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ENTERPRISE RESOURCE PLANNING (ERP) ACHIEVEMENT MODEL TO REDUCE GAP OF UN-MATCH KEY PERFORMANCE INDICATOR (KPI) MEASUREMENT

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Abstract. *The Industrial Revolution has now entered the fourth era known as the Internet of Things (IOT) era in the industry, which includes various things not only in the production process but also in all related business processes. One of the tools that are starting to be widely used in companies, especially in medium and large scale companies, is the use of the Enterprise Resources Planning (ERP) system. With the use of ERP, it is expected that each of the company's business activities will be integrated with one another so that an effective and efficient business process continuity can be created. During its implementation, this ERP system also needs to be controlled by the company by creating a measurable Key Performance Indicator (KPI) to ensure that the ERP system is understood by its users properly and implemented correctly so that it can actually fulfill its initial objectives, but in reality there are gaps between the ERP system utilization KPI target set by the parent company and its realization every month. The condition of the gap between the target and the realization of KPI achievement in ERP implementation is a condition that is not desired by any company, therefore an analysis will be carried out to determine the factors causing it and will be carried out using factor analysis and regression analysis methods and then look for a model that can best describe the relationship between these factors and the user's understanding of the ERP Utilization KPIs in the company. The results showed that there are 3 factors that influence the achievement success rate, namely ERP Expertise, ERP Values, and ERP Sustainability. By paying attention to these models and factors, it can be determined what steps the company needs to take in the future to improve the achievement success rate of ERP Utilization KPIs so as to reduce the gap between targets and existing realizations.*

Keywords: Enterprise resource planning, Key performance indicator, Factor analysis, Measurement model, Implementation systems

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1. **Introduction.** In carrying out its business activities, the company requires a reliable information system to support a large number of business process transactions each year. For companies that have used an Enterprise Resources Planning (ERP) software system, to monitor the implementation and effectiveness of their business processes, the company implements a Key Performance Indicator (KPI) based assessment system for the entire business community. The graph of the company's KPI achievement as an example in the data year in 2019 is shown in Figure 1.

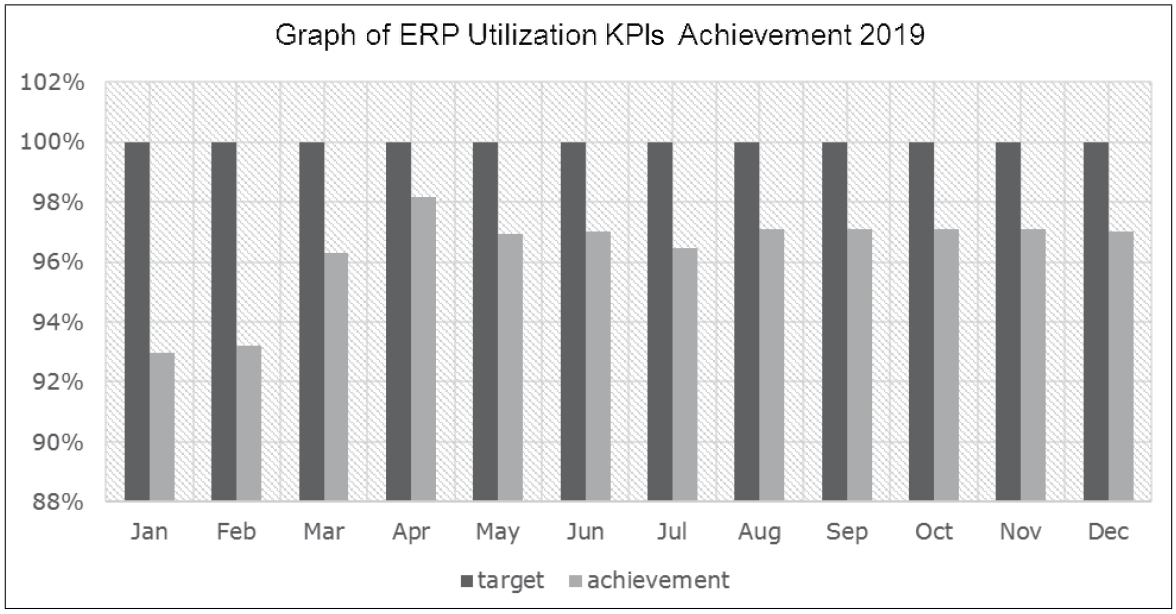

FIGURE 1. Graph of ERP Utilization KPIs achievement versus 2019 target

Based on the data in Figure 1, it can be seen that the KPI achievement from January to December 2019 is always below the set target of 100%, or in other words it can be seen that there is still a gap every month between the target and KPI achievement. Of course, this condition is not in accordance with company expectations, where it is expected that the use or utilization of this ERP system should always reach 100%, but in fact there is still a gap that occurs after the company uses ERP software, there is always a gap between the KPI target system utilization. Therefore, it is necessary to analyze the identification of the factors that influence the existence of gaps or not optimizing the utilization of the ERP system, so that the company can take the right steps to achieve the predetermined targets. The main objective of this research is to answer the following problems. What factors influence the gap between the expected target and the realization of KPI performance achievement in the use of ERP? What is the model shape of the gap between the expected targets and the realization of KPI performance achievement in the use of ERP? And what strategies should the company take in order to increase the success of KPI achievement in the use of ERP in the future?

2. Literatur Review.

2.1. **IT balanced scorecard.** IT balanced scorecard has 4 perspectives [1], including

1) Corporate Contribution (CC)

   This perspective measures the performance of the IT Department using the views of company management and executives, focusing on 3 main objectives, namely controlling IT costs, the business value of new IT projects, and the business value of the IT Department itself [2].

2) User Orientation (UO)
   This perspective is used to evaluate the performance of the IT Department from the views of customers and internal users. Here there are 3 main goals to be achieved, namely becoming a preferred supplier, partnering with users, and user satisfaction [3].
3) Operational Excellence (OE)
   This perspective is used to evaluate how effective and efficient IT processes are in the company, where the IT Department is required to be able to provide services with maximum quality and minimum cost [4].
4) Future Orientation (FO)
   This perspective discusses how the company's efforts, especially the IT Department, in preparing for future challenges, including through the process of improving the capabilities of IT personnel through training, research on the latest information technology developments and anticipation for the future, as well as mastery of new technology [5,6].

2.2. **Knowledge development (SECI model).** In the knowledge development process, the terms tacit knowledge and explicit knowledge are known where tacit knowledge is a form of knowledge that is difficult to formally express, is specific to certain contexts, and is relatively difficult to communicate because it is in a person's thinking and is the root of all knowledge, whereas explicit knowledge is a form of knowledge that has been collected in such a way (codified), expressed in formal language and words, is easy to transmit and store, but is only a small part of the total existing knowledge [7,8], there are 4 models of the knowledge conversion process as follows:

1) From tacit knowledge to tacit knowledge, which is called the socialization process (S).
2) From tacit knowledge to explicit knowledge, which is called the externalization process (E).
3) From explicit knowledge to explicit knowledge, which is called the combination (C).
4) From explicit knowledge to tacit knowledge, which is called the internalization (I).

2.3. **Research instrument development.** With the theoretical foundation of the IT balanced scorecard and the knowledge management systems cycle, then construction can be built or carried out for the development of research instruments as a basis for making a questionnaire. The table of construction results is presented in Table 1.

3. Methodology.

3.1. **Data collection methods.** The data source comes from the PT Pertamina Patra Niaga employee group, especially the ERP Utilization KPIs holders and also ERP users in the company with a sample size of approximately 200 people. Data was collected using a questionnaire until October 12, 2020. Out of 200 respondents were asked to fill in the returned response totaling 190 responses.

3.2. **Validity analysis.** A questionnaire is said to be valid if the questions on the questionnaire are able to reveal something that will be measured by the questionnaire [34]. With the corrected item to total correlation method, the questionnaire item is said to be valid if the corrected item to total correlation value is greater than the r table value.

3.3. **Reliability analysis.** Reliability in statistics and psychometrics is also called reliability, which is a series of measurements or measuring instruments that have consistency if these measurements are repeated [35]. A measuring instrument is said to be reliable if in consistent conditions a measuring instrument gives similar results from one test to another. In this study, the SPSS tool was used with the Cronbach's alpha method, where the coefficient results will be said to be reliable if they have a value above 0.70.

Table 1. Research instrument development

Factor	Indicator	Statement	Reference
Corporate Contribution (CC)	Management view (CC1)	Top management companies have succeeded in utilizing ERP systems in companies	[9]
	Added value to business (CC2)	The use of ERP provides edit value to the company business	[10]
	Process redesign (CC3)	The use of ERP makes the company's control function better	[11]
	Understanding of business process (CC4)	ERP users' understanding of company business processes will affect ERP utilization in the company	[12]
	Data quality (CC5)	The quality of data in an ERP system will affect the decision-making process within the company	[13]
User Orientation (UO)	User satisfaction (UO1)	Users who are satisfied with the current ERP system will affect the ERP utilization rate in the company	[14]
	Easy to learn (UO2)	The ease with which an ERP system can be studied will affect the ERP utilization within the company	[15]
	Benefits for users (UO3)	The use of ERP can increase the effectiveness of working for its users	[16]
	Usability (UO4)	Ease of use of the ERP system will affect ERP utilization within the company	[17]
	Quality of IT services (UO5)	The speed of IT department services will affect ERP utilization	[18]
Operation Excellent (OE)	Effectiveness and efficiency of BP (OE1)	The use of ERP has made business processes effective and efficient	[19]
	Data accuracy (OE2)	The need for accurate data for reporting will affect the utilization of ERP in the company	[20]
	Adaptability (OE3)	The ease with which an ERP system can be adjusted according to user needs will affect ERP utilization in the company	[21]
	Accessibility (OE4)	The availability of an ERP system that is easy to access at any time will affect the ERP utilization rate in a company	[22]
	Effectiveness of IT processes (OE5)	The effectiveness of IT processes or services will affect ERP utilization in the company	[23]
Future Orientation (FO)	Personnel expertise (FO1)	The expertise possessed by current users is sufficient to face future business challenges	[24]
	Personnel development (FO2)	The training program can affect the readiness of ERP users to face future challenges	[25]
	System upgradeability (FO3)	The ease with which the ERP system can be upgraded in the future will affect the ERP utilization in the company	[26]
	ICT development project (FO4)	The existence of continuous IT system development will affect ERP utilization in the company	[27]
Socialization (S)	Tacit to tacit knowledge (S1)	The process of transferring knowledge in the company will affect the ERP utilization in the company	[28]
	Tacit knowledge (S2)	The skills and knowledge possessed by workers affect ERP utilization in the company	[29]
Externalization (E)	Tacit to explicit knowledge (E1)	The existence of a good documentation process (such as making SOPs) will affect ERP utilization in the company	[30]
	Explicit knowledge (E2)	The socialization of the documents/SOPs that have been made will affect the utilization of ERP in the company	[31]
Combination (C)	Explicit to explicit knowledge (C1)	The training process that has been documented will affect the ERP utilization process in the company	[32]
Internalization (I)	Explicit to tacit knowledge (I1)	ERP users who carry out documented SOPs will affect the level of ERP utilization in the company	[33]

3.4. **Factor analysis.** Factor analysis is carried out in the following stages [36]:

1) Develop a correlation matrix for the variables to be analyzed and conduct tests/examination;
2) Perform factor extraction;

3) Perform factor rotation;
4) Calculating the factor score.

4. Result and Discussion.

4.1. **Validity test.** The validity test was carried out using the corrected item to total correlation method in SPSS by comparing the r table for 190 samples with a 95% confidence level of 0.207 with r count on each indicator representing each statement in the questionnaire, as shown in Table 2.

Table 2. Summary of validity test

Indicator	Corrected item-total correlation	Valid/No
Management view (CC1)	0.368	Valid
Added value to business (CC2)	0.736	Valid
Process redesign (CC3)	0.664	Valid
Understanding of business process (CC4)	0.701	Valid
Data quality (CC5)	0.719	Valid
Effectiveness & efficiency of business process (OE1)	0.622	Valid
Data accuracy (OE2)	0.813	Valid
Adaptability (OE3)	0.677	Valid
Accessibility (OE4)	0.740	Valid
Effectiveness of IT processes (OE5)	0.746	Valid
User satisfaction (UO1)	0.721	Valid
Easy to learn (UO2)	0.775	Valid
Benefits for users (UO3)	0.791	Valid
Usability (UO4)	0.775	Valid
Quality of IT Services (UO5)	0.731	Valid
Personnel expertise (FO1)	0.401	Valid
Personnel development (FO2)	0.772	Valid
System upgradeability (FO3)	0.815	Valid
ICT development project (FO4)	0.802	Valid
Tacit to tacit knowledge (S1)	0.728	Valid
Tacit knowledge (S2)	0.687	Valid
Tacit to explicit knowledge (E1)	0.706	Valid
Explicit knowledge (E2)	0.739	Valid
Explicit to explicit knowledge (C1)	−0.004	No
Explicit to tacit knowledge (I1)	0.772	Valid

From the results of the first validity test, the C1 indicator was declared invalid, and for this reason the indicator was removed from the initial indicator group and then reanalyzed until all indicators were declared valid.

4.2. **Reliability test.** Based on the results of the reliability test using the SPSS tool, it was found that the Cronbach's alpha value was 0.949, the condition that Cronbach's alpha is greater than 0.700, so it is considered to have met the requirement for the analysis [35], as shown in Table 3.

Table 3. Reliability test results

Cronbach's alpha	Number of items
0.949	25

4.3. **Factor analysis.**

4.3.1. *Correlation matrix examination.* This examination includes Bartlett's Test of Sphericity, a sample adequacy test for each indicator/variable (Measure of Sampling Adequacy – MSA) represented by the Anti-Image Correlation value, and the Kaiser-Meyer-Olkin test with the following criteria:

1) Bartlett's Test of Sphericity has a significance value below 0.05;
2) The KMO-MSA value is greater than 0.700;
3) The Anti-Image Correlation value for each indicator is greater than 0.500.

Table 4. KMO & Bartlett's Test results

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.922
Bartlett's Test of Sphericity	Approx. Chi-Square	1839.097
	Df	276
	Sig.	0.000

4.3.2. *New factors forming.* From the results of the rotation processed, in Table 5, it can be seen that the indicators are grouped into 3 new factor components which are then named as in the following table.

Table 5. Formed factors

No.	Indicator	New factor
1	Usability (UO4)	ERP Expert Behavior
2	Easy to learn (UO2)	
3	Personnel development (FO2)	
4	Explicit to tacit knowledge (I1)	
5	ICT development project (FO4)	
6	Effectiveness of IT processes (OE5)	
7	Quality of IT services (UO5)	
8	Explicit knowledge (E2)	
9	Accessibility (OE4)	
10	System upgradeability (FO3)	
11	Tacit knowledge (S2)	
12	Adaptability (OE3)	
13	User satisfaction (UO1)	
14	Tacit to explicit knowledge (E1)	
15	Effectiveness & efficiency of business process (OE1)	ERP Values
16	Process redesign (CC3)	
17	Added value to business (CC2)	
18	Benefits for users (UO3)	
19	Personnel expertise (FO1)	ERP Expertise
20	Management view (CC1)	

4.3.2.1. *ERP Expert Behavior.* The first factor that is formed consists of 14 indicators (numbers 1 to 14 in Table 5) which are grouped together and represented as "ERP Expert Behavior".

4.3.2.2. *ERP Values.* The second factor that is formed consists of 4 indicators (numbers 15 to 18 in Table 5) which are grouped together and represented as "ERP Values" where this factor measures the benefits felt by users of the ERP system and for the company. with the use of this ERP system.

4.3.2.3. *ERP Expertise.* The third factor interpretation that is formed is "ERP Expertise" which is a representation of 2 indicators that are grouped into one. In principle, ERP Expertise is a variable that measures the level of readiness of ERP system users' knowledge and skills in order to face challenges and changes in the future [37].

4.3.2.4. *Development of ERP system utilization success rate model.* After the discovery of new influencing factors as mentioned above, the next step is to carry out an analysis using multiple linear regression methods to obtain a model that can provide an overview of the perceptions of users and KPI holders on the success rate of ERP utilization in the company.

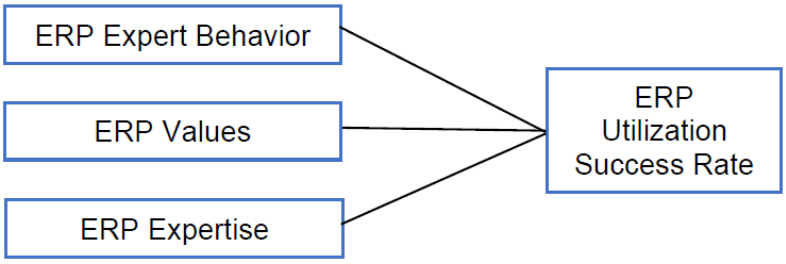

FIGURE 2. Understanding factors of ERP Utilization KPIs

4.4. **Regression analysis.** After obtaining a linear equation model with 3 variables as mentioned above, then a descriptive analysis is carried out to determine the maximum and minimum value of each of the existing independent variables so that the following results are obtained:

$$Y = 6.578 + 0.316X_1 + 0.599X_2 + 0.463X_3$$

From the model obtained, it can be concluded as follows.

1) ERP Expert Behavior factor has a correlation coefficient of 0.316 (positive) which means that with the increasing of ERP Expert Behavior, the level of understanding of ERP Utilization KPIs of KPI holders and users will increase, where for each increase of one point ERP Expert Behavior will increase understanding of KPI by 0.316 points

TABLE 6. Results of SPSS regression analysis

Coefficients					
	Unstandardized coefficients		**Standardized coefficients**	**t**	**Sig.**
	B	**Std. error**	**Beta**		
(Constant)	6.578	0.183		36.018	0.000
ERP Expert Behavior (X_1)	0.316	0.184	0.167	1.719	0.089
ERP Values (X_2)	0.599	0.184	0.317	3.259	0.002
ERP Expertise (X_3)	0.463	0.184	0.245	2.519	0.014

(assuming other factors are constant). Sig value 0.089 (> 0.050) means that this X_1 variable partially does not have a significant effect on the dependent variable Y.

2) The ERP Values factor has a correlation coefficient of 0.599 (positive) which means that with the increasing benefits felt by the company for this ERP system, the understanding of ERP Utilization KPIs from KPI holders and users will also increase, where for every one point increase, this ERP value will increase the understanding of KPI by 0.599 points (assuming other factors are constant). Sig value 0.002 (< 0.050) means that this X_2 variable partially has a significant effect on the dependent variable Y.
3) ERP Expertise factor has a correlation coefficient of 0.463 (positive) which means that with the increasing expertise of this ERP system, the understanding of ERP Utilization KPIs from KPI holders and users will also increase, where for every one point increase in this ERP Expertise will increase understanding of KPIs by 0.463 points (assuming other factors are constant). Sig value 0.014 (< 0.050) means that this X_3 variable partially has a significant effect on the dependent variable Y.

5. **Conclusion.** For factors influencing the achieving ERP Utilization KPIs, there are 3 factors that can affect the achievement of ERP Utilization KPIs, namely as follows:

1) ERP expert behavior, which represents indicators of usability, personnel development, ease of learning, explicit to tacit knowledge, ict development, effectiveness of it processes, quality of it services, explicit knowledge, system upgradeability, tacit knowledge, accessibility, adaptability, tacit to explicit knowledge, and customer satisfaction;
2) ERP values, which represent indicators of business process effectiveness and efficiency, company control functions, business added value, and benefits for users;
3) ERP expertise factor which represents the indicators of personnel expertise and management view.

It was found that companies can reduce the gap in the achievement of KPIs for the use of ERP and KPIs by increasing understanding of the ERP system from their employees to reach a value of 9.59 from a scale of 0.00-10.00. However, if the company does not pay attention to these factors, the understanding of ERP utilization can decrease to 1.93 from a scale of 0.00-10.00. Therefore, the company is expected to take strategic steps in order to achieve optimal solutions for each of the new factors that have been discovered.

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