

## What Factors Influence Users to Install a Photography-Category Application to their Android Smartphone

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**Abstract**—Availability of the various kinds of Android applications provide the users to get any mobile application that can support their daily activities, whether it supports the work or other needs. Too many applications available often confuse the user to make a decision which application they have to install to their smartphone. By using the exploratory factor analysis (EFA), this study analyzes the factors that may influence users to decide whether or not installing a particular application from the photography category in Playstore. The result obtained three main factors, with most variables, interpret the factor is an external factor. The main factors are labeled as Advertisement factor, Application Overview factor, and Users' Side factor. This paper finds that psychologically users consider third party references to discover the satisfaction of photography application functionality.

**Keywords**—Exploratory Factor Analysis (EFA), Google Play store, installation decision, photography applications

### 1 Introduction

Most of the people nowadays are relied on their smartphone, not just for communication but also as a helping tool in their everyday tasks. The smartphone technology development widely increases as the various supported application development also rapidly spreads to support the users' needs.

There are ways to get the mobile apps installed in Android smartphone. Some users ask for their apps to be installed directly from the outlet they bought the phone from. Usually, there are outlets provide that kind of services to ordinary people that are unfamiliar with application installation. However, every Android smartphone users are always being suggested to install any application directly from Google play store, the official application provider for the Android platform, for the sake of security [1].

Today, more than two million Android apps are available at Google play store, consist of various categories that users can pick to install to their Android smartphone. Among those apps, 12% belongs to low-quality apps. The latest data shows that the most downloaded applications from all apps are from the category of education as 243,794. The most downloaded free apps are also from the education category as

225,054, and the most downloaded paid apps are from the category of personalization as 19,947 [2].

The top chart in Google Play Store (by August 20th, 2018) shows that the top categories are Photography, then followed by categories Family, Provider's Recommendation, Music & Audio, Entertainment, Shopping, Personalization, Social, and Communication. Total applications in Photography category are 70,310, with 4.08 of average rating and 12% apps with more than fifty thousand downloads [2].

With so many application available in the Photography category, users sometimes are hesitated when they want to choose proper applications. Many elements may affect the user when they are about to install a particular application. This research will evaluate those elements' effect regarding a user's decision to install an application of photography category application. The result of our study is expected to be useful to the developers when they are going to create photography category application that will be downloaded by many users.

This paper will be organized as follows. Section 1 represents an overview and background of the research. Section 2 provides related works correspond to our research. Section 3 will describe the conceptual model. Section 4 will explain the exploratory factor analysis as our research methodology, and the conclusions of possible future work and research issues will be provided in section 5.

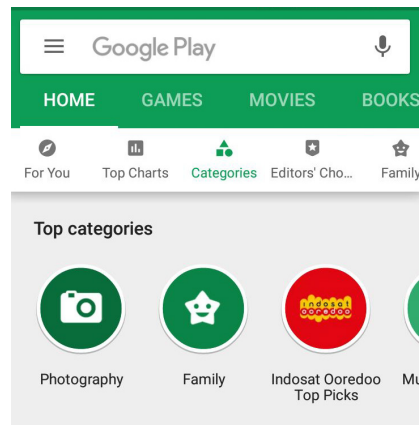
## **2 Related Work**

Smartphone application implies as a program which has been intended to be worked in the smartphone and installed by downloading from a particular place [3]. Mobile applications are software applications that designed to run on smartphones, tablets and other mobile devices. Those apps are typically available through app stores which are operated by the owners of the mobile operating system. One of the most popular operating system native stores is Google Play [4].

Android is a mobile operating system (OS) developed by Google. Google bought the company in 2005 and launched the mobile Android OS to the consumer market in 2007. After the Android OS had been launched to the market, it achieved the support of some smartphone manufacturers, which have all built phones explicitly designed for the Android system. The Android increasing popularity devices has a direct impact on the Google play store, which was first introduced as an Android Market [4]. Google play store is now the biggest app store in the world and has more than two million apps available for download [2].

Some studies also have a similar purpose as ours. Some factors that considered to affect in organizational performance are perceived usefulness, user satisfaction, technological, organizational, and people characteristics [5].

Research that evaluated the usability performance of a specific mobile application that focuses on a system for the culinary recommendation consisted of effectiveness, satisfaction and learnability performance [6].



**Fig. 1.** Top Categories in Google Play Store

Risk perception, privacy concern, and social influence are some elements that may affect the Geo-Social Networks usage, a study that has been conducted by [7].

When users go to Google Play Store, they may find that the apps provided are divided into some categories. In the top categories, Photography is the category that came first, followed by other categories, as shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** [8]. Some elements that may affect users' decision in installing application are described as following.

## 2.1 Internal Factors

Internal factors are all the things that come from the users' side that make them decide to install the Android photography category applications.

**Self's Factor:** Self's factor consists of two kinds of things, which will be explained in the following:

*User's Internet Quota:* If users operate their smartphone regarding those connect with mobile data, they may need connectivity to Wi-Fi, or they have to buy their internet quota from network provider when Wi-Fi does not exist. When users are intended to install particular applications, they may download it from the Google play store, which they have to be connected to the internet.

*User's Psychological Trust:* As previously mentioned, users are always suggested to go to Play Store whenever they need a particular application, which they can directly download any preferable applications. However, users have many kinds of backgrounds, some are familiar with the technology, but a lot of them are not. Therefore, when they want to have an application installed on their smartphone, the only just go to some outlets that serve the installation for mobile phone.

*User's Smartphone Specification:* The specification of the smartphone also affects the kind of applications installed. The smartphone specifications such as the internal memory or the camera resolution can be the factor that affects the users whether they decide to install the application or not.

**Apps' Factor:** Apps' factors are from all the factor that comes from the particular applications. In this study, we divide this factor into:

*Functionality:* In information technology, functionality is any aspect of a product or result, for instance, a software application or computing device ability, that is needed by the user [9].

The application fulfills the requirements; the ease of use, if the app was difficult to set up, includes documentation providing clear adequate instructions; application or component functionality works as we assume it was intended; all features work as expected [10].

In the photography category, applications are meant to be functioning for sharing, or editing, or capturing the photo or video.

*Free / Paid:* There are 2,258 paid applications of 51,154 application in Photography category in Google play store, and the rest are free. This study may evaluate how much this factor will influence users' decision.

## 2.2 External Factors

On the contrary, to the internal factors, external factors are the elements that come from outside of the users' side.

**Internal Apps:** These factors are the elements that are provided by the application itself. In the Google play store, the items appear along with installation view. The result of this study may be able to recognize how these factors may influence the users in installing the photography category application.

*Review:* Apps review is an evaluation of an application that comes from the users. It can be either the opinions or suggestions from the users of the application [11].

*Rating:* Rating is the evaluation or assessment of the application, regarding quality, quantity, or combination of both. In Play Store, the users give the rating in the form of 1-star to 5-stars [11].

**Other Influence:** Other factors remaining in external factors are advertisement and friends' recommendation.

*Advertisement:* This factor is the form of marketing communication regarding the specific application. The advertisement can run on television, website or other apps.

We may be able to determine how much the advertisements affect the user to install the apps.

*Friends' Recommendation:* The last factor used in this research is friends' recommendation. People usually follow for installing a specific application according to their group or community.

## 3 Conceptual Model

The conceptual model is based on the elements that have been described in the previous section. In the model, there will be some modifications for adjusting to the photography category applications in the Google Play store [12].

Based on the description in the previous section, the elements/factors that may affect the user to install the photography category applications can be described in the following **Fehler! Verweisquelle konnte nicht gefunden werden..**

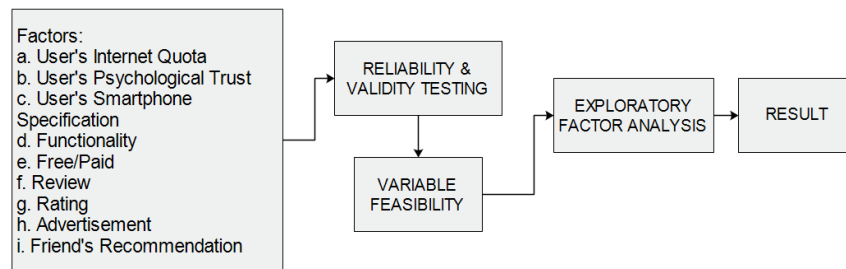


Fig. 2. Conceptual Model

## 4 Exploratory Factor Analysis (EFA)

### 4.1 Research Design

This research can be classified as exploratory research. The exploratory research aims to search new relationships to formulate the research problem. It also studies to define the structure between inspected variables, whether its form a group or it stands by itself [13]. The examination of the factors influence the users to install the mobile photography application is the primary objective of our study. From Figure 1, there are sixteen variables formed and will be analyzed in the study. Those variables are the number of the questionnaires for the respondents. The indicators then will be rated with five Likert scales ranging from level 1 (“never”) to level 5 (“always”). The statements in our questionnaire represent every indicator. We also ask the respondents to fill out some demographic information such as age and occupation. The respondents are the users that have been familiar with the use of photography category application; those are for sharing, editing, or capturing the photo or video.

### 4.2 Respondent Demographics

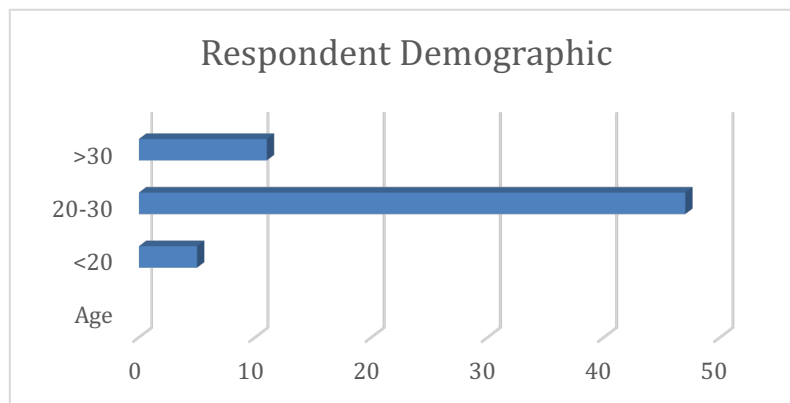
The total of valid questionnaires is from 79 respondents, which are the users of photography category application from age 15 to 45 years old. The number of male and female respondents are considered equal. Some of the respondents are familiar with using more than one kind of photography category application. **Fehler! Verweisquelle konnte nicht gefunden werden.** shows the chart of respondent demographics.

### 4.3 Data Analysis

**Validity and Reliability Testing:** This study evaluated the data using the Exploratory Factor Analysis (EFA), which is a statistical method area to reveal the basic

structure of data. It can be used for refinement steps, construction validity evaluation and also hypothesis testing [14].

This approach is usually taken for multivariate statistical cases in education, psychology and also professions related to health. In EFA, the researchers have no expectations of some variables. So the investigators are allowed to explore for generating a theory, or model from the proposed model [15].



**Fig. 3.** Respondent Demographics

Just like the previous research, several processes are sequentially performed to obtain the value from the result of distributed questionnaires [16].

Most often reported the type of reliability coefficient is coefficient alpha that usually called Cronbach's alpha. The evaluation calculates the internal consistency reliability. When the internal consistency occurs low, then the item content means very varied, so the total score is not the best analysis for the calculation [17].

**Table 1.** The value obtained from the first testing result

Factor	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Fnc1	54.8228	80.814	.398	.750
Fnc2	54.0253	83.692	.256	.760
Fnc3	54.6076	75.318	.544	.736
UIQ1	54.8481	83.643	.156	.772
UIQ2	54.2911	78.209	.391	.750
UPT1	56.1013	83.605	.278	.759
UPT2	53.4177	81.067	.433	.748
USS1	55.1013	79.836	.379	.751
USS2	55.2152	81.094	.276	.760
FP1	53.3418	83.382	.303	.757
FP2	53.7722	80.255	.376	.751
FP3	55.0127	86.115	.055	.782
Rv1	53.7848	80.325	.450	.747

Rt1	53.8608	81.506	.406	.750
Adv1	55.0886	80.800	.421	.749
Adv2	55.0253	80.128	.458	.746
Adv3	55.2785	80.973	.418	.749
FR1	54.1013	83.605	.372	.754

**Table 2.** Value Obtained From the Second Testing Result

Factor	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Fnc1	41.2911	53.055	.381	.780
Fnc3	41.0759	47.122	.616	.755
UIQ2	40.7595	50.313	.405	.780
UPT2	39.8861	52.538	.470	.773
USS1	41.5696	54.274	.246	.794
FP1	39.8101	53.925	.371	.781
FP2	40.2405	51.749	.410	.778
Rv1	40.2532	52.217	.465	.773
Rt1	40.3291	52.942	.438	.775
Adv1	41.5570	52.840	.419	.777
Adv2	41.4937	51.689	.499	.770
Adv3	41.7468	52.679	.437	.775
FR1	40.5696	55.710	.324	.784

EFA process uses a correlation matrix to display the relationships between individual variables. The correlation matrix has to be over 0.30, which means that within the data the factor accounts for approximately 30% relationship [15].

This study examines the Cronbach's Alpha to test the reliability testing, for complete obtained data for first testing which is 0.756. 18 factors are being calculated using SPSS as the tool for the statistics; the first testing result is shown in **Fehler! Verweisquelle konnte nicht gefunden werden..**

**Table 3.** Value Obtained From the Third Testing Result

Factor	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Fnc1	38.6456	47.565	.359	.787
Fnc3	38.4304	41.941	.597	.761
UIQ2	38.1139	44.564	.409	.785
UPT2	37.2405	46.441	.495	.775
FP1	37.1646	47.755	.396	.783
FP2	37.5949	46.065	.406	.783
Rv1	37.6076	46.421	.469	.777
Rt1	37.6835	46.937	.455	.778
Adv1	38.9114	47.031	.421	.781
Adv2	38.8481	45.951	.500	.774
Adv3	39.1013	47.041	.427	.781

FR1	37.9241	49.789	.323	.789
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The first testing result obtained that there are some factors with corrected item-total correlation with values above 0.3 and the values below it (which is blocked in green). Those factors are Fnc2 with a value of 0.256, UIQ1 with a value of 0.156, UPT1 with a value of 0.278, USS2 with a value of 0.276 and FP4 with a value of 0.055. The factors with a value less than 0.3 are removed than we recalculate the validity and reliability test using SPSS.

The second testing with only 13 factors resulted in the Cronbach's Alpha value is 0.790. Just like the first testing, the obtained corrected item-total correlation is also examined in the second testing. The factor with a value less than 0.3 is USS1 (0.246). The value obtained interpret the second testing result is shown in **Fehler! Verweisquelle konnte nicht gefunden werden..**

The third testing was calculated (with the rest 12 indicators/factors), it resulted the Cronbach's Alpha value is 0.794. In third testing, all value of corrected item-total correlation obtained above 0.3, we can say that all indicators/factors are valid and reliable. The value obtained interpret the second testing result is shown in **Fehler! Verweisquelle konnte nicht gefunden werden..**

**Kaiser-Meyer-Olkin (KMO) and Bartlett's Test:** To examine the adequacy of the samples suitability testing of the observation number (data) and the multivariate correlation was being examined using Kaiser-Myer-Olkin (KMO) and Barlett test. The result is shown in Fehler! Verweisquelle konnte nicht gefunden werden..

KMO value of 0.662 which is more significant than 0.5, it means the first requirement that is the adequacy of the data is being fulfilled. The Sig. The value of Barlett's Test of Sphericity is 0.000 which is smaller than Alpha 0.05; it means that this factor analysis is feasible. The conclusion can be considered as there is a correlation between all the multivariate variable.

**Eigenvalue:** Eigenvalue represents the sum of squared loadings for a factor. It is frequently used to determine the number of factors. According to Kaiser criterion as a way to decide the constructs number for rotation (factors with eigenvalues higher than one). Another method used to determine the number of factors is Scree test as the representation of the eigenvalues [13].

By using SPSS tool,

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.662
Approx. Chi-Square	327.86
Bartlett's Test of Sphericity	4
df	66
Sig.	.000

**Component Matrix:** The eigenvalues obtained some factors, which are three factors. Moreover, also by using SPSS tool, with principal component analysis extraction method, we get Matrix Rotation: The purpose of rotation is to make the group of factors simplified, it minimizes low factor loadings and maximizes high factor loadings that are greater than 0.55 [15]. Based on Fehler! Verweisquelle konnte nicht gefunden werden., variable Adv2 has the greatest loading factor in factor 1 that is 0.899, but this variable has low loading factor in factor 2 and factor 3, so variable Adv2 is included in factor 1.



Fehler! Verweisquelle konnte nicht gefunden werden. shows the result of the rotated component matrix obtained in SPSS tool, using Varimax with Kaiser Normalization. The first factor consists of variables Adv1, Adv2, and Adv3. The second factor consists of variables Rv1 and Rt1, and the last factor consists of variables UPT1, FP1, and FP2.

of Component Matrix which shows the distribution of 12 variables in 3 factors formed. The values in the table are factor loadings that show a correlation between the variable itself to factor number 1, number 2 and number 3. The variable determination process for which factor is by comparing the correlation value in each row of the variable.

shows the result of some factors based on eigenvalue, that is larger than 1. There are only three factors that have eigenvalue more significant than 1. The result can also be seen in Fehler! Verweisquelle konnte nicht gefunden werden..

**Table 4.** KMO and Bartlett’s Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.662
Approx. Chi-Square	327.86
Bartlett's Test of Sphericity	4
df	66
Sig.	.000

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**Table 5.** Number of factors based on eigenvalue

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3.741	31.173	31.173
2	2.046	17.047	48.220
3	1.139	9.489	57.709
4	.965	8.042	65.752
5	.920	7.670	73.422

6	.800	6.669	80.091
7	.730	6.080	86.171
8	.557	4.646	90.817
9	.407	3.390	94.206
10	.314	2.616	96.822
11	.225	1.873	98.695
12	.157	1.305	100.000

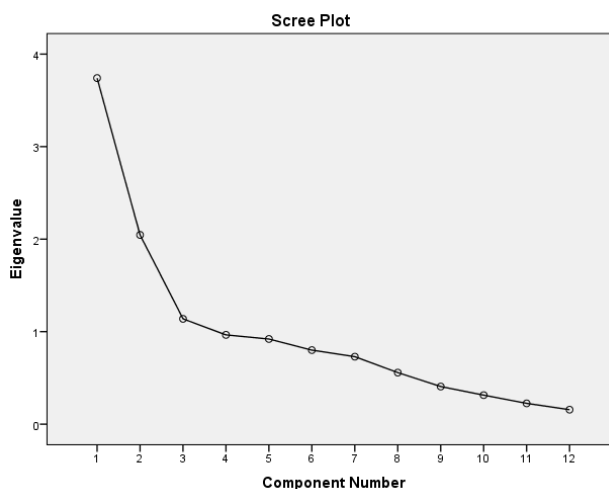


Fig. 4. Scree Plot of the Eigenvalues

**Matrix Rotation:** The purpose of rotation is to make the group of factors simplified, it minimizes low factor loadings and maximizes high factor loadings that are greater than 0.55 [15]. Based on Fehler! Verweisquelle konnte nicht gefunden werden., variable Adv2 has the greatest loading factor in factor 1 that is 0.899, but this variable has low loading factor in factor 2 and factor 3, so variable Adv2 in included in factor 1.

Fehler! Verweisquelle konnte nicht gefunden werden. shows the result of the rotated component matrix obtained in SPSS tool, using Varimax with Kaiser Normalization. The first factor consists of variables Adv1, Adv2, and Adv3. The second factor consists of variables Rv1 and Rt1, and the last factor consists of variables UPT1, FP1, and FP2.

Table 6. Component Matrix

	Component		
	1	2	3
Fnc1	.476	-.028	-.196
Fnc3	.712	.117	-.077
UIQ2	.522	-.069	.341
UPT2	.606	.449	.125
FP1	.508	.616	.348

FP2	.505	.321	.473
Rv1	.604	.227	-.464
Rt1	.575	.034	-.561
Adv1	.536	-.682	.099
Adv2	.614	-.663	.110
Adv3	.558	-.534	.108
RC1	.427	.314	-.233

**Table 7.** Rotated Component Matrix

	Component		
	1	2	3
Fnc1	.248	.437	.115
Fnc3	.292	.533	.398
UIQ2	.423	.058	.460
UPT2	.011	.397	.654
FP1	-.130	.212	.835
FP2	.131	.045	.750
Rv1	.060	.777	.154
Rt1	.176	.784	-.030
Adv1	.867	.097	-.026
Adv2	.899	.143	.034
Adv3	.764	.140	.073
RC1	-.060	.516	.254

**Table 8.** Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.741	31.173	31.173	3.741	31.173	31.173
2	2.046	17.047	48.220	2.046	17.047	48.220
3	1.139	9.489	57.709	1.139	9.489	57.709
4	.965	8.042	65.752			
5	.920	7.670	73.422			
6	.800	6.669	80.091			
7	.730	6.080	86.171			
8	.557	4.646	90.817			
9	.407	3.390	94.206			
10	.314	2.616	96.822			
11	.225	1.873	98.695			
12	.157	1.305	100.000			

Rotation Method: Varimax with Kaiser Normalization

## 5 Result and Analysis

From all the processes described in previous sections, in this section there will be an interpretation phase for the result obtained by naming the factors according to the characteristic of the factor. The first factor that consists of variables Adv1, Adv2 and Adv3 are labeled Advertisement factor. The second factor consists of variables Rv1 (review) and Rt1 (rating), so these factors are labeled as Application Overview factor. The third factor consists of variables UPT2 (user's psychological trust), FP1 and FP2 (for free/paid application) which the users prefer to choose free applications, so the factor is labeled as User's Side. Fehler! Verweisquelle konnte nicht gefunden werden. shows the total variance explained in our study.

The last phase of exploratory factor analysis is stability and consistency testing of a formed factor. First criteria used is an eigenvalue. The eigenvalue that is greater than one is in factor 1, factor 2 and factor 3. The second criteria used is based on the scree plot in Fehler! Verweisquelle konnte nicht gefunden werden.. From the combination of the criteria, we may conclude that there are three factors formed.

By using exploratory factor analysis, this study has reached three factors that influence the user to install photography application on their Android smartphone, the factors are:

### 5.1 Factor 1 labeled as Advertisement factor

The first factor is formed by three variables that are: advertisement of the application running on television (Adv1), internet/web (Adv2), and other application (Adv3). The highest loading factor is earned by Adv2 (0.899) that is advertisement running on the internet/web. Research by Adology revealed that mobile advertising and mobile application affects users' purchase behavior [18] and also a study of attitudes toward mobile advertising [19].

### 5.2 Factor 2 labeled as Application Overview factor

The second factor is formed by two variables; review of the application (Rv1) and rating of the application (Rt1). Both variables have nearly similar loading factors that are 0.777 and 0.784. Some sites discuss the importance of application review and rating [20]–[23]. Some studies also have researched about users' review as a source of improving apps for developers [24], and unique study about online review features [25].

### 5.3 Factor 3 labeled as User's Side factor

The third factor is formed of three variables, which are; UPT2 (loading factor: 0.654) that stands for user psychological trust, and FP1 (loading factor: 0.835) and FP2 (loading factor: 0.750) that stand for free/paid application. User psychological trust variable represents user's awareness to download the application directly from Google play store. Moreover, it already mentioned in the previous section that for their own

secure, users are always suggested to install the application directly from Google play store [1], [26].

Free/paid variables represent users' tendency to choose free apps more than paid ones. Some sites discuss the application pricing, monetizing and why most apps are free [27]–[30]. Some studies discussed covert communication in mobile apps [31] and also about the impact of the hidden cost of free mobile apps [32].

## 6 Conclusion

The previous section already discussed the exploratory factor analysis to identify the factors that influence the user to install mobile photography application from Google play store. The variables are chosen by using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. The factor formed by approaching based on eigenvalue and scree plot. The interpretation of factor analysis result is based on factor loading significantly and labeling the factor formed.

The factor analysis resulted in three main factors that influence the user to install a mobile photography application to their Android smartphone. The factors are Advertisement factor, Overview factor, and Users' Side factor. From the description in section two, most of the variables that form the main factor are from external factor (advertisement, review, rating, and free application), except for user psychological trust which is an internal factor. We find that when users want to know about the satisfactory or functionality of a mobile application, they only just follow the third party references which are review and rating of an application.

There is a high expectation that the result of this study may be useful for the developers, especially the mobile photography application for guidance so that the applications developed will be downloaded, successfully installed, and also used by many active users continuously.

In this study, only exploratory factor analysis (EFA) is used as a methodology for obtaining the result to analyze the factors. For the future work and research, it is highly expected that more methodologies will be involved to obtain the result thoroughly.

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