

## Exploring The Impact of E-CRM System on Customers in Banking Sector Using PLS-SEM Approach

Shymaa Mohamed Mohamed<sup>1</sup>, Mohamed Marie<sup>2</sup>, Engy Yehia<sup>3</sup>

Submitted: 24/04/2023

Revised: 27/06/2023

Accepted: 06/07/2023

**Abstract:** The banking sector has faced a variety of difficulties in the competitive business environment. The adoption of electronic means by banks is a requirement for them to meet these problems and keep customers satisfied. Through different electronic touch points, E-CRM aids in establishing and preserving mutually beneficial long-term connections with customers. This study aims to understand the effects of E-CRM on customer satisfaction, loyalty, and trust in the banking industry. Customers of banks using E-CRM services filled out questionnaires to help with this. Partial Least Squares Structural Equation Modeling (PLS-SEM) was utilized to evaluate the study model using the data that were collected through a survey. The first results revealed that E-CRM had strong effect on service quality, trust, and customer satisfaction while very weak effect on customer loyalty. We performed an enhancement of the research model through two phases, and the results proved that enhancing E-CRM systems positively affects customer satisfaction and loyalty when quality and trust are put as a mediator for them.

**Keywords:** Customer relationship management, electronic customer relationship management, customer satisfaction, service quality, trust, customer loyalty, PLS-SEM.

### 1. Introduction

Electronic Customer Relationship Management (E-CRM) enables banks provide services to their clients and develop procedures [1]. Many issues are now solved due to advancements in communication networks, making E-CRM a revolutionary phenomenon in the banking sector. To support company strategy, businesses use information technology (IT) based on CRM systems [2]. A wide range of banking services and products will be available to customers, depending on their needs. Customers will develop expectations regarding the worth and satisfaction of different market products. Customers that are happy will repurchase and recommend a business to others. Unhappy customers frequently switch to rival brands and criticize products to others [3]. Customer relationship management (CRM) is a method to establish connections with clients and understand their needs in order to grow devoted customers. Customers who are loyal to a business are generally more profitable. CRM enables businesses to better understand consumer behavior, wants, and relationships through the provision of goods and services [4]. ICT advancements are causing significant changes in the banking industry [5]. In order to retain consumers and boost their financial performance, banks have been encouraged to offer their clients the finest services available due to intense competition, globalization,

and rising consumer expectations [6];[7]. The business strategy has changed from being focused on banks to being focused on customers as a result. During a dramatic shift in technology and consumer behavior, maintaining client happiness and loyalty has become an enormous issue for the banking industry as a result of product monotony [8]. To enhance their client interactions, banks employ a variety of ICT techniques [2]. One such issue is the development of E-CRM. E-CRM has been adopted by banks as a means of surviving in such a volatile market environment as well as gaining an advantage over rivals [9]. Banks must change their existing approach into an all-channel strategy that uses the Internet, the web, or physical branches due to the rapid rise of digital banking [10]. As a result, banks provide a variety of digital goods, such as self-service technology, mobile banking, internet banking, telebanking, and so forth [11]. Across a variety of service industries, it has been scientifically demonstrated that service quality is a significant predictor of customer satisfaction [12]. The banking sector is the subject of this study. The banking sector is a subset of financial services, which are the main engine of economic growth [13], hence that was the initial factor in choosing this sector. Banks are regarded as relevant to the market and the global economy since they are a conventional service industry, and individuals and businesses rely heavily on them for their services [14].

E-CRM has a large positive association with customer satisfaction, which leads to more satisfied consumers and positive word-of-mouth, according to numerous research studies conducted in the past, in addition, they postulated that effective implementation of ECRM tools would enhance and build long-lasting relationships with the customers which would lead to a profitable customer base [15];[16];[17];[18];[2];[20];[21];[22];[23];[24].

Some of researches used Structural equation model (SEM) through Smart PLS software to study relationship between ECRM and

*1* 3 Business Information Systems Department, Faculty of Commerce and Business Administration, Helwan University, Helwan, Cairo, Egypt,

Shymaa.Mohamed21@commerce.helwan.edu.eg,  
engy\_yehia@commerce.helwan.edu.eg

*2* Information Systems Department, Faculty of Computers and Artificial Intelligence, Helwan University, Helwan, Cairo, Egypt, mohamedmarie71@gmail.com

other factors [1];[18];[24];[25];[26];[27];[28];[29];[30];[31].some of them used Structural equation model (SEM) through AMOS software such as [2];[19];[32];[33];[34];[35];[36];[37];[38], and other researchers used multiple regression analysis such as [26];[39];[40];[41].This research aims to understand the role that E-CRM plays in the banking industry and how it affects customer loyalty, customer satisfaction, service quality and trust. The objectives of the present study are: (a) to explore the dimensions of E-CRM in context of banking industry; (b) to propose a research model showing relationship between E-CRM and customer loyalty, customer satisfaction, service quality and trust. in the banking industry, (c) testing hypotheses to choose the best model to enhance E-CRM system.

## 2. Research Model and Hypothesis

E-CRM is becoming commonplace in many industries. Banks use a variety of E-CRM systems to better connect with their clients and offer them convenient one-stop shopping. These tools include ATMs, debit/credit cards, online banking, mobile banking, electronic financial transfers, and more [42]. Due to their considerable effects on a company's financial performance, service quality and e-service quality have recently emerged as two of the most crucial marketing study fields [28]. The main way that satisfaction has been defined is as the outcome of a comparison between the performance that was given and what the consumer anticipated. When a person compares his expectations with the delivered goods, outputs, and perceived performance, he or she is said to be satisfied [3]. Several academics contend that through fostering online trust, service providers give their clients the impression that they would take all reasonable steps to secure their transactions and guard them against future inconveniences [43];[44]. In the modern marketplace, businesses succeed when their customers are devoted to them and help them gain a competitive advantage. By integrating E-CRM into their whole procedure, banks can quickly increase their customer base [45]. In our earlier previous work, a literature review was conducted to examine the relationship between E-CRM system and other factors and based on the study results, we hypothesized that there is a relationship between E-CRM and its dimensions (technology support, knowledge management and online communication) and service quality, customer satisfaction, loyalty, and trust. Accordingly, the research model was proposed with five hypotheses as following:

H1: The Electronic Customer Relationship Management System (E-CRM) is positively affected by the improvement of technology support (TS), online communications (OC), and knowledge management (KM).

H2: Service Quality is positively influenced by E-CRM.

H3: Customer satisfaction is positively influenced by E-CRM.

H4: Trust is positively influenced by E-CRM.

H5: Customer Loyalty is positively influenced by E-CRM.

## 3. Material and Methods and Hypothesis

There are several stages to the analysis of this study. The instrument's reliability was tested as the first step. To establish the accuracy of each item, a Partial Least Squares (PLS) analysis was conducted. The hypothesis was tested using the Structural Equation Modelling Model (SEM). The approaches and materials employed, as well as the experimental methodology, dataset

description, and method is all included in this section. This study verified the formulated research model using PLS-SEM. An assessment model based on two structural and measurement models was used for the data analysis. The primary justification for using PLS-SEM in this study is that it offers a simultaneous analysis procedure for both the measurement data and the structural model, improving the accuracy of the findings [46];[47]. Second, PLS-SEM is very efficient for analyzing complicated models [48]. Third, PLS-SEM does not necessitate fragmenting the model; instead, the entire model is analyzed [49]. Finally, PLS-SEM performs simultaneous evaluations of the measurement model and the structural model, increasing estimation accuracy [50].The associations between the independent and dependent variables were measured using structural equation modelling, which was also utilized to study the interaction effects and pathways between variables and help provide additional insight into causal models. The analysis of this study was done using the statistical package for social sciences (SPSS V26) for both descriptive and inferential statistics, and (SmartPLS 3.2.7) for SEM-PLS modelling.

### 3.1 Data Set Description

Our dataset included in this research, was collected from an online questionnaire prepared and sent to customers used E-CRM system in the banking sector in Egypt. The questions were created using instrument items used in earlier study on the components of E-CRM. Each item employed a five-point Likert scale, with 1 denoting severe disagreement and 5 denoting complete agreement. The independent variable is E-CRM, it is constituting three dimensions namely, technology Support (4 items), online communication (4 items) and knowledge management (4 items) but the dependent variables is customer loyalty (4 items), service quality (4 items), customer satisfaction (4 items) and trust (4 items).

### 3.2 Demographic Information of the respondents

The sample demonstrates the responses collected from banking customers which were 205 in total. The demographic profiles of the respondents are shown in Table 1. There are 89 (43.4%) male respondents and 116 (56.6%) female respondents. In terms of age, the results showed that the age of respondents that ranged less than 30 years are 52 (25.4%); between 30 to 40 years are 81 (39.5%); between 41 to 50 years are 51 (24.9%); between 51 to 60 years are 15 (7.3%) and above 60 years is 6 (2.9%) respondents. In terms of Educational Level, it can be observed that 1 (0.5%) respondent have completed No Education; 9 (4.4%) respondents have completed High school; 9 (4.4%) respondents have completed High school ;55 (26.8) respondents have completed post-graduate; In terms of Do you have bank accounts in an Egyptian bank?, 158(77.1%) respondents are yes and47(22.9%) respondents are no; in terms of Which E- Banking services you use than more others?126 (61.5%) respondents are using ATM ; 13(6.3 %) respondents are Use internet of electronic banking services ; 66(32.2 %) respondents are Use internet of electronic banking services and ATM. Finally, in terms of to what extend you use e-banking services in your banking transactions, 62(30.2%) respondents are at a little rate; 94(54.9 %) respondents are at an average rate; 49(23.9 %) respondents are at a high rate.

**Table 1. Demographic information of respondents**

Variable	Category	Frequency	Percentage (%)
Gender	Male	89	43.4
	Female	116	56.6
Age	Less than 30	52	25.4
	From 30 to 40	81	39.5
	From 41 to 51	51	24.9
	From 51 to 60	15	7.3
	More than 60	6	2.9
Educational Level	No Education	1	0.5
	High school	9	4.4
	College	55	26.8
Having bank accounts	Postgraduate	140	68.3
	Yes	158	77.1
E- Banking services used	No	47	22.9
	ATM	126	61.5
Times of using of e-banking services	E-banking services	13	6.3
	All of that	66	32.2
Times of using of e-banking services	At a little rate.	62	30.2
	At an average rate.	94	45.9
	At a high rate	49	23.9

### 3.3 Reliability analysis

In order to measure the reliability of each item, Cronbach's Alpha was used. Cronbach's alpha reliability test is illustrated in table 2. E-CRM has 3 dimensions i.e., Technology support has 4 items ( $\alpha=0.851$ ); Online communication has 4 items ( $\alpha=0.797$ ); Knowledge management has 4 items ( $\alpha=0.864$ ). Customer loyalty has 4 items ( $\alpha=0.854$ ). Customer satisfaction has 4 items ( $\alpha=0.844$ ). Service Quality has 4 items ( $\alpha=0.842$ ). Trust has 4 items ( $\alpha=0.805$ ). Cronbach's alpha more than 0.7 is considered acceptable [51]. Since all the items have Cronbach's alpha value of more than 0.7 (Table 2), therefore, this instrument is reliable for the study.

**Table 2. Reliability analysis**

Variables	No. of Item	Cronbach's Alpha
Technology support	4	0.851
Online communication	4	0.797
Knowledge management	4	0.864
Customer loyalty	4	0.854
Customer satisfaction	4	0.844
Service Quality	4	0.842
Trust	4	0.805

## 4. Results and Discussions

### 4.1 Descriptive Statistics

Before examining the impact of E-CRM, the descriptive statistics (i.e., mean, and standard deviation) of all the dimensions of E-CRM, service quality, customer satisfaction, trust and customer loyalty has been calculated in table 3. In the case of E-CRM dimensions, it is observed from the table that Knowledge

management have the highest mean score of 3.681, stating that most of the respondents consider customized products/ services to be responsible for the success of E-CRM in the banking industry. The standard deviation for customized products/ services is 0.65. The means are closely followed by Online communication (mean= 3.54, S.D= 0.689); and Technology support (mean= 3.4, S.D= 0.815); whereas, customer loyalty (mean= 3.4, S.D= 0.815); customer satisfaction (mean= 3.41, S.D= 0.827); service quality (mean= 3.5, S.D= 0.750) and trust (mean= 3.54, S.D= 0.706).

**Table 3. Descriptive Statistics**

Variables	Mean	Standard Deviation
Technology support	3.4	0.815
Online communication	3.54	0.689
Knowledge management	3.681	0.65
Customer loyalty	3.68	0.788
Customer satisfaction	3.41	0.827
Service Quality	3.5	0.750
Trust	3.54	0.706

A Correlation between the variables is computed using Pearson's correlation analysis. The results are shown in table 4. The results reveal that all the variables are statistically correlated to each other at a significance level of 0.01, thereby, indicating that all the variables are positively related to each other.

**Table 4. correlation analysis**

Variables	TS	OC	KM	E-CRM	SQ	CS	Trust	CL
TS	1	.651**	.583**	.887**	.431**	.649**	.579**	.189**
OC		1	.551**	.852**	.491**	.659**	.527**	.236**
KM			1	.824**	.516**	.544**	.451**	.110
E-CRM				1	.557**	.723**	.611**	.209**
SQ					1	.545**	.393**	.426**
CS						1	.583**	.130
Trust							1	.080
CL								1

### 4.2 Measurement Model Assessment

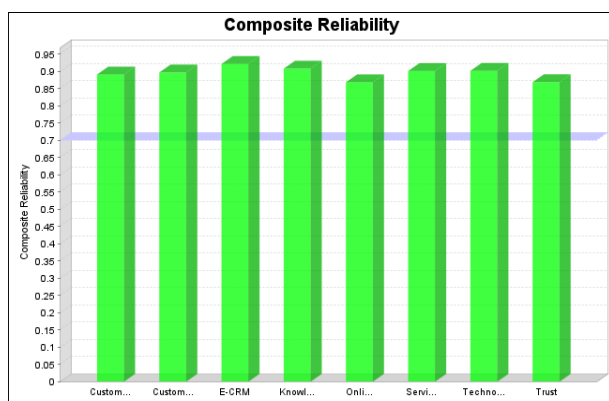
In order to test hypotheses to forecast relationships in the inner model, the outer model testing should be performed first to verify indicators and latent variables that can be tested further which means, evaluating the internal consistency reliability, convergent validity, and discriminant validity. The structural model will be evaluated after the measurement model's validity and reliability have been proven. The measurement model's validity and reliability are covered in the following sections. To determine whether all of the indicators linked to a construct are truly measuring it, the internal consistency reliability is examined. The internal consistency can be evaluated in a variety of methods. The most popular statistical measure for this purpose is Cronbach's alpha. Researchers are recommended to explore alternative measures of internal consistency such composite dependability because Cronbach's alpha has some limitations. When measuring internal consistency, composite reliability takes into account the fact that each indicator has a unique outer loading. Following the previous rules, the reliability of each construct was assessed. The results in table 5 show that all constructs had a composite reliability score of more than 0.70 [52].

The average variance extracted (AVE) and the outer loadings of the items are typically used to assess the convergent validity of reflective measurement models. The AVE of a construct should be 0.50 or greater to be considered significant. Following the previous guide, the convergent validity through AVE was established as shown in table 5. The average of AVE for dependent variables namely, CL, CS, SQ and TR is 0.67.

Figure 2 presents the results of the composite reliability. These results demonstrate the constructs' excellent dependability and adequate internal consistency.

**Table 5. Internal reliability and convergent validity of the research model**

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
TS	0.854	0.901	0.695
OC	0.798	0.868	0.623
KM	0.865	0.907	0.709
<b>Dependent Variables</b>			
SQ	0.854	0.901	0.695
CS	0.846	0.897	0.686
TR	0.803	0.869	0.628
CL	0.839	0.891	0.672



**Fig.1.** Composite reliability of the research model

Based on the table 6, Item loading is another measure of reliability, the minimum significant outer loadings required is 0.70 [52]. However, the authors recommended that if the outer loading is between 0.4-0.7; we should examine the effect of indicator deletion on internal consistency reliability. If deletion does not rise measure(s) above threshold, we should retain the reflective indicator. One item (TR2) was removed because they're below the threshold of 0.4, and all other items were retained.

**Table 6. Item Loading of the research model**

Items	CL	CS	KM	OC	SQ	TS	TR
CL1	0.765	0.187	0.103	0.282	0.345	0.191	0.073
CL2	0.840	0.059	0.028	0.161	0.333	0.130	0.021
CL3	0.878	0.112	0.140	0.213	0.385	0.146	0.101
CL4	0.792	0.074	0.097	0.133	0.336	0.172	0.080
CS1	0.126	0.802	0.550	0.574	0.537	0.486	0.536
CS2	0.099	0.898	0.540	0.653	0.543	0.560	0.537
CS3	0.115	0.765	0.290	0.480	0.352	0.467	0.439
CS4	0.142	0.841	0.462	0.498	0.411	0.609	0.530
KM1	0.167	0.580	0.860	0.570	0.582	0.555	0.486
KM2	0.169	0.554	0.861	0.435	0.460	0.542	0.487

KM3	-0.008	0.412	0.852	0.489	0.352	0.469	0.365
KM4	0.065	0.345	0.798	0.379	0.343	0.411	0.234
CO1	0.133	0.482	0.368	0.781	0.298	0.419	0.332
CO2	0.225	0.566	0.410	0.824	0.399	0.538	0.524
CO3	0.224	0.500	0.394	0.729	0.404	0.542	0.470
CO4	0.215	0.562	0.575	0.820	0.461	0.555	0.445
SQ1	0.348	0.461	0.431	0.441	0.852	0.401	0.341
<b>SQ2</b>	0.432	0.458	0.366	0.381	<b>0.857</b>	0.381	0.338
<b>SQ3</b>	0.344	0.540	0.491	0.482	<b>0.848</b>	0.439	0.380
<b>SQ4</b>	0.320	0.404	0.445	0.339	<b>0.775</b>	0.220	0.300
<b>TS1</b>	0.167	0.604	0.466	0.552	0.380	<b>0.832</b>	0.519
<b>TS2</b>	0.171	0.434	0.480	0.509	0.337	<b>0.816</b>	0.439
<b>TS3</b>	0.118	0.588	0.455	0.529	0.332	<b>0.827</b>	0.550
<b>TS4</b>	0.209	0.520	0.564	0.589	0.422	<b>0.860</b>	0.461
<b>TR1</b>	0.052	0.607	0.390	0.581	0.381	0.507	<b>0.834</b>
<b>TR2</b>	0.060	0.219	0.201	0.147	0.180	0.287	<b>0.583</b>
<b>TR3</b>	0.034	0.420	0.346	0.409	0.292	0.451	<b>0.844</b>
<b>TR4</b>	0.127	0.594	0.493	0.516	0.389	0.560	<b>0.874</b>

The Knowledge management indicator has the strongest loading factor value (0.847) of the other indicators, making it the most reliable at explaining E-CRM actions. After establishing the convergent validity, we examined the discriminant validity. A construct's discriminant validity is determined by how much it differs from other constructs. Fornell-Larcker criterion is typically used to establish discriminant validity. The square root of AVE is compared to the correlations of the construct when employing the Fornell-Larcker criterion. The correlations between the construct and other constructs should all be lower than the square root of the construct's AVE. The results of the Fornell-Larcker criterion in the table 7 confirm the discriminant validity [52]. That is, by using the Fornell-Larcker Criterion method, it has been demonstrated that each variable satisfies the criteria for discriminant validity.

**Table 7. Fornell-Larcker criterion of the research model**

Construct	CL	CS	KM	OC	SQ	TS	TR
CL	0.820						
CS	0.145	0.828					
KM	0.120	0.568	0.843				
OC	0.255	0.671	0.561	0.789			
SQ	0.432	0.564	0.522	0.500	0.834		
TS	0.200	0.643	0.591	0.654	0.442	0.834	
TR	0.089	0.620	0.474	0.564	0.411	0.589	0.792

### 4.3 Structural Model Assessment

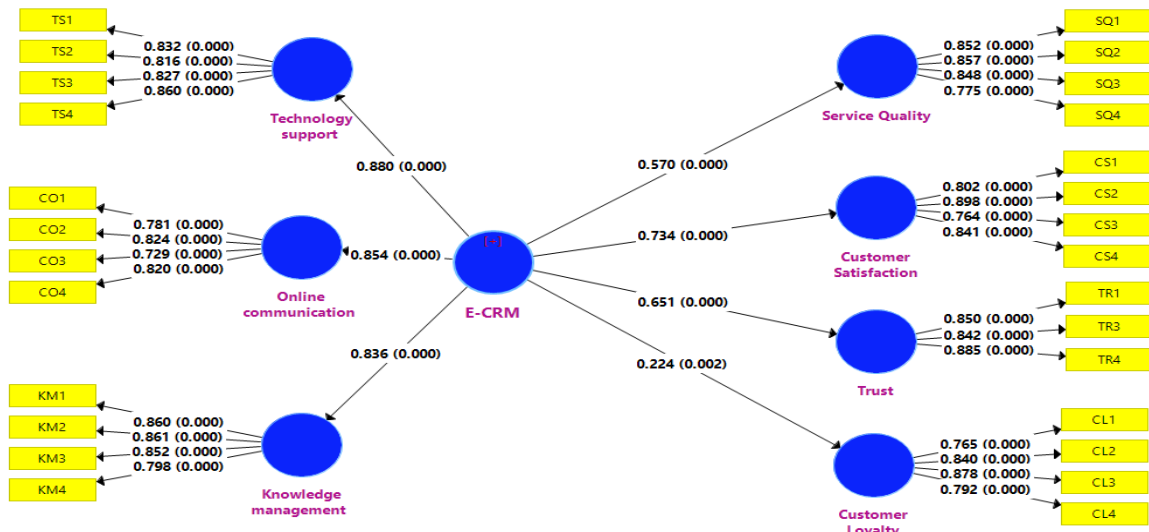
In this section, the structural model will be evaluated after determining the validity and reliability of the measurement models. Guidelines for assessing and reporting the structural model were supplied by researchers in the following subsections, including path coefficients, coefficient of determination (R<sup>2</sup>), effect size (f<sup>2</sup>), predictive relevance (Q<sup>2</sup>), and goodness of fit (GoF) index.

a) Path coefficients: Path coefficients refer to the evaluations of the connections between the model's constructs [53]. Those coefficients are in the range of +1 to -1, with +1 denoting a significantly positive correlation, 0 denoting a weak or nonexistent relationship, and -1 denoting a significant negative relationship. Figure 3 displays the estimated model together with the associated p-values and the predicted path coefficients for the major hypotheses. According to the research model, the results of the hypotheses, in table 8, show that; *Technology Support*, *Online Communications*, and *Knowledge Management (KM)* have a statistically significant on E-CRM, so *H1* is accepted, E-CRM has a statistically significant on Customer Loyalty, since ( $\beta = 0.224, P < 0.002$ ), so *H2* is accepted. But E-CRM has a statistically significant on Customer Satisfaction since ( $\beta = 0.734, P < 0.000$ ), so *H3* is accepted. Also, E-CRM has a statistically significant positive effect on, Service Quality since ( $\beta = 0.570, P < 0.000$ ), and Trust, ( $\beta = 0.651, P < 0.000$ ), so *H4* and *H5* is accepted.

E-CRM -> CS	0.734	19.106	0.000	0.653	0.804
E-CRM -> SQ	0.570	8.665	0.000	0.443	0.696
E-CRM -> TR	0.651	11.608	0.000	0.541	0.754

**Table 8.** Hypothesis testing of the research model.

Path	$\beta$	t-value	P.value	95% CI	
				LL	UL
TS	0.880	44.802	0.000	0.839	0.915
OC → E-CRM	0.854	35.105	0.000	0.803	0.900
KM	0.836	28.713	0.000	0.770	0.886
E-CRM -> CL	0.224	3.169	0.002	0.109	0.384



**Fig.2.** Structure equation of the research model

b) Coefficient of determination ( $R^2$ ): Coefficient of determination ( $R^2$ ) refers to the impact of independent variables on the dependent latent variables, which is one of the structural model's quality indicators [53]. The  $f^2$  effect size measures the impact an exogenous construct would have on the endogenous construct if it were removed from the model. [54] suggested that  $R^2$  with 0.19, 0.33, or 0.67 are low, moderate, or high, respectively. Furthermore, the adjusted  $R^2$  values are useful in evaluating the quality of various models or comparing the model across various contexts [55]. The results were reported in table 9 and show small variations in the endogenous variables were explained by the variations in the exogenous variables. A construct is considered to have a small effect if its  $f^2$  value is between 0.02 and 0.14, while it is thought to have a medium impact if its  $f^2$

value is between 0.15 and 0.34, and a large impact if its  $f^2$  value  $\geq 0.35$ .

**Table 9.** R Square and Associated R Square Adjusted of the research model

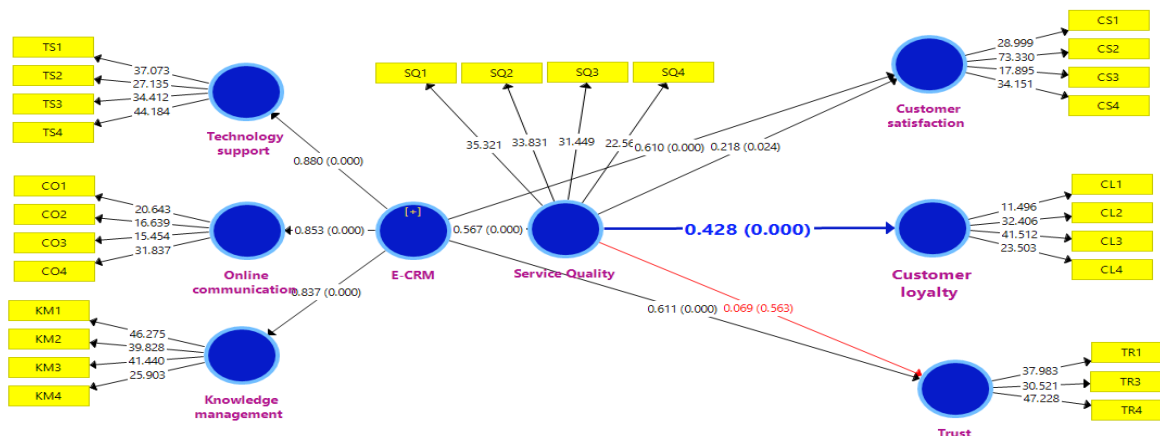
Path	R Square	R Square Adjusted	F Square	Effect Size
E-CRM -> CL	0.016	0.050	0.053	VeryWeak effect
E-CRM -> CS	0.539	0.538	1.166	Strong
E-CRM -> SQ	0.625	0.325	0.481	Strong
E-CRM -> TR	0.424	0.405	0.681	Strong

A construct with an  $f^2$  value  $< 0.02$  means it has no effect on the endogenous construct [48]. Table 9 presents the  $f^2$  effect size of the constructs. The results illustrate that some constructs have no effect on the model, while the other have small effect size. The average of R Square for dependent variables namely, CL, CS, SQ, and TR is 0.401 which means the effect of the E-CRM variable on the dependent latent variables is 40%. Based on the calculation results in a table 9, only the effect of E-CRM on customer loyalty has a weak influence in the structural model, whereas the complete path of influence between exogenous and endogenous factors has a significant influence.

b) Predictive Relevance ( $Q^2$ ):  $Q^2$  value determines the model's out-of-sample predictive power. A model may accurately forecast data that was not utilized in the model estimation when it is said to have predictive power or predictive relevance. An endogenous construct's  $Q^2$  value that is greater than 0 indicates the model's predictive relevance for this construct [48]. The Sum of squares of observations (SSO) is equal to the number of observations. Every observation is a scaled deviation from the mean (scaled by the standard deviation). Therefore, the SSO represents the mean value prediction. In contrast, the sum of squares error (SSE) is the prediction error when using the model prediction. Table 10 presents the  $Q^2$  values obtained from the analysis. The values of  $Q^2$  are higher than 0, so it can be safely concluded that the research model's predictive relevance is high except Customer loyalty.

**Table 10. Predictive Relevance of research model**

Construct	SSO	SSE	$Q^2 (=1-SSE/SSO)$
Customer loyalty	820.000	797.490	0.027



**Fig.3.** Structural equation of the enhanced model

### 5.1. The Enhanced Model 1

In the enhanced model 1, we take service quality as a mediator to enhance the effect of E-CRM on customer loyalty. This is illustrated in the figure 4. As shown in Table 11, Cronbach's Alpha of: Service Quality (0.854), for customer Satisfaction (0.846), for trust (0.824) and for Customer Loyalty (0.839), which are in acceptable range. As far the requirement of the Structural Equation Modelling, the average variance extracted for all constructs is higher than 0.5 which indicates a strong construct to create a statistical relationship. The findings of Composite Reliability provide evidence of the high reliability and sufficient internal consistency of the constructs.

Construct	820.000	524.780	0.360
Customer satisfaction	820.000	646.094	0.212
Service Quality	615.000	428.768	0.303

c) Goodness of Fit (GOF): [56], introduced the Goodness of Fit as a global fit indicator; it is the geometric mean of the average  $R^2$  the average variance extracted of the endogenous variables. The GoF index is determined as follows:

$$GOF = \sqrt{R^2 \times AVE} = \sqrt{0.401 \times 0.67} = 0.518.$$

The GOF criteria determine whether GoF values are unacceptable (less than 0.1), low (between 0.1 and 0.25), medium (between 0.25 and 0.36), or strong (between 0.25 and 0.36) to be recognized as a globally adequate PLS model. According to these criteria, and the value of the Gof is (0.518), it can be safely concluded that the Gof model is large enough to be considered as sufficient valid global PLS model. The result of the research model proved that there is very weak impact between ECRM and customer loyalty Therefore, the model should be enhanced as we will illustrate in the following section.

### 5. Enhancement of the Proposed Research Model

The result of the research model proved that there is very weak effect between ECRM and customer loyalty Therefore, the enhanced model 1 and the enhanced model 2 were proposed through two phases to improve the results of the research model.

**Table 11. Construct Reliability and Validity of the enhanced model 1**

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
TS	0.854	0.901	0.696
OC	0.798	0.868	0.623
KM	0.865	0.908	0.711
Mediator			
SQ	0.854	0.901	0.696
Dependent Variables			
CS	0.846	0.897	0.685
TR	0.824	0.894	0.738
CL	0.839	0.894	0.679



The recent trend of SEM, Fornell-Larcker criterion were conducted to determine the discriminant validity and found that, the square roots of AVE (on the main diagonal), all components are greater than the correlation between them.

**Table 12. Fornell-Larcker criterion of the enhanced model 1**

Construct	CL	CS	KM	OC	SQ	TS	TR
CL	0.824						
CS	0.132	0.828					
KM	0.114	0.570	0.843				
OC	0.241	0.672	0.560	0.789			
SQ	0.428	0.564	0.520	0.497	0.834		
TS	0.194	0.642	0.590	0.654	0.439	0.834	
TR	0.083	0.639	0.483	0.591	0.416	0.593	0.859

The results of the hypotheses and the direct effect of exogenous variables on endogenous are presented in table 13. E-CRM with  $\beta = (0.567, p = 0.000)$  has significant effect on Service Quality, and Service Quality with  $\beta = (0.0218 \text{ and } 0.428), p = (0.000 \text{ and } 0.000)$  have positive effect on Customer Satisfaction and Customer Loyalty. But has not effect on Trust.

**Table 13. Hypothesis testing of the enhanced model 1**

Path	$\beta$	t-value	P-value	95% CI	
				LL	UL
E-CRM -> SQ	0.567	7.964	0.000	0.397	0.682
SQ -> CS	0.218	2.363	0.018	0.049	0.393
SQ -> TR	0.069	0.594	0.553	-0.142	0.311
SQ -> CL	0.428	5.392	0.000	0.256	0.574

**Table 14. R Square and Associated R Square Adjusted of the enhanced model 1**

Path	R Square	R Square Adjusted	Effect Size
E-CRM -->SQ-> CL	0.183	0.179	Enhanced

The proposed model indicates that improving E-CRM systems positively affects customer satisfaction and loyalty when quality is put as a mediator for them, specifically this improvement appears in the customer satisfaction variable. We did not notice any change in the trust variable between the proposed model and the enhanced model 1. Table 14 confirming these results where the R square of customer loyalty in the proposed model is (1.6%) but in the enhanced model 1 is (18%). This difference can be seen strongly, and it can be noticed that the average of R Square for dependent variables namely, CL, CS, SQ, and TR is 0.375. Based on the results of Table 15 the value of Q2 for customer loyalty is %12 within the enhanced model 1 which is 11.5 more than the proposed model, which indicates that the enhanced model 1 is more efficient than the proposed model, this means that it increases customer satisfaction improvement.

**Table 15. Predictive Relevance of the enhanced model 1**

Construct	SSO	SSE	Q <sup>2</sup> (=1-SSE/SSO)
Customer loyalty	820.000	724.027	0.117
Customer satisfaction	820.000	508.794	0.380
Service Quality	820.000	646.379	0.212
Trust	615.000	429.819	0.301

The GoF index is determined as follows:

$$GOF = \sqrt{R^2 \times AVE} = \sqrt{0.375 \times 0.70} = 0.52.$$

Therefore, compared to the base values described above, it can be said that the enhanced model 1 performs adequately. As a result, the model's structure and data are consistent with one another.

## 5.2. The Enhanced Model 2

The enhanced model 1 indicates that enhancing E-CRM systems positively affects customer satisfaction and loyalty when quality is put as a mediator for them, specifically this improvement appears in the customer satisfaction variable. We did not notice any change in the trust variable between the proposed model and second the enhanced model 1. So, we suggest the enhanced model 2 to enhance the trust variable. This is illustrated in figure 5. As shown in table 16, Cronbach's Alpha of Customer Loyalty (0.864), which are in acceptable range. Also, the results of the composite reliability provide evidence of the high reliability and sufficient internal consistency of the constructs.

**Table 16: Construct Reliability and Validity of the enhanced model 2**

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
SQ	0.854	0.901	0.696
CS	0.846	0.897	0.685
TR	0.803	0.868	0.627
CL	0.839	0.894	0.679

The average variance retrieved for all constructs is more than 0.5, which is required by structural equation modelling and identifies a strong construct to establish a statistical link. The recent trend of SEM, Fornell-Larcker criterion (see, table 17) were conducted to indicate the discriminant validity and found that, the square roots of AVE (on the main diagonal), all components are greater than the correlation between them.

**Table 17. Fornell-Larcker criterion of the enhanced model 2**

Construct	CL	CS	KM	OC	SQ	TS	TR
CL	0.824						
CS	0.132	0.828					
KM	0.114	0.570	0.843				
OC	0.241	0.672	0.560	0.789			
SQ	0.428	0.564	0.520	0.497	0.834		
TS	0.194	0.642	0.590	0.654	0.439	0.834	
TR	0.083	0.639	0.483	0.591	0.416	0.593	0.859

The enhanced model 2's structural model is illustrated in Figure 5's diagram. The model's T-values demonstrate a high degree of construct efficiency. Positively significant correlation exists between the independent and dependent variables. Following in

table 18 shows the result of indirect effect of structural model of this model. Under the enhanced model 2, the results of the hypotheses, as shown in Table 18, the direct effect and indirect effect of exogenous variables on endogenous are presented. Trust with  $\beta = 0.267$ ,  $p = 0.000$  has significant effect on Customer Satisfaction, and Customer Satisfaction with  $\beta = -0.193$  and  $p = 0.000$  have negative effect on Customer loyalty.

**Table 18. Hypothesis testing of the enhanced model 2**

Path	$\beta$	t-value	P.value	95% CI	
				LL	UL
E-CRM -> CS	0.464	4.912	0.000	0.304	0.660
E-CRM -> SQ	0.567	7.937	0.000	0.421	0.682
E-CRM -> TR	0.638	11.746	0.000	0.530	0.737
SQ -> CL	0.428	5.464	0.000	0.261	0.566
SQ -> CS	0.200	2.506	0.013	0.051	0.361
TR -> CS	0.245	3.215	0.001	0.090	0.396

**Table 19: R Square and Associated R Square Adjusted of the enhanced model 2**

Track	R Square	R Square Adjusted	Effect Size
CL	0.183	0.179	Enhanced
CS	0.606	0.600	Enhanced
SQ	0.321	0.318	Enhanced
TR	0.408	0.405	Enhanced

The enhanced model 2 indicates that improving E-CRM systems positively affects customer satisfaction and loyalty when quality is put as a mediator for them, specifically this improvement appears in the customer satisfaction variable. We did not notice any change in the confidence variable between the proposed model and enhanced model 1. Table 19 confirming these results where the R square of customer loyalty in proposed model is (1.6%) but in the enhanced model 2 is (18.5%). This difference can be seen strongly when and it can be noticed that the average of R Square for dependent variables namely, CL, CS, SQ, and TR is 0.3795. Based on the results of table 20, the value of Q2 for customer loyalty is 13.8% within the enhanced model 2 which is 11.7 more than the proposed model, which indicates that the enhanced model 2 is

more efficient than the proposed model, this means that it increases customer satisfaction improvement.

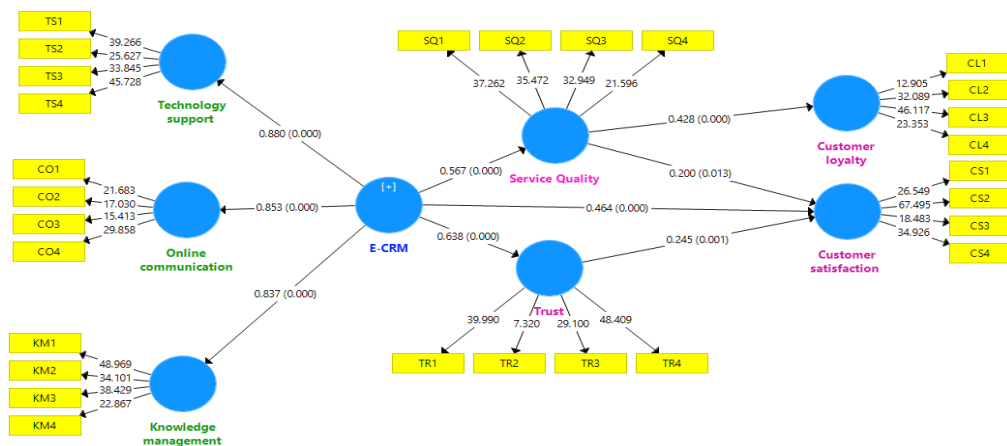
**Table 20. Predictive Relevance of the enhanced model 2**

Construct	SSO	SSE	Q <sup>2</sup> (=1-SSE/SSO)
Customer loyalty	820.000	723.927	0.117
Customer satisfaction	820.000	490.109	0.402
Service Quality	820.000	646.411	0.212
Trust	820.000	623.617	0.239

The GoF index is determined as follows:

$$GoF = \sqrt{R^2 \times AVE} = \sqrt{0.3795 \times 0.6718} = 0.50.$$

Therefore, compared to the base values described above, it can be said that the enhanced model 2 works well. As a result, the model's structure and data are consistent with one another. The enhanced model 2 determines that enhancing E-CRM systems positively affects customer satisfaction and loyalty when quality and trust are put as a mediator for them, specifically this improvement appears in the customer satisfaction variable.



**Fig.4. Structural Model of the enhanced model 2**



## 5. Conclusion

Strong web-based technology and internet accessibility will contribute to an increase in business quality that will ultimately satisfy customers and end users. Customers now want to communicate with service providers online, thus many businesses are converting their traditional operations into online stores to better serve their clients. Customers are the foundation of any business. According to consumer demand, E-CRM will assist and offer a wide range of services, opening possibilities for further business expansion. These businesses could acquire an edge over rival companies in the marketplace. Understanding the effects of E-CRM on customer loyalty, customer happiness, service quality, and trust in the banking industry was the driving force for this research. Customers of banks who used e-CRM services filled out questionnaires for this purpose. Partial Least Squares Structural Equation Modeling (PLS-SEM) was utilized to evaluate the study model using the data that were collected through a survey. The initial findings of the research model showed that E-CRM had a significant impact on service quality, customer happiness, and trust but very little on customer loyalty. The results of our enhanced two-phased extension of the study model demonstrated that improving E-CRM systems has a beneficial impact on customer satisfaction and loyalty when quality and trust are used as a mediator for those outcomes. Therefore, this study summarizes that: E-CRM has a positive and significant direct impact on customer satisfaction. E-CRM has a direct and positive impact on service quality. E-CRM has a positive and significant direct effect on trust. E-CRM has a positive and significant indirect effect on loyalty through service quality.

## 6. References

- [1] Dehghanpouri, H., Soltani, Z., & Rostamzadeh, R. (2020). The impact of trust, privacy and quality of service on the success of E-CRM: the mediating role of customer satisfaction. *Journal of business & industrial marketing*.
- [2] Al-Dmour, H. H., Algharabat, R. S., Khawaja, R., & Al-Dmour, R. H. (2019). Investigating the impact of ECRM success factors on business performance: Jordanian commercial banks. *Asia Pacific Journal of Marketing and Logistics*.
- [3] Kotler, P., & Armstrong, G. (2017). *Principles of Marketing*. New Jersey: Pearson Education, Inc.
- [4] Herman, L. E., Sulhaini, S., & Farida, N. (2021). Electronic customer relationship management and company performance: Exploring the product innovativeness development. *Journal of Relationship Marketing*, 20(1), 1-19.
- [5] Priya, R., Gandhi, A. V., & Shaikh, A. (2018). Mobile banking adoption in an emerging economy: An empirical analysis of young Indian consumers. *Benchmarking: An International Journal*.
- [6] Al-Abdullat, B. M., & Dababneh, A. (2018). The mediating effect of job satisfaction on the relationship between organizational culture and knowledge management in Jordanian banking sector. *Benchmarking: An International Journal*.
- [7] Kwateng, K. O., Osei-Wusu, E. E., & Amanor, K. (2019). Exploring the effect of online banking on bank performance using data envelopment analysis. *Benchmarking: An International Journal*.
- [8] Sarmah, B., & Rahman, Z. (2018). Customer co-creation in hotel service innovation: an interpretive structural modeling and MICMAC analysis approach. *Benchmarking: An International Journal*, 25(1), 297-318.
- [9] Yamuna, G. (2020), "A study on the customer satisfaction among the users of online banking services", *International Journal of Advanced Science and Technology*, Vol. 29 No. 4, pp. 647-653.
- [10] Report Linker (2020), *Digital Payments Market - Growth, Trends, Forecasts (2020 - 2025)*, Globe Newswire News Room, 3 June, available at: <http://www.globenewswire.com/news-release/2020/06/03/2043142/0/en/Digital-Payments-Market-Growth-Trends-Forecasts-2020-2025.html>.
- [11] Mathew, S., Jose, A., Rejikumar, G., & Chacko, D. P. (2020). Examining the relationship between e-service recovery quality and e-service recovery satisfaction moderated by perceived justice in the banking context. *Benchmarking: An International Journal*.
- [12] Ismail, A., & Yunan, Y. M. (2016). Service quality as a predictor of customer satisfaction and customer loyalty. *LogForum*, 12(4), 269-283.
- [13] Dharnija, P., Gupta, S., & Bag, S. (2019). Measuring of job satisfaction: the use of quality of work life factors. *Benchmarking: An International Journal*.
- [14] Milan, G. S., Slongo, L. A., Eberle, L., De Toni, D., & Bebbler, S. (2018). Determinants of customer loyalty: a study with customers of a Brazilian bank. *Benchmarking: An International Journal*.
- [15] Bataineh, A. Q. (2015). The Effect of eCRM Practices on eWOM on Banks' SNSs: The Mediating Role of Customer Satisfaction. *International Business Research*, 8(5), 230.
- [16] Kaur, J., & Kaur, B. (2016). The influence of e-CRM competitive advantage on e-CRM performance in the Indian banking industry. *Strategic Change*, 25(5), 537-550.
- [17] Mang'anyi, E. E., Khabala, O. T., & Govender, K. K. (2018). Bank customer loyalty and satisfaction: the influence of virtual e-CRM. *African Journal of Economic and Management Studies*.
- [18] Mulyono, H., & Situmorang, S. H. (2018). E-CRM and loyalty: A mediation Effect of Customer Experience and satisfaction in online transportation of Indonesia. *Academic journal of Economic studies*, 4(3), 96-105.
- [19] Rashwan, H. H. M., Mansi, A. L. M., & Hassan, H. E. (2019). The impact of the E-CRM (expected security and convenience of website design) on E-loyalty field study on commercial banks. *Journal of Business and Retail Management Research*, 14(1).
- [20] Upadhyaya, M. (2020). Analysis of E-CRM, service quality and brand trust relationship with student satisfaction. *Humanities & Social Sciences Reviews*, 8(1), 227-232.
- [21] Alnawas, I., & Hemsley-Brown, J. (2019). Examining the key dimensions of customer experience quality in the hotel industry. *Journal of Hospitality Marketing & Management*, 28(7), 833-861.
- [22] Nunkoo, R., Teeroovengadum, V., Ringle, C. M., & Sunnassee, V. (2020). Service quality and customer satisfaction: The moderating effects of hotel star rating. *International Journal of Hospitality Management*, 91, 102414.
- [23] Oh, H., & Kim, K. (2017). Customer satisfaction, service quality, and customer value: years 2000-2015. *International Journal of Contemporary Hospitality Management*.
- [24] Boonlertvanich, K. (2019). Service quality, satisfaction, trust, and loyalty: the moderating role of main-bank and wealth status. *International Journal of Bank Marketing*.
- [25] Aulia K., Zakaria W., Muchsin S. & Diah N. (2022) The Effect of E-CRM on Customer Loyalty with Customer Satisfaction as a Mediation Variable: Study of Users of BNI Direct South Sumatra. *International Research Journal of Management, IT & Social Sciences*, Vol. 9 No. 3, pages: 375-385.
- [26] Kumar, P., & Mokha, A. K. (2020). A Study on Relationship Between Electronic Customer Relationship Management (E-CRM) and Customer Loyalty in the Banking Industry. *Ramanujan International Journal of Business and Research*, 5, 211-226.
- [27] Tariq, M., Jamil, A., Ahmad, M. S., & Ramayah, T. (2019). Modeling the effectiveness of electronic customer relationship management (E-CRM) systems: empirical evidence from Pakistan. *Revista Gestão & Tecnologia*, 77-100.
- [28] Pradnyadewi, L. P. A., & Giantari, I. A. (2022). Effect of E-Service Quality on Customer Satisfaction and Customer Loyalty on Tokopedia Customers in Denpasar. *European Journal of Business and Management Research*, 7(2), 200-204.
- [29] Mahmoodzadeh, M. (2015). The effect of brand experience, service quality and perceived value on brand loyalty study (Case Study: National

- Bank of Birjand city). *Environment Conservation Journal*, 16(SE), 387-394.
- [30] Salameh, A., Hatamleh, A., Azim, M., & Kanaan, A. (2020). Customer oriented determinants of e-CRM success factors. *Uncertain Supply Chain Management*, 8(4), 713-720.
- [31] Alnaser, F., Ghani, M., & Rahi, S. (2018). Service quality in Islamic banks: The role of PAKSERV model, customer satisfaction and customer loyalty. *Accounting*, 4(2), 63-72.
- [32] Kumar, P., & Mokha, A. K. (2022). Electronic Customer Relationship Management (E-CRM) and Customer Loyalty: The Mediating Role of Customer Satisfaction in the Banking Industry. *International Journal of E-Business Research (IJEER)*, 18(1), 1-22.
- [33] Ibrahim, Y., Abbas, T., & Kamal, M. (2021). The Use of Electronic Customer Relationship Management (E-CRM) Features through Hotel'Website to Enhance Customer Loyalty and Brand Image. *Journal of Association of Arab Universities for Tourism and Hospitality*, 21(1), 106-128.
- [34] Al-Msallam, S. (2015). The relationship between customer satisfaction and customer loyalty in the banking sector in Syria. *Journal of Marketing and Consumer Research*, 7.
- [35] Hidayat, R., Akhmad, S., & Machmud, M. (2015). Effects of service quality, customer trust and customer religious commitment on customers satisfaction and loyalty of Islamic banks in East Java. *Al-Iqtishad Journal of Islamic Economics*, 7(2), 151-164.
- [36] Oumar, T. K., Mang'Unyi, E. E., Govender, K. K., & Rajkaran, S. (2017). Exploring the e-CRM–e-customer-e-loyalty nexus: a Kenyan commercial bank case study. *Management & Marketing. Challenges for the Knowledge Society*, 12(4), 674-696.
- [37] Subagiyo, R., Mutafarida, B., Asiyah, B. N., Bachtiar, J., & Fauzan, F. (2020). The Influence of E-Banking Service Quality, E-Customer Relationship Management, and Experiential Quality Oncustomer Trust, Customer Satisfaction, and Customer Loyalty in Bank Jatim. *Journal of Research in Business and Management*, Volume 8, Issue 12 (2020) pp: 49-54.
- [38] Darajat, T. A. (2020). Analysis of E-CRM and e-Service Quality of Customer Loyalty at PT. Kidang Rangka Jakarta Mebel with Satisfaction as a Intervening Variable: Analysis of E-CRM and e-Service Quality of Customer Loyalty at PT. Kidang Rangka Jakarta Mebel With Satisfaction as a Intervening Variable. *Jurnal Mantik*, 3(4), 671-677.
- [39] Al-Shoura, M. S., Al-Kasasbeh, E. A., & Rabbai, R. A.-Q. (2017). Investigating the Impact of E-CRM on Customer Loyalty: A Case of B2B (Business to Business Zain's Customers) in Zain Company in Jordan. *Humanities and Social Sciences Series*, Vol. 32, No.4
- [40] Aldaihani, F. M., & Ali, N. A. (2018). Effect of Electronic Customer Relationship Management on Electronic service quality provided by the commercial banks in Kuwait. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 8(2), 143-154.
- [41] Kalu, A. O., Unachukwu, L. C., Ibiom, O., & Nwadioghoh, E. E. (2018). Electronic Customer Relationship Management and Consumer Behaviour (A Study of Diamond Bank Plc, Nigeria). *Invention Journal of Research Technology in Engineering & Management (IJRTEM)*, Volume 2 Issue 7 PP 26-36.
- [42] Adlin, F. N., Ferdiana, R., & Fauziati, S. (2019, May). Current trend and literature on electronic CRM adoption review. In *Journal of Physics: Conference Series* (Vol. 1201, No. 1, p. 012058). IOP Publishing.
- [43] Poon, P., Albaum, G., & Yin, C. Y. (2017). Exploring risks, advantages, and interpersonal trust in buyer-salesperson relationships in direct selling in a non-western country. *International Journal of Retail & Distribution Management*.
- [44] Schmidt, A. M., Ranney, L. M., Noar, S. M., & Goldstein, A. O. (2017). Development of the FDA tobacco credibility scale (FDA-TCS). *Tobacco regulatory science*, 3(1), 47-55.
- [45] Abu-Shanab, E., & Anagreh, L. (2015). Impact of electronic customer relationship management in banking sector. *International Journal of Electronic Customer Relationship Management*, 9(4), 254-270.
- [46] Alshurideh, M., Al Kurdi, B., Salloum, S. A., Arpaci, I., & Al-Emran, M. (2020). Predicting the actual use of m-learning systems: a comparative approach using PLS-SEM and machine learning algorithms. *Interactive Learning Environments*, 1-15.
- [47] Al-Skaf, S., Youssef, E., Habes, M., Alhumaid, K., & Salloum, S. A. (2021, March). The acceptance of social media sites: an empirical study using PLS-SEM and ML approaches. In *International Conference on Advanced Machine Learning Technologies and Applications* (pp. 548-558). Springer, Cham.
- [48] Hair, J. F. (2016). *A Primer on Partial Least Squares Structural Equations Modeling (PLS-SEM)* SAGE. Newcastle upon Tyne, UK.
- [49] Goodhue, D. L., Lewis, W., & Thompson, R. (2012). Does PLS have advantages for small sample size or non-normal data? *MIS quarterly*, 981-1001.
- [50] Barclay, D., Higgins, C., & Thompson, R. (1995). The partial least squares (PLS) approach to casual modeling: personal computer adoption and use as an Illustration.
- [51] Hair, J. F., Black, W. C., Babin, B., & Anderson, R. E. (2010). *Multivariate Data Analysis: a Global Perspective* New Jersey: Pearson Prentice Hall.
- [52] Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial management & data systems*.
- [53] Hair Jr, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European business review*.
- [54] Chin, W. W. (1998). The partial least squares approach to structural equation modeling. *Modern methods for business research*, 295(2), 295-336.
- [55] Henseler, J., Hubona, G., & Ray, P. A. (2016). Using PLS path modeling in new technology research: updated guidelines. *Industrial management & data systems*.
- [56] Tenenhaus, M., Vinzi, V. E., Chatelin, Y. M., & Lauro, C. (2005). PLS path modeling. *Computational statistics & data analysis*, 48(1), 159-205.
- [57] Kuna, S. L. ., & Prasad, A. K. . (2023). Deep Learning Empowered Diabetic Retinopathy Detection and Classification using Retinal Fundus Images. *International Journal on Recent and Innovation Trends in Computing and Communication*, 11(1), 117–127. <https://doi.org/10.17762/ijritcc.v11i1.6058>
- [58] Sharma, M. K. (2021). An Automated Ensemble-Based Classification Model for The Early Diagnosis of The Cancer Using a Machine Learning Approach. *Machine Learning Applications in Engineering Education and Management*, 1(1), 01–06. Retrieved from <http://yashikajournals.com/index.php/mlaeem/article/view/1>