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How Are Security, Privacy and Trust Affecting Continuance Intention of Contact Tracing Applications?

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Abstract. This empirical paper aims to assess the explanatory power of Expectation-Confirmation Model with additional new constructs, concerning the users' continuous usage of contact tracing applications. A survey instrument was developed with participants (N=531) drawn from Indonesian respondents who use contact tracing applications named PeduliLindungi application. The model was validated and tested with partial least squares structural equation modeling. This study provides insights on factors that influence users' continuance intention to use contact tracing applications. The findings showed that confirmation influences all correlated variables namely, perceived privacy, perceived security, effort expectancy, performance expectancy, trust, and satisfaction. Satisfaction is positively and significantly influenced by perceived security, effort expectancy, and performance expectancy. Effort expectancy and trust have a substantial impact on performance expectancy. Perceived security, effort expectancy, performance expectancy, and satisfaction each have an effect on the continuance intention variable. Overall, the majority of hypotheses are accepted except for the correlation between perceived privacy and satisfaction and between trust and continuance intention. Research limitations and future research are presented, along with academic and managerial contributions.

Keywords: Contact Tracing Applications, Continuance Intention, Perceived Privacy, Perceived Security, Trust.

1. Introduction

The World Health Organization (WHO) defined the 2019 coronavirus disease (COVID-19) as a Public Health Emergency of International Concern (PHEIC) because of the considerable increase in confirmed cases across several nations. At the beginning of March 2020, less than a month after the initial discovery, 893 confirmed cases were found in Indonesia (World Health Organization, 2020a). Early detection of transmission groups has become a crucial step in combating the virus' spread, following WHO technical guidelines on COVID-19. Moreover, the coronavirus has created numerous variants during the past two years, resulting in more than 6 million fatalities worldwide and more than 500 million cases of COVID-19. Conducting all preventive measures is vital since COVID-19 still carries a great deal of uncertainty. A few of COVID-19 prevention best measures, including early quarantine, extensive screenings, reliable contact tracing systems, and patient isolation, can significantly minimize the pandemic (Girum et al., 2020). A study also revealed that rapid contact tracing is considered a vital point for the containment of COVID-19 in the UK due to its ability to reduce the spread (Keeling et al., 2020). According to WHO, contact tracing functions to identify and assist in providing quarantine support for individuals who are believed to have had contact with positive confirmed COVID-19 patients and can be used to locate the source of infection by investigating the location of suspected infection. Because there is still a chance that the virus will mutate and lead to a variable number of cases in other nations, contact tracing remains essential.

Digital contact tracing could potentially circumvent the constraints that exist in manual contact tracing, namely, scalability, delayed notifications, and errors in contact identification (Kleinman & Merkel, 2020). Inevitably, governments have developed their respective contact tracing applications to detect infected individuals to carry out contact tracing digitally, wherein Indonesia launched a government surveillance technology named PeduliLindungi as a national contact tracing application for COVID-19. WHO recommends that each nation assemble laws governing the use and safety of the personal data obtained through the application since it is acknowledged that there are concerns regarding the collection and use of data and its security. Concern over information security has increased specifically in Indonesia as a response to one incidence of a widespread social media leak involving the COVID-19 vaccination certificate of the country's president, raising issues about the government's commitment to data security (Reuters, 2021). More of the guidance from (World Health Organization, 2021) indicated that the associated data and contact tracing applications would be discarded and deactivated once the pandemic was no longer a public health threat.

Recent years have resulted in a considerable portion of the literature on contact tracing applications, most of which centered on how the technology was accepted during the first year of the pandemic (Albrecht et al., 2021; Fox et al., 2021; Sharma

et al., 2020; Zetterholm et al., 2021). Earlier study using the Technology Acceptance Model (TAM) method were conducted to examine user acceptance of the PeduliLindungi application (Kurniawati et al., 2020). Due to the PeduliLindungi application's ease of use, the growing number of users confirmed the app's level of acceptance (Kurniawati et al., 2020). According to (Hassandoust et al., 2021), users' decision to disclose their personal information depends on an appraisal of the privacy-related risks and benefits of contact tracing applications. However, its benefits become a different driving factor influencing users' decision to adopt the contact tracing application (Hassandoust et al., 2021).

Due to the pivotal role in handling COVID-19, contact tracing applications are presumably recognizable to most individuals considering that the pandemic has been going on for some time. (Warsame & Ireri, 2021) believes that once an information system is used systematically, it reaches the post-adoption stage. The post-adoption framework was considered appropriate for examining continuance intention to use contact tracing applications when most individuals have already adopted the technology. However, only a few research have emphasized the post-adoption implications of contact tracing applications, one of the studies from (Suh & Li, 2021) examined the influence of user appraisal and emotion toward continuance intention to use contact tracing applications. To fill these gaps in research, this study explores factors influencing users' continuance intention to use contact tracing applications in Indonesia, with an extended expectation-confirmation model (ECM) underpinnings from (Bhattacherjee, 2001). The study proposes and empirically tests the conceptual model ECM with additional variables of effort expectancy, perceived privacy, perceived security, and trust. The overall structure of the study takes the form of seven chapters, including this introductory chapter. The later section presents the literature review, followed by the section on research methodology, results, discussion, conclusions and implications, and finished with chapter of limitations and future research.

2. Literature Review

2.1. PeduliLindungi Application

By periodically identifying users' locations to offer data on COVID-19 crowds and zones, PeduliLindungi is designed to ensure that all citizens can travel safely and comfortably in public spaces. Additionally, this contact tracing application offers details on COVID-19 cases across Indonesia, users' COVID-19 test results and vaccination records, and a telemedicine function for medical advice. In accordance with national law, the Indonesian government mandates the usage of the application as a condition for accessing public areas. Most public venues include Quick Response (QR) codes at the entrance, allowing users to log visited locations using the PeduliLindungi application. Given that PeduliLindungi users occasionally encounter technical issues, the QR Code check-in feature can also be accessed

through other Super-app platforms. The contact tracing functionality of PeduliLindungi shall be referred to in the terminology of contact tracing apps in general.

2.2. Expectation-Confirmation Model

The intention to continue using information systems, also known as the IS continuance intention, is distinct from the initial use or acceptance of technology and refers to a purpose to keep using information systems (Bhattacherjee, 2001). In light of the compatibility between individual decisions to continue using IT and consumer decisions to repurchase, (Bhattacherjee, 2001) proposed a model to assess information technology sustainability (IT continuance). The continuance intention in ECM depends on three variables, including the level of user satisfaction with the technology (satisfaction), the level of user confirmation of expectations (confirmation), and expectations after adopting the technology (perceived usefulness). (Bölen, 2020) proposed that ECM is based on the actual user experience of the technology that focuses on the long-term use of information technology. The concept of "continuance" refers to the outcomes of user behavior at the post-adoption stage, which includes the intention and ongoing use of a specific technology (Nabavi et al., 2016). (Han et al., 2018) defined continuation intention as a user's choice to keep utilizing goods or services after using them beforehand. A systematic literature review by (Yan et al., 2021) shows that continuance intention can affect the likelihood of users performing certain behaviours.

The extent to which the technology supports the user's impression of the initial expectation is referred to as confirmation (Rahi & Ghani, 2019). Users will assess the performance of the technology when it is utilized compared to one‘s prior expectations. In the design and development of contact tracing applications, privacy and security are two crucial considerations (World Health Organization, 2020b). Both security and privacy are associated with the idea that the technology has a mechanism to guarantee optimal data security. (Foroughi et al., 2019) believed that the majority of users have a negative opinion of a technology's privacy and security. Developers of contact tracing applications must reassure users about their security and privacy features as the PeduliLindungi application extends its capabilities to include integration with other platforms. Therefore, H1 and H2 were proposed.

H1. Confirmation is positively correlated with perceived privacy.

H2. Confirmation is positively correlated with perceived security.

(Viswanath Venkatesh et al., 2003) presumptively believe that performance expectancy is a characteristic that may be utilized to examine user behaviour both before and after adoption of technology. Users of particular applications can acknowledge all of the benefits to correspond to their prior expectations; as a result,

user satisfaction relies on the confirmation that utilization is consistent with users' actual experience (Tam et al., 2020). Meanwhile, contact tracing application continues to be developed to tailor the needs to overcome the fluctuating situation of the pandemic. Effort expectancy can still be necessary since people may stop using a specific technology if new capabilities are too complicated or labour-intensive (Li & Wang, 2017). Therefore, H83, H4, and H5 were proposed.

H3. Confirmation is positively correlated with effort expectancy.

H4. Confirmation is positively correlated with satisfaction.

H5. Confirmation is positively correlated with performance expectancy.

In the world of online interactivity, trust has long been valued as a critical component. A certain level of expectation toward a technology is referred to as trust (Ouimet et al., 2020). (Bengio et al., 2020; Chowdhury et al., 2020) stated the importance of developing trust towards contact tracing applications through the element of user's privacy. Believing that consumers' expectations are susceptible to change over time (Hossain & Quaddus, 2012), other elements like trust can have an impact. Therefore, H76 was proposed.

H6. Confirmation is positively correlated with trust.

Data privacy is a major obstacle to contact tracing applications, corresponding to research from the United States, the United Kingdom, and Europe (Guillon & Kergall, 2020). The use of contact tracing applications that collect personal information increases the risk that the information will be discovered (intentionally or accidentally) and used by the government or other parties for purposes beyond COVID-19 countermeasures (Hobson et al., 2020). Perceived privacy refers to the belief that the PeduliLindungi application protects the security of personal data in the event of data misuse or terms of integration with other platforms, taking into account the PeduliLindungi contact tracing feature that may be accessed through other integrated applications. Therefore, H7 was proposed.

H7. Perceived privacy is positively correlated with satisfaction.

Perceived security is a baseline that users perceive through security features in apps that deliver sufficient security information to stimulate trust in using applications through various existing technologies (Gupta et al., 2020). Application security concerns the vulnerability of apps to assaults aimed at changing how the technology performs, accessing personal data, or disabling application usage (Hobson et al., 2020). In other words, perceived security is a user's expectation of a contact tracing application provider's capacity to secure personal information or data against security breaches. Empirical studies have shown that security flaws risk continued use and user retention; as a consequence, security concerns must be handled appropriately to enhance user satisfaction (Oghuma et al., 2016). Therefore, H8 was proposed.

H8. Perceived security is positively correlated with satisfaction.

The Unified Theory of Acceptance and Use of Technology (UTAUT) hypothesis frequently uses the effort expectancy variable to measure how effortless it is to use a given application. (Viswanath Venkatesh et al., 2003) describes effort expectancy as the number of effort users put through when using technology. Effort expectation in this study is an indicator utilized to determine how each participant feels about how simple it is to use the contact tracing application. Users consider technology to be beneficial if they are able to embrace it without making any additional effort (Lim et al., 2018). Moreover, users' perception of the technology as a useful instrument is said to be predicated on effort expectancy, which will influence their decision to use it in the distant future (Chen et al., 2021). (Kim et al., 2019) expressed that technology's ease of use perception can catalyze continuous use intention. Therefore, H89, H10, and H11 were proposed.

H9. Effort expectancy is positively correlated with performance expectancy.

H10. Effort expectancy is positively correlated with satisfaction.

H11. Effort expectancy is positively correlated with continuance intention.

The assumption that using technology will help users perform particular tasks is known as performance expectancy (V. Venkatesh et al., 2012). (Rabaa'i & ALMaati, 2021) proposes that when people experience the benefits of technology, they will feel safer and more contented and will continue to utilize it. The performance expectancy variable in research on COVID-19 refers to the user's perception of the effectiveness of contact tracing programs in providing valuable and timely information (Chopdar, 2022). Users are more inclined to utilize the system more frequently in the future toward the perceived usefulness when their initial assumptions or expectations are met (Sarkar & Khare, 2019). Therefore, H12 and H13 were proposed.

H12. Performance expectancy is positively correlated with satisfaction.

H13. Performance expectancy is positively correlated with continuance intention.

Trust is defined as the degree of credibility, security, integrity, and reliability of a technology perceived by its users (Shareef et al., 2018). Regardless of whether the trustee can govern or observe the other partaker, (Mayer et al., 1995) defined trust as one party's willingness to be exposed to another party's decisions in the belief that the other party will undertake certain acts that are relevant to the trustee. Users of contact tracing applications who are in a position of trust are more open to the decisions of the app developers. Furthermore, users are more likely to cooperate with a product or service they trust by sharing information (Martin et al., 2016). In the words of (Ouimet et al., 2020), a technology that is viewed as being unreliable will inevitably be thought to be of insignificant utility. Therefore, H14 and H15 were proposed.

H14. Trust is positively correlated with performance expectancy.

H15. Trust is positively correlated with continuance intention.

Users typically have pre-existing expectations of a product or service before purchase, impacting the degree of satisfaction and intention to recommend it following use (Susanto et al., 2016). An associated psychological state called satisfaction is the outcome of a cognitive evaluation of the confirmation of expectations and performance (Bhattacherjee, 2001). The alignment between expectations and confirmations throughout time is seen as the satisfaction framework from the time after adoption (Gupta et al., 2020). According to (Bhattacherjee, 2001), the essential component of ECM is the direct relationship between satisfaction and continuation intention. This resulted in the establishment of the following hypothesis for the study. Therefore, H16 was proposed.

H16. Satisfaction is positively correlated with continuance intention.

Following a discussion of all the hypotheses this study explores, Figure 1 displays the extended ECM research model suggested by this study.

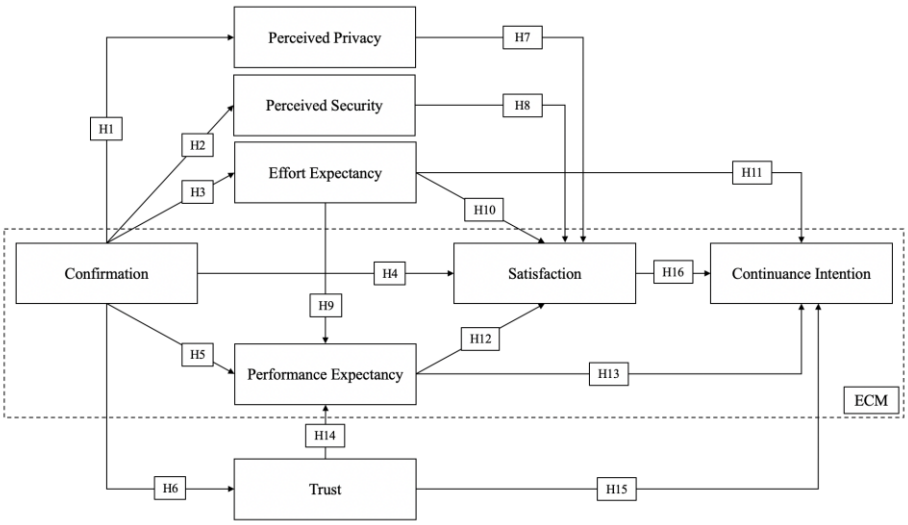

Fig: 1. Research Model

3. Research Methodology

3.1. Data Collection

The population for this study consisted of people who had previously used contact tracing tools to guarantee the data's accuracy for the post-adoption period. The sample size was determined using Slovin's formula, which resulted in a minimum of 400 participants from the 90 million users of the PeduliLindungi applications. An online questionnaire was developed as the most effective way to collect opinions about this study. A total of 535 questionnaire responses were obtained during the

two-week data collection period from July 20 to August 3, 2022, with four responses failing to meet the requirements. The profile of all participants will be explained in Table 1.

Table 1: Participants profile

Characteristics	Category	Frequency	Percent
Gender	Male	240	45
	Female	291	55
Age (years)	Below 18	12	2
	18 – 25	216	41
	26 – 35	178	34
	36 – 45	76	14
	46 – 56	31	6
	Above 56	18	3
Occupation	Student	143	27
	Housewife	20	3,8
	Civil servant / army / police officer	151	28,5
	State-owned / private companies officer	110	20,8
	Teacher	25	4,8
	Farmer and fisherman	1	0,2
	Labourer	3	0,6
	Merchant	13	2,5
	Professional	8	1,6
	Entrepreneur	41	7,8
	Migrant worker	1	0,2
	Others	14	2,7
	Not working	1	0,2
Domicile	Sumatra	77	14,6
	Java	404	76,1
	Nusa Tenggara	13	2,5
	Kalimantan	22	4,1
	Sulawesi	10	1,8
	Maluku	5	0,9
	Papua	0	0
Dose of vaccine	Never	3	0,6
	1st	6	1,2
	2nd	139	26,2
	3rd	383	72,2
CTA used at	Trade sector (malls and markets)	254	47,9
	Transportation	97	18,3
	Workplaces and factories	75	14
	Tourism (hotels and tourist attractions)	72	13,6
	Educational institutions	32	6
	Religious places	1	0,2
CTA's technical problems	Frequent errors or crashes	137	25,9
	Difficult to scan QR Code	102	19,3
	CTA updates too often	99	18,7
	Quick-draining the phone battery	58	11

	Unable to check out from previous check in location	40	7,4
		39	7,3
	Vaccine certificate doesn't exist or incorrect	29	5,3
	Doesn't receive verification email or OTP code	27	5,1
	COVID-19 test results doesn't appear		
Access to contact tracing feature through other platforms	Tokopedia	119	21
	Gojek	207	37
	Grab	89	15,3
	Shopee	19	3,5
	BNI Mobile Banking	1	0,1
	Dana	128	23
	tiket.com	1	0,1

3.2. Measurement and Data Analysis

The structured questionnaire, developed after comprehensively evaluating diverse works of literature, is presented in Table 2. There are 34 measurement items in the questionnaire, with eight constructs, including Confirmation, Perceived Privacy, Perceived Security, Trust, Effort Expectancy, Performance Expectancy, Satisfaction, and Continuance Intention. Confirmation, Effort Expectancy, Performance Expectancy, Satisfaction, and Continuance Intention were among the items derived from diverse literary sources (Gupta et al., 2020; Huang, 2019; Malik & Rao, 2019; Oghuma et al., 2016; Ouimet et al., 2020; Suzianti & Paramadini, 2021; Tam et al., 2020; Yousaf et al., 2021). Respondents were given the completed questionnaire and were asked to score their level of agreement with the statements using a Likert scale that ranged from "Strongly Disagree" (1) to "Strongly Agree" (7). Prior to the questionnaire's distribution, a primary analysis involving 30 respondents is performed to verify the validity and reliability of the questionnaire, as well as its readability and item clarity.

SMART PLS 3.0 was utilized as the tool for data analysis. The measurement model assessment and structural equation modeling (SEM) are the two proposed assessments.. Each accepted hypothesis in this study has to meet the criteria of a t-value larger than 1.96 and a p-value less than 0.05 to be considered significant.

Table 2: The final questionnaire

Variable		List of questions
Confirmation	(CON1)	My experience of using contact tracing applications is better than I expected.
	(CON2)	The contact tracing application's service level is better than I expected.
	(CON3)	Contact tracing applications have given me more benefits than initially anticipated.
	(CON4)	Overall, most of my expectations from using the contact tracing application are confirmed.
	(CON5)	In general, the functions of the contact tracing

		application fulfilled my expectation.
Perceived Privacy	(PP1)	Contact tracing application prevents illegal data access better than expected.
	(PP2)	Contact tracing application ensures privacy better than expected.
	(PP3)	I feel much safer than expected sharing my data through the contact tracing application.
Perceived Security	(PS1)	The contact tracing application's provider implements security measures to protect all of its users.
	(PS2)	Contact tracing application ensures a safe contact tracing for COVID-19.
	(PS3)	I feel secure using the contact tracing application.
Trust	(T1)	I trust the government as the provider of contact tracing applications.
	(T2)	I use the contact tracing application with confidence.
	(T3)	The government, as the contact tracing application provider, is worthy of its users' trust.
Effort Expectancy	(EE1)	Learning how to use the contact tracing application is easy for me.
	(EE2)	It is easy for me to become skilful at using contact tracing applications.
	(EE3)	I think that the contact tracing application has clear-cut functions.
	(EE4)	Overall, I find that the contact tracing application is easy to use.
Performance Expectancy	(PE1)	I find contact tracing applications useful in my daily life.
	(PE2)	Using the contact tracing application helps me accomplish things more quickly.
	(PE3)	Using the contact tracing application increases my productivity.
	(PE4)	I find the contact tracing application useful as I can easily share location information with others.
	(PE5)	Contact tracing application saves time and effort by providing useful information all in one place.
	(PE6)	Contact tracing application is an effective mechanism of contact tracing for COVID-19.
Satisfaction	(SAT1)	I am happy with using the contact tracing application.
	(SAT2)	I am satisfied with my decision to contact tracing application.
	(SAT3)	I was doing the right thing by using the contact tracing application.
	(SAT4)	My overall experience with contact tracing applications is pleasant.
	(SAT5)	My overall experience with contact tracing applications is satisfying.
Continuance Intention	(CI1)	Regardless of the obligation to use contact tracing applications, I intend to continue the use of contact tracing applications in the future.

(CI2)	Regardless of the obligation to use the contact tracing applications, I would advise my peers to use contact tracing applications.
(CI3)	I intend to continue using the contact tracing application.
(CI4)	I will keep using the contact tracing application as regularly wherever I go.
(CI5)	Aside from the PeduliLindungi application, I intend to increase the usage of contact tracing applications through other platforms such as Dana, Gojek, Tokopedia, Grab, and others.

4. Results

4.1. Measurement Model Assessment

Latent variables may be inferred from observed variables using the multivariate method known as Confirmatory Factor Analysis (CFA) (Phakiti et al., 2018). CFA was employed to examine the model's constructs for validity and reliability. The Average Variance Extracted (AVE) of 0.5 or above indicates that the measuring instrument measures what it intends. The Composite Reliability (CR) and Cronbach's Alpha (α) values more than 0.7 (Hair et al., 2014) indicates the consistency for repeated testing on the relevant questionnaire. Results show that the measurement model satisfies both convergent validity and reliability requirements, as shown in Table 3.

Table 3: Confirmatory factor analysis

Variables	CR	α	AVE
Confirmation	0,902	0,864	0,648
Continuance Intention	0,937	0,915	0,748
Effort Expectancy	0,890	0,837	0,670
Perceived Privacy	0,922	0,874	0,799
Perceived Security	0,917	0,864	0,786
Performance Expectancy	0,930	0,909	0,689
Satisfaction	0,928	0,903	0,721
Trust	0,924	0,876	0,802

4.2. Structural Equation Modelling (SEM)

The bootstrapping method in SMART PLS 3.0 with 5000 resamples was applied in this study to test the hypothesis. Based on the analysis and testing, it is known that confirmation has a positive and significant effect on the variables perceived privacy, perceived security, trust, effort expectancy, performance expectancy, and satisfaction. In addition, performance expectancy is influenced by the effort expectancy and trust variables. Then the variables perceived security, effort expectancy, and performance expectancy have a positive and significant effect on satisfaction. Furthermore, the continuance intention variable is influenced by

perceived security, effort expectancy, performance expectancy, and satisfaction. Overall, the majority of hypotheses are accepted except for the correlation between perceived privacy and satisfaction and between trust and continuance intention.

The suggested research model also obtained R^2 values of 0.723 for continuance intention, 0.781 for satisfaction, 0.646 for performance expectancy, 0.426 for effort expectancy, 0.461 for trust, 0.463 for perceived privacy, and 0.456 for perceived privacy. As can be seen in Table 4, two of the sixteen hypotheses were ruled out since both values were not within the acceptable range. The findings led to the approval of 14 hypotheses (H1, H2, H3, H4, H5, H6, H8, H9, H10, H11, H12, H13, H14, and H16).

Table 4: Hypotheses results

Hypotheses		Original Sample	T Statistics	P Values	Status
H1	CON → PP	0,681	20,949	0,000	Accepted
H2	CON → PS	0,676	17,612	0,000	Accepted
H3	CON → EE	0,653	16,480	0,000	Accepted
H4	CON → SAT	0,191	3,525	0,000	Accepted
H5	CON → PE	0,278	4,587	0,000	Accepted
H6	CON → T	0,680	18,388	0,000	Accepted
H7	PP → SAT	0,088	1,719	0,086	Rejected
H8	PS → SAT	0,222	3,373	0,001	Accepted
H9	EE → PE	0,280	5,966	0,000	Accepted
H10	EE → SAT	0,195	4,357	0,000	Accepted
H11	EE → CI	-0,150	2,779	0,005	Accepted
H12	PE → SAT	0,322	5,321	0,000	Accepted
H13	PE → CI	0,270	4,229	0,000	Accepted
H14	T → PE	0,363	5,712	0,000	Accepted
H15	T → CI	0,037	0,679	0,498	Rejected
H16	SAT → CI	0,690	10,451	0,000	Accepted

5. Discussion

The suggested research model was able to explain 72,3% of the users' intention to continue using contact tracing applications. Confirmation influences all correlated variables in hypotheses, which indicated that users' initial expectations were confirmed based on the usage of current utilization. The study's findings showed that performance expectancy, effort expectancy, and satisfaction significantly and positively impacted confirmation, which is in line with previous studies (Gupta et al., 2020; Huang, 2019; Malik & Rao, 2019; Suzianti & Paramadini, 2021; Tam et al., 2020; Yousaf et al., 2021). These findings could indicate that contact tracing

applications will affect users' performance and satisfaction once their expectations for contact tracing applications' convenience, functionality, and benefits are confirmed. The same manner also applied to perceived privacy and perceived security, in accordance with prior research (Gupta et al., 2020; Oghuma et al., 2016; Yousaf et al., 2021). These results revealed that such confirmation reduces any concerns about the contact tracing application's risks regarding security and privacy aspects. However, the results of this study conflict with (Ouimet et al., 2020) findings in the context of teleconsultation applications. The findings from this study demonstrate that users' trust in contact tracing applications improves when users' expectations about utilizing them are confirmed.

From this study, perceived privacy variable was found to be insignificant and irrelevant to users' satisfaction. This finding is inconsistent with (Yousaf et al., 2021), where the privacy protocols embedded in the context of fitness application play an essential role in ensuring data integrity and helping create user satisfaction. Users are expected to have the perceptions of assurances from the PeduliLindungi application to maintain the confidentiality of personal data since it is developed by the government and integrated with credible and reliable platforms. The findings exhibit that the perception that the contact tracing application guarantees the security of personal data in the event of data misuse or the case of integration with other platforms does not affect the level of user satisfaction. The following variable that significantly and positively affects users' satisfaction is perceived security. This finding is consistent with (Gupta et al., 2020), but contradictory with (Oghuma et al., 2016) in the instance of the Mobile Instant Messaging (MIM) application in South Korea for public reassurance of information security from the country's technological advancement.

The effect of effort expectancy on performance expectancy, satisfaction, and continuance intention to use contact tracing applications was reported in this study. Invariant with previous studies (Huang, 2019; Malik & Rao, 2019; Tam et al., 2020), this study reveals that if contact tracing application users had no difficulty operating the app, it would form the perception of functionality and satisfaction, then be more likely to maintain app utilization.

Performance expectancy was another factor influencing satisfaction, which was in line with prior research (Huang, 2019; Malik & Rao, 2019; Oghuma et al., 2016; Suzianti & Paramadini, 2021; Tam et al., 2020; Yousaf et al., 2021). Users of the PeduliLindungi application feel satisfied when it can provide information and perform its roles as part of handling COVID-19 in Indonesia. Moreover, numerous research (Gupta et al., 2020; Malik & Rao, 2019; Oghuma et al., 2016; Ouimet et al., 2020; Tam et al., 2020; Yousaf et al., 2021) also supports the positive association between performance expectancy and continuance intention. It will be a deciding factor in the application's sustainable use if the PeduliLindungi application can offer valuable and real-time information in dealing with COVID-19. Contrary to (Huang,

2019; Suzianti & Paramadini, 2021) findings, contact tracing applications must fulfill users' need for safe contact tracing for COVID-19 in order to continue using the application.

Furthermore, trust positively and significantly influenced performance expectancy, which revealed that users' trust has direct consequences for the benefits derived from the utilization of contact tracing applications. Another polarity, in the context of the teleconsultation platform, a prior study from (Ouimet et al., 2020) indicated that users' trust in the technology has no direct impact on the benefits derived from its utilization despite its apparent essential purpose. Additionally, in line with (Ouimet et al., 2020) finding, users' trust did not positively affect continuance intention. PeduliLindungi application is a national contact tracing application with the government viewed as the app provider. (Guillon & Kergall, 2020) said that trust in the government is associated with support in dealing with the COVID-19 pandemic. It is the government's obligation and responsibility to prevent the spread, one of which is through contact tracing applications. (Susanto et al., 2016) also discovered an insignificant correlation between trust and continuation intentions; it is suggested that trust does not always favorably affect technology use because trust might fluctuate over time.

Lastly, the finding in this study is in accordance with the theory (Bhattacherjee, 2001) and most of the previous studies (Gupta et al., 2020; Huang, 2019; Malik & Rao, 2019; Oghuma et al., 2016; Suzianti & Paramadini, 2021; Tam et al., 2020; Yousaf et al., 2021) which was confirmed that satisfaction positively and significantly affect continuance intention. Consequently, the continuance intention of using contact tracing application is influenced by the satisfaction formed from using contact tracing application.

6. Conclusions and Implications

6.1. Conclusions

This study extends ECM to include perceived privacy, perceived security, trust, and effort expectancy in order to explore the factors influencing users' intention to continue using contact tracking programs. The hypothesis is being expanded to give a more thorough understanding of the contributing variables. This study gathered 531 respondents, whose responses were then analysed using SEM. A total of 14 of 16 hypotheses are supported. More information on this study's academic and managerial contributions is provided in the subsequent chapter.

6.2. Implications

Academically, this research addresses the topic of contact tracing applications as an essential tool in controlling the spread of coronavirus. An in-depth literature review of continuous intention to use contact tracing applications has yet to be profoundly explored. In order to comprehend continuous intention better, this study provides a

theoretical framework that incorporates ECM with a number of variables. This proposed research model offered a 72.3% explanation of users' continuance intention to use contact tracing applications. Furthermore, by confirming the constructs used, the study's findings add to the body of research already in existence. The study also broadens the context in which the ECM is often applied, extending it from a general and optional IS use context to an application's mandatory use.

Managerially, this study's implication can also be used by contact tracing application providers to develop long-term strategies to enhance public usage by focusing on factors that affect satisfaction, which is the most influential determinant of continuous intention to use contact tracing applications. For instance, a specific technical issue suggests that contact tracing application upgrades appear far too frequently, presumably to address bugs, add features, enhance application performance, or address other technical problems. Updates ought to be voluntary and only necessary periodically to prevent adding another constraint. Accordingly, application providers can do routine evaluations of multiple plausible causes to pinpoint the precise origin of the cited issue, enabling effective and efficient improvements. Moreover, there are risks associated with external parties breaching security in the context of application security. Application providers can improve user perceptions and awareness that contact tracing apps prioritize personal data security, including apprising sufficient details on risk management strategies for information system security that the contact tracing application has implemented.

7. Limitation and Future Research

Despite our best efforts to draw several conclusions, we were unable to eliminate several limitations of our study. First, the analysis concentrated on the use of contact tracing applications in a single country. Each country has distinct demographics, habits, coronavirus case numbers, and regulations, all of which might be represented by distinct aspects of the app used for COVID-19 contact tracing. Second, this study incorporates additional constructs into the Expectation Confirmation Model. We believe other theoretical models can be combined to produce a better, more thorough explanation. In addition, there is also scope for further research into the potential for contact tracing applications to change function once the COVID-19 pandemic has shifted to endemic levels, as the pandemic response functionality will be eliminated.

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