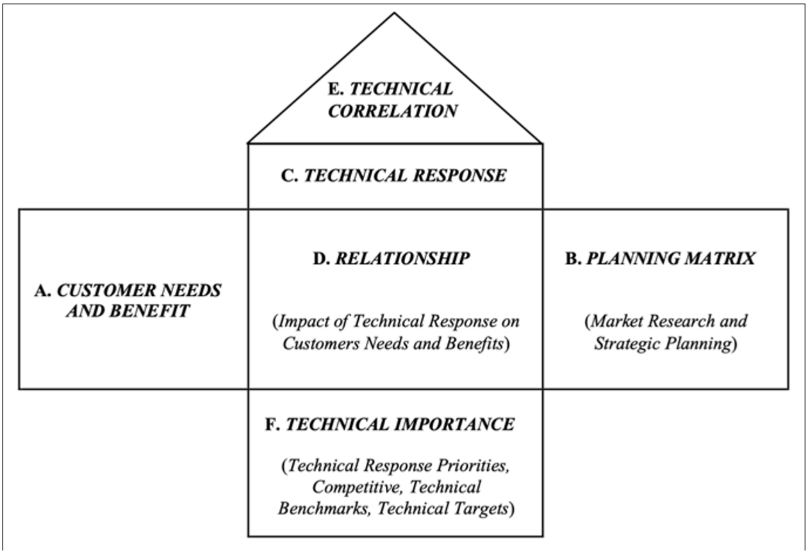

Fig. 3. Six House of Quality Parts

Moving forward, the second part of the HoQ is the Planning Matrix. The planning matrix is a complex and structured steps with intention to formulate the interconnection between customer's needs and degree of satisfaction to the system's workability. There are also goal and sales point included to determine the expectation target on customer's point of view regarding the system. Goal point is created based on the IPA Quadrant, with higher quadrant place represent higher goal point. The goal point statement is displayed in Table 8.

Table 8. Goal Point Statement

Indicator Code	IPA Quadrant	Goal Point (g)
PR01	2	5
PR02	2	5
PR03	3	4
PR04	3	4
ID05	3	4
ID06	3	4
ID07	3	4
ID08	3	4
ID09	2	5
ID10	3	4
EE11	2	5
EE12	4	3
EE13	2	5
CS14	2	5
CS15	2	5

Indicator Code	IPA Quadrant	Goal Point (g)
CS16	3	4
EF17	2	5
EF18	2	5
SR19	2	5
SR20	2	5
SR21	2	5

The classification of goal point will affect the Improvement Ratio score (*ir*). Improvement ratio indicates the effort spend by the product or service owner to achieve the goal. The Improvement Ratio is the division of goal point per instrument by the average score per instrument. The formula is stated in equation (4).

$$ir = g / x \quad (4)$$

ir = improvement ratio
g = goal point per-instrument
x = average score of perception / performance per-instrument

While it is visible that the perception or performance average score affect the improvement ratio, the average score of expectation (y) could also affect the sales point (sp) calculation. Sales point usually split in three range based on class interval. The interval is arranged by subtracting the maximum value of y with the minimum value and divide it by three to get the resulting range as shown in Table 9. After the range is set, the class interval can be created by adding the range to the minimum value of y to create low class sales point and so on to the maximum value of y, as displayed in Table 10.

Table 9. Sales Point Range

Max value of y	3,765
Min value of y	3,500
Range	0,088

Table 10. Sales Point Class Interval

Class Interval	Sales Point
3,500 – 3,588	1
3,589 – 3,677	1,2
3,678 – 3,765	1,5

Next phase in the planning matrix is the calculation of raw weight (*rw*) as well as the normalized raw weight (*nrw*). Raw weight depicted the model of company or product owner's concerns toward every customer needs. This could be done by multiplying the average score of expectation per instrument with the improvement ratio score and the sales point, that could be found in equation (5). While the *nrw* is the normalization value of the *rw* with the formula shown in the equation (6). After the *rw* and *nrw* is calculated, the customer's goal rank could also be presented. This rank represents the urgency level of customer's needs. Table 11 shows the detailed value of improvement ratio, sales point, raw weight normalized raw weight and the goal rank for each instrument to produce the final planning matrix table.

$$rw = y \times ir \times sp \tag{5}$$

rw = raw weight
y = average score of expectation per-instrument
ir = improvement ratio
sp = sales point

$$nrw_i = rw_i / total\ rw \tag{6}$$

nrw = normalized raw weight
rw = raw weight
i = instrument's number
sp = sales point

Table 11. Final Planning Matrix

Indicator Code	ir	sp	rw	nrw	goal rank
PR01	1,380	1,5	7,733	6,122	2
PR02	1,357	1,5	7,666	6,070	3
PR03	1,203	1	4,282	3,391	18
PR04	1,241	1	4,342	3,438	17
ID05	1,241	1	4,392	3,478	15
ID06	1,199	1	4,208	3,332	20
ID07	1,221	1	4,349	3,443	16
ID08	1,192	1	4,268	3,379	19
ID09	1,392	1,5	7,735	6,124	1
ID10	1,160	1,2	5,070	4,014	13
EE11	1,404	1,2	6,155	4,873	10
EE12	0,842	1,2	3,662	2,899	21
EE13	1,384	1,5	7,649	6,056	4
CS14	1,396	1,2	6,154	4,872	11
CS15	1,350	1,5	7,521	5,955	7
CS16	1,136	1,2	4,953	3,922	14
EF17	1,350	1,5	7,603	6,020	5
EF18	1,339	1,5	7,500	5,938	9
SR19	1,361	1,2	6,000	4,751	12
SR20	1,343	1,5	7,521	5,954	8
SR21	1,354	1,5	7,541	5,971	6

The third part of the HoQ-QFD is the preparation of Technical Response (TR). The technical response is an array of product owner's response to answer all the customer's needs or indicators. One response could be used to solve multiple indicators. Characteristically, the technical response could have some technical specifications which can be measured and should have the tendencies to support the product development. The technical specification generated could act as a foundation for product owner to conduct their next development iteration process. Table 12 contains all the technical response stated by the product owner correlating with each instrument.

Table 12. Technical Response

Response Code	Technical Response
TR01	Increase CPA Dashboard bandwidth access to maintain the accessibility
TR02	Speed up the process of generating monthly data
TR03	Maintain the integrity of CPA data sources
TR04	Maintain and improve the data accuracy and consistency on the CPA Dashboard
TR05	Complete the financial posts as a basis for profitability analysis, customer portfolio maintenance and KPI fulfilment
TR06	Maintain and increase the CPA Dashboard responsiveness and ad hoc data provision
TR07	Maintain and improve the data privacy protocol over CPA Dashboard
TR08	Provide SOP, socialization, glossary materials and tutorials related to all CPA applications
TR09	Simplifying the user interface while still providing important insights for dashboard users
TR10	Apply process monitoring as a basis for information on dashboard data availability
TR11	Improve response and capability in resolving issues regarding CPA Dashboard

The next step of the HoQ is to establish the Relationship. The previously created technical response will be the main material to be calculated furthermore. Each of the instruments will be assigned to the technical response available to provide the impact score for each of them. Each impact score (*is*) is represented by a symbol to determine their value. Table 13 shows the illustration symbol representation for each impact score.

Table 13. Impact Score Symbol

Impact Score (is)	Representing Symbol
9	●
3	○
1	Δ

The impact score determination is important to show how a technical response is suitable to solve the problem statement in form of each indicator. The higher the score, the more suitable a technical response is paired with instruments or indicators. The impact score (*is*) could also be used for technical response contribution (*ct*) score calculation.

The contribution score is calculated by counting the sum-product of *is* and *nrw* multiplication as written in the equation (7) below. The contribution (*ct*) score will then be normalized to create Normalized Contribution (*nCt*) score, that will be used as the result for this research on the later stage. Table 14 gives detailed illustration regarding the pairing of each instrument to their respected technical response, complete with their impact score written in representing symbol.

$$ct = \Sigma(is \times nrw) \tag{7}$$

ct = contribution score
is = impact score
nrw = normalized raw weight

Table 14. Impact-Contribution Calculation

	TR01	TR02	TR03	TR04	TR05	TR06	TR07	TR08	TR09	TR10	TR11	nrw
PR01	○	●										6,122
PR02	●								Δ			6,070
PR03		●		○								3,391
PR04			●							○		3,438
ID05				●				Δ				3,478
ID06					●			Δ				3,332
ID07			●	○								3,443
ID08					●			○	Δ			3,379
ID09								○	●			6,124
ID10						●						4,014
EE11					●				○			4,873
EE12					●							2,899
EE13				●						○		6,056
CS14							●			○		4,872
CS15							●					5,955
CS16							●					3,922
EF17		●								○	Δ	6,020
EF18		●								Δ		5,938
SR19								●		Δ	Δ	4,751
SR20									Δ	Δ	●	5,954
SR21											●	5,971
Ct	72,99	193,2	61,93	106,3	130,3	36,13	132,7	78,07	85,14	77,8	118,1	
nCt	0,067	0,177	0,057	0,097	0,119	0,033	0,121	0,071	0,078	0,071	0,1081	

The penultimate part of the HoQ is the Technical Correlation. This section shows the viscosity between elements contained in technical response. Technical correlation also known as the roof model because of its structure which resembling the house' roof triangle depicted in Fig. 4. The forming of technical correlation is usually made by discussion between stakeholders to identify the cohesiveness between technical response with output that could be used by all the stakeholders, to create a simultaneous development phase to be more effectively conducted.

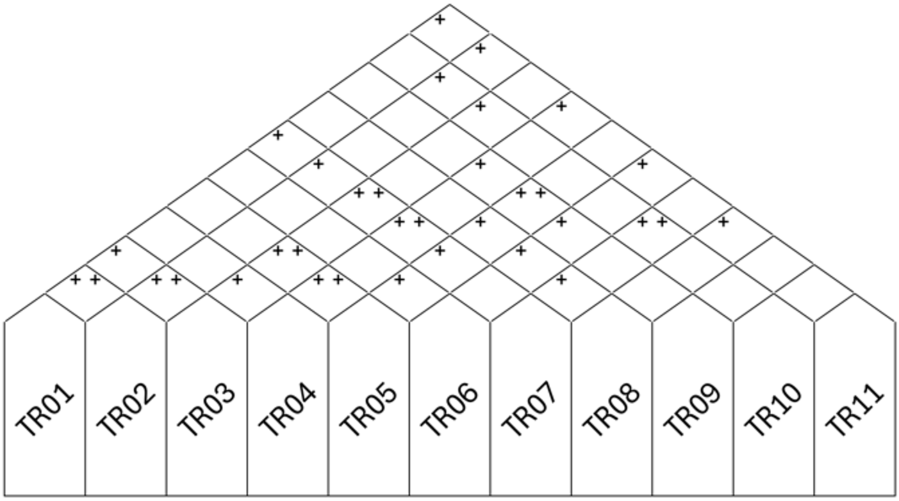

Fig. 4. HoQ Roof Model – Technical Correlation

Entering the final part of the HoQ, dubbed as the Technical Importance, this section compiles all the information gathered from the previous part to create conclusion of the HoQ-QFD model. There are two main ranks from the HoQ that can be used as specification and detailed requirement for the system's next improvement iteration. Customer Goal Rank as stated in the Planning Matrix shows the importance and how urgent a feature or indicator should be improved on the next improvement schedule to maintain the customer's satisfaction, shown in Table 15. The other important rank is the Technical Rank, listed in Table 16, as the rank could be a real actionable plan for the product owner could take in the next improvement iteration. This rank could help the product owner in determining the improvement and development priority. Again, this should be done to fit and meet the customer's expectation and maintain the customer's satisfaction. It could also boost the usability of the system in the long stretch.

Table 15. Customer Goal Rank

Customer Goal Rank	Indicator Code	nrw
1	ID09	6,124
2	PR01	6,122
3	PR02	6,070
4	EE13	6,056
5	EF17	6,020
6	SR21	5,971
7	CS15	5,955
8	SR20	5,954
9	EF18	5,938
10	EE11	4,873
11	CS14	4,872

12	SR19	4,751
13	ID10	4,014
14	CS16	3,922
15	ID05	3,478
16	ID07	3,443
17	PR04	3,438
18	PR03	3,391
19	ID08	3,379
20	ID06	3,332
21	EE12	2,899

Table 16. Technical Rank

TR Rank	TR Code	nCt
1	TR02	0,177
2	TR07	0,122
3	TR05	0,119
4	TR11	0,108
5	TR04	0,097
6	TR09	0,078
7	TR08	0,071
8	TR10	0,071
9	TR01	0,067
10	TR03	0,057
11	TR06	0,033

4.4 Discussion

The research result suggests the framework for next improvement development iteration for the CPA Dashboard. Implementation of this research result is useful for the company or product owner so that the system development could accommodate the customer's needs as well as improving the quality. By utilizing the final technical response rank, the product owner and all the stakeholders could get the right idea and clear direction of what should be focused on to improve from their system.

However, some challenges along the way are inevitable. All stakeholders should come in an agreement on the development and improvement processes. The technical response rank scope is so generally vast that it can affect and impact multiple parties that includes the application and system development part, data security part, business process redesign as well as network and infrastructure part. Every single stakeholder should coordinate and discuss the possibility of the work collaboration. This could be done by arranging a development-forum lead by the product owner, discussing the development context in the right direction and compromise portion in each party. Hence, the responsibility dispute could be minimalized.

5 Conclusions

As the research done, the implementation of PIECES, IPA and House of Qualify – QFD model was done to get the optimal input for the development journey and the continuous improvement process of CPA Dashboard to increase its usability score. There are some conclusions taken such as:

- Based on PIECES framework questionnaire, the final PIECES score is 3,57, thus the system is satisfactory to the users
- From the IPA framework, there are 12 instruments which marked in 2nd quadrant, 8 instruments in quadrant number 3 and 1 instrument in the 4th quadrant. This result shows that the product owner should maintain the system's performance especially for those instruments in quadrant number 2.
- The HoQ – QFD model developed in this research shows the customer goal rank as the system's key factors to be maintained and enhanced in the near future. Also, there is technical response rank as the foundation of next improvement and development iteration. This scope prioritization includes speeding up data production to be available on the CPA Dashboard, improving data privacy protocol as well as completing the financial posts which could be used as profitability analysis basis.

On the other hand, there are some suggestions regarding the research result as well. The measurement of user satisfaction and user expectation toward the system should be implemented in periodically fashion, so that it can be used as a monitoring tool for the company in determining the system's feature development focus. The HoQ – QFD model should also be made as a standard so that it can be implemented corporate wide. The last suggestion is that, after the company implement this research result as a base of improvement scope, the system usability measurement should be conducted one more time to assess the system usability and compare it from the baseline condition.

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