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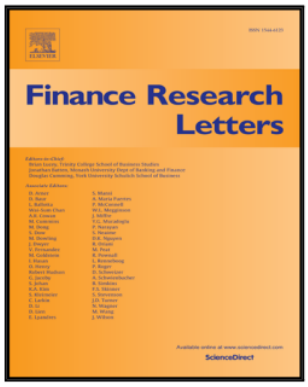

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Adoption of Digital Technologies for Micro and Small Business in Indonesia[1]

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Highlights

- A survey of 2,222 micro and small enterprises in Indonesia
- Determinants of the use of technological-based innovation
- Some business factors as well as firm and owner characteristics matter
- The adoption is different during the Covid-19

Abstract

A substantial proportion of Indonesian households in Indonesia depend on micro and small enterprises for their income. Mobile phone and internet penetration is expected to substantially drive micro and small enterprises to use technological-based innovation which eventually will improve the productivity and efficiency of those firms. In this paper, using a survey of 2,222 micro and small enterprises in Indonesia, we estimate an empirical model on the determinants of the use of technological-based innovation including digital finance technologies and online sales for micro and small enterprises. By doing so, we are able to improve understanding of the barriers to micro and small business use of digital technologies in Indonesia. Our results reveal that some business factors as well as firm and owner characteristics play significant role in explaining the barriers of

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[3] The views expressed in this paper are the authors' only and do not necessarily reflect those of Otoritas Jasa Keuangan.

adopting digital innovation. We also find that firms with higher income and selling during Covid-19 pandemic mostly adopt digital technologies in their business activity.

Keywords: digital technologies, adoption, micro and small enterprises, Covid-19, Indonesia

1. Introduction

It is generally considered that a substantial proportion of households in Indonesia depend on their micro and small enterprises for income. Over the years, in Indonesia, a set of innovations in the financial and non-financial aspects were generated to reach out to the micro and small enterprises. Although some affirmative policies have, to some extent, been implemented by the government to boost the performance of those enterprises, some obstacles remain in place. The 'mobile revolution', particularly penetration of mobile phone and internet, opens up a set of possibilities for innovation to improve the business process of micro and small business by enabling technology.

Some previous studies have pointed out the importance of technological adoption and capabilities for micro, small and medium enterprises particularly in improving their competitiveness and performance (Pal et al., 2008; Duch-Brown et al., 2017; Sadeghi and Biancone, 2018; Zhou et al., 2019; Hansen and Bøgh, 2020; Räisänen and Tuovinen, 2020). Moreover, Agyekum et al. (2021)

show that the usage of information and communication technologies for the services of small and medium enterprises (SMEs) contributes to improve their access to external credit facilities, which subsequently enhance financial inclusion. It is also in line with Ayyagari et al. (2011) who find that firm innovation has positive impact on access to external financing.

In this present paper, digitalization of small business model motivates us to empirically investigate determinants of adoption of digital technology by micro and small enterprises. Going deeper, we also argue here that the adoption is more pronounced during the pandemic time[4]. Covid-19 pandemic shift the behavior of people due to the moving restriction and lockdown policy which creates "social distance". Papadopoulos et al. (2020) argue that digital technologies become more important for SMEs during the Covid-19 for their business process. Similarly, Caballero-Morales (2021) show that digital resources such as internet and communication platforms (WhatsApp, ZOOM, Skype) are the main facilitator for SMEs to maintain network and create innovative products, eventually helping them survive during and after Covid-19.

We surveyed 2222 micro and small enterprises in Indonesia across several industries such as local commerce or shop, services and agriculture. We asked several questions regarding the use of technology, the firm characteristics, and how Covid-19 pandemic have changed their business in terms of business activity dan profitability. We also look at whether the adoption of digital technologies is accelerated during the Covid-19 pandemic. Our original survey enables us to clearly understand of the barriers to micro and small business use of digital technologies especially in Indonesia. Encouraging micro and small enterprises to digitalize their business are therefore essential for tackling income inequality and underemployment in Indonesia as many vulnerable households depend on those firms.

Our results show that on business factors that include consumer demand of online payment and low level of direct selling could increase probability to adopt digital technology. Firm factors such as younger age, younger firm, higher education, and availability of fast internet could be significant factor to increase the micro and small firm's probability to adopt digital technology. Our deeper investigation shows that during covid-19 pandemic, firms that have a higher selling and income most likely adopt digital technology such as online marketing and online payment. In general, our

[4] It is, however, slightly different with An et al. (2020) revealing that adoption of new financial technologies is less likely found in regions that historically infected by epidemic disease.

results provide evidence that business factors and firm's internal factors are the main determinants of adoption of digital technology for micro and small enterprises.

The rest of the paper is organized as follows. Section 2 provide brief explanation about data and methodology. Section 3 present empirical results and section 4 offers concluding remarks and policy implication.

2. Data and Research Method

We investigate the determinant of adoption of digital technology for micro and small business. We conduct an online survey of 2,222 microenterprises and small businesses[5] located in Java Island, Indonesia[6]. We clean our data to drop extreme value and avoid respondent's mistake while entering their data. This cleaning leaves us with 2,213 observations. Our survey is designed to identifying barriers to uptake of technological-based innovation including digital finance technologies and online sales[7]. The descriptive statistics of the data is presented in Table 1, while the correlation matrix of variables is reported in Table 2.

To see the determinant of adoption of digital technology, following Hervas-Oliver et al. (2021) , we perform logit model for the analysis. These models allow us to see what factors contributes in explaining the adoption of digital technology relative to non-adoption and to see which factor dominates this adoption. The following is our baseline model:

$$digital\ adoption_i = \alpha + \beta_1 business\ factors_i + \beta_2 firm\ factors_i + \beta_3\ Banking\ factors_i + \beta_4 control\ variables_i + \varepsilon_i$$

A deeper investigation of adoption of digital technology for micro and small firm, we examine the impact of Covid-19 pandemic that arguably affects the business model of micro and small firm

[5] According to the Indonesia Law No. 20/2008, micro enterprises are those having assets no more than 50 million Rupiah and annual revenue no more than 300 million Rupiah. As for small firms, it is defined that those firms have assets between 50 – 500 million Rupiah and annual revenue between 300 million Rupiah to 2.5 billion Rupiah.
[6] Java is the most populated island in Indonesia, approximately 56% Indonesian people live in this island. It is also the center of government administration, business, and industry (Affandi et al., 2019).
[7] The survey was done in September-October 2020

due to restriction in mobilization and lockdown policy. This will give us insight whether the pandemic is forcing the firm to adopt the digital technology in order to survive the business. The following is the estimation model.

$$digital\ adoption_i = \alpha + \beta_1 business\ factors_i + \beta_2 firm\ factors_{i+} \beta_3\ Banking\ factors_i + \beta_4 control\ variables_i + \beta_5 covid19_i + \varepsilon_i$$

Where *covid19* is our conditional variable of the impact of covid 19 pandemic. We take into account the impact of pandemic by asking whether pandemic reduces their income or increase their income. We create variable by ranging the answer from 1 if the pandemic significantly the firm's income and 5 if the pandemic increases significantly the income.

Our dependent variable in this empirical study is the adoption of technological-based innovation. There are three dependent variables to measure the type and level of adoption of technological-based innovation by micro and small enterprises. First, we consider online marketing which is measured a dummy variable 1 if the firms offer and promote the product through online platform, 0 otherwise. Online marketing, including social media, is now becoming an importance component of marketing strategies (Li et al., 2017; Son et al., 2017; Dong and Li, 2018; Nijssen and Ordanini, 2020; Sharma et al., 2020; Alavion and Taghdisi, 2020). Moreover, improving buyers' confidence by a more transparent strategy is also a concern in the marketplace industry in Indonesia (Syuhada and Gambetta, 2013). Second, the availability of point of sales (POS) is used by including a dummy variable for point of sales system. It means the value of 1 for the firm uses software to electronically record their daily transactions and 0, otherwise. Lastly, we take into account online payment to measure the extent to which the adoption is in place. It is a dummy variable for availability of online payment. 1 means firm accept online payment platform from e-wallet using QR code and 0 otherwise.

As for the explanatory variables, we disentangle the factors determining adoption of technological-based innovation into three major parts: business factors, firm factors and banking factors. Business factors are proxied by three variables. First, we take into account the business model of the firms whether they face declining in the physical store visit. Therefore, a dummy variable is

included with the value of 1 if the number of consumer visit at store decreased and 0 otherwise. Second, we account for competition by including a dummy variable for availability of online payment for other firms. The value of 1 if other firms mostly use online payment and 0 otherwise. Third, a dummy variable is included taking the value of 1 if a lot of consumer ask whether there is availability of online payment in the firm and 0 otherwise. As for firm level factors, a set of variables are accounted in the model including firm age, age of the owner, education of owner, gender of owner, funding, awareness of technology, internet connectivity, closeness to society that heavily uses smartphone. We also consider four variables to capture the financial aspect including the use of government-subsidized loan, ownership of bank account, and distance to the nearest financial institution. We also control for some variables including revenue and asset. As mentioned by Hernández et al. (2020), firm size is important determinant of small business performance. The detailed description of all variables can be seen in Table 1.

Table 1. Descriptive statistics

Variable	definition	Obs	Mean	Std. Dev.	Min	Max
online_marketing	A dummy variable 1 if the firms offer and promote the product through online platform, 0 otherwise	2,222	0.819532	0.384663	0	1
POS	A dummy variable for point of sales system. 1 means that the firm uses software to electronically record their daily transactions.	2,222	0.245725	0.430613	0	1
online_payment	A dummy variable for availability of online payment. 1 means firm accept online payment platform from e-wallet using QR code, 0 otherwise	2,222	0.692169	0.4617	0	1
direct_selling	A dummy variable for physical store visit. 1 means the number of consumer visit at store decreased, 0 otherwise	2,222	0.475248	0.499499	0	1
onlinepay_other	a dummy variable for availability of online payment for other firms. 1 means yes, 0 otherwise	2,222	0.842034	0.364791	0	1
consumer_onlinepayment	a dummy variable for a lot of consumer ask whether there is availability of online payment in the firm. 1 means yes, 0 otherwise	2,222	0.59586	0.490835	0	1

firm_age	age of firm ranges 1 to 4. 1 is categorized as young firm and 4 older firm	2,222	1.770927	1.056359	1	4
owner_age	age of owner	2,192	28.43613	11.94528	12	82
educ_owner	owner education level	2,222	3.611611	1.018916	1	6
Male	a dummy variable 1 means male and 0 women for owner	2,222	0.352835	0.47796	0	1
owner_fund	a dummy variable 1 means that the owner uses their own fund for create the firm, 0 otherwise	2,222	0.822232	0.382403	0	1
tech_user	a dummy variable 1 means owner of firm is aware of technology, 0 otherwise	2,222	4.074257	1.048733	1	5
d_internet	a dummy variable 1 means the firm has stable internet connectivity, 0 otherwise	2,222	0.892439	0.309895	0	1
d_smartphone	a dummy variable 1 if close society of the firm is smartphone user, 0 otherwise	2,222	0.937894	0.241403	0	1
d_KUR	a dummy variable 1 means the firm received KUR (government-subsidized loan), 0 otherwise	2,222	0.146715	0.353901	0	1
d_depositor	a dummy variable 1 means the owner has a bank account	2,222	0.90279	0.29631	0	1
account_time	a variable to account how long the owner has a bank account	2,222	6.447795	6.45866	0	40
distance_finance	distance to the nearest financial institution range 1 means very close to 4 means far	2,222	1.825383	0.687002	1	4
owner	a dummy variable 1 if respondent is the owner, 0 otherwise	2,222	0.905491	0.292602	0	1
income_gross	gross income of firm ranges from 1 to 5	2,222	1.433843	0.934066	1	5
asset	the asset of the firm ranges 1 to 4	2,222	1.281278	0.685346	1	4
income_cov19	a variable range 1 to 5. 1 is the income during COVID-19 pandemic reduce significantly and 5 is income is higher, stable, and increase significantly	2,222	2.372637	0.972716	1	5
selling_increase_cov19	A dummy variable 1 means the total selling is increasing during the COVID-19 pandemic	2,222	0.618362	0.485898	0	1

3. **Empirical Results**

We examine the determinant of adoption of digital technology for micro and small enterprises. We have 3 main aspect which are business factors, firm factors, and banking factors that could be a potential determinant of technological adoption on micro and small business. We present the results in two parts. First, Table 3 dan 4 show the empirical results with logit and probit model respectively. Second. Table 4 shows the covid-19 pandemic situation.

As presented in Table 3, we find that pressure from the competitors which using the technology and customers that demand possibility to pay via online payment are positively associated with the use of digital technologies, however, the impact of declining in physical visit is only on the use of digital payment but not on online marketing and point of sales. It indicates that business factors such as the low rate of store physical visit, availability of online payment in other similar firm, and a lot of consumers ask regarding online payment platform availability in the store most likely increase the probability to adopt digital technology in their business activity.

For the firm factor aspect, we find that there is also disparity in the use of digital technologies across demographic characteristics of owners, in particular elders are less likely to exploit digital technologies for their business. It is also found that owner education has positive and significant effect on the use of POS and online payment. Moreover, internet connectivity plays significant role in explaining the barriers to adopt all innovation-based technologies. It indicates that firm factor such as younger age, younger firm, higher education, and availability of fast internet could be significant factor to increase the micro and small firm's probability to adopt digital technology. Turning to the financial aspect, we find that micro and small enterprises obtain funding from the government are less likely to use the digital technologies.

We go deeper by looking at the impact of Covid-19 on the use of digital technologies by micro and small enterprises (Table 5). Shafi et al. (2020) study the impact of Covid-19 on the operation of micro, small and medium enterprises in Pakistan, however, they do not make an empirical estimation. In here, we use two variables capturing the change due to Covid-19. First, we identify whether firms that their income during COVID-19 pandemic is declining, stable, or increasing significantly. Second, we identify firms that their total selling is increasing during the COVID-19 pandemic. Our empirical results find that firms having higher income during the pandemic are positively associated with the use of POS and online payment, while those with increasing selling is positively associated with the use of online marketing. The results indicate that firms that have a higher selling and income most likely adopt digital technology.

We also look at whether different industry behave differently in the adoption of technology shown in table 4. We split the sample into service and retail industry since most of our sample consist of that two industry. Consistent with the overall sample, our results shows the that the determinant of technological adoption for both industry are not different.

Table 2. Baseline logit regression

	(1) online_marketing	(2) POS	(3) online_payment
Business factors			
direct_selling	0.114	-0.121	-0.308**
	(0.72)	(-1.13)	(-2.51)
onlinepay_other	2.082***	0.522**	1.403***
	(12.25)	(2.48)	(8.25)
consumer_onlinepayment	1.552***	0.486***	2.052***
	(8.79)	(3.98)	(16.39)
Firm factors			
firm_age	-0.364***	-0.355***	-0.00793
	(-4.41)	(-4.31)	(-0.11)
age_owner	-0.0554***	-0.0493***	-0.0472***
	(-6.83)	(-5.62)	(-6.41)
educ_owner	0.0988	0.138**	0.187***
	(1.30)	(2.45)	(3.02)
d_gender_male	-0.568***	0.443***	-0.269**
	(-3.58)	(3.93)	(-2.13)
owner_fund	0.273	0.0840	0.296*
	(1.33)	(0.57)	(1.86)
tech_user	0.0912	0.0746	0.0720
	(1.14)	(1.46)	(1.23)
d_internet	0.716***	0.730***	0.666***
	(3.29)	(3.16)	(3.51)
d_smartphone	0.559**	-0.156	-0.0659
	(1.99)	(-0.61)	(-0.26)
Banking factors			
d_KUR	-0.335*	0.0539	-0.517***
	(-1.77)	(0.28)	(-2.98)
d_depositor	0.353	1.002***	0.976***
	(1.32)	(4.05)	(4.72)
account_time	0.00582	0.0181	0.0179
	(0.42)	(1.28)	(1.44)
distance_finance	-0.0656	-0.0373	-0.129
	(-0.58)	(-0.48)	(-1.50)
Control variables			
owner	0.352	0.100	0.0699
	(1.44)	(0.44)	(0.33)
income_gross	0.102	0.278***	0.175**
	(1.11)	(4.09)	(2.23)
asset	-0.168	0.0969	0.230**
	(-1.37)	(1.00)	(2.10)
_cons	-0.349	-3.168***	-2.711***
	(-0.52)	(-5.23)	(-4.70)
N	2213	2213	2213
pseudo R^2	0.461	0.121	0.345

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.0$

Table 3. Regression on the effect of covid19 on the use of technology of micro enterprises

	(1) online_marketing	(2) POS	(3) online_payment
Covid19			
income_cov19	0.0843	0.0666*	0.146***
	(1.58)	(1.87)	(3.65)
selling_increase_cov19	0.627***	0.0361	0.00721
	(6.96)	(0.50)	(0.10)
Business factors			
direct_selling	0.108	-0.0308	-0.104
	(1.18)	(-0.47)	(-1.43)
onlinepay_other	1.110***	0.287**	0.820***
	(11.34)	(2.46)	(8.34)
consumer_onlinepayment	0.827***	0.283***	1.176***
	(8.63)	(4.00)	(16.64)
Firm factors			
firm_age	-0.195***	-0.189***	0.00749
	(-4.18)	(-4.10)	(0.18)
age_owner	-0.0292***	-0.0283***	-0.0255***
	(-6.44)	(-5.73)	(-6.12)
educ_owner	0.0591	0.0771**	0.102***
	(1.40)	(2.33)	(2.92)
d_gender_male	-0.336***	0.257***	-0.163**
	(-3.78)	(3.85)	(-2.28)
owner_fund	0.180	0.0461	0.161*
	(1.58)	(0.53)	(1.78)
tech_user	0.0452	0.0435	0.0402
	(1.01)	(1.46)	(1.23)
d_internet	0.314**	0.381***	0.344***
	(2.54)	(3.01)	(3.21)
d_smartphone	0.329**	-0.121	-0.0267
	(2.07)	(-0.82)	(-0.19)
Banking factors			
d_KUR	-0.143	0.0695	-0.245**
	(-1.34)	(0.64)	(-2.46)
d_depositor	0.201	0.576***	0.568***
	(1.35)	(4.23)	(4.84)
account_time	0.00490	0.0109	0.0106
	(0.63)	(1.36)	(1.51)
distance_finance	-0.0371	-0.0184	-0.0618
	(-0.59)	(-0.40)	(-1.28)
Control variables			
owner	0.185	0.0830	0.0311
	(1.34)	(0.63)	(0.25)
income_gross	0.0591	0.161***	0.0921**
	(1.13)	(4.01)	(2.08)
asset	-0.117*	0.0538	0.112*
	(-1.70)	(0.94)	(1.86)
_cons	-0.642	-2.034***	-1.940***
	(-1.59)	(-5.82)	(-5.72)
N	2213	2213	2213
pseudo R^2	0.494	0.124	0.349

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4. Regression on the effect of covid19 on the use of technology of services-based micro enterprises

	Service			Retail		
	online_marketing	POS	online_payment	online_marketing	POS	online_payment
Covid19						
income_cov19	0.127	0.0793	0.292**	0.0768	0.0525	0.235*
	(0.69)	(0.77)	(2.46)	(0.47)	(0.49)	(1.85)
selling_increase_cov19	1.570***	0.218	-0.0292	1.135***	-0.0290	0.175
	(5.17)	(1.03)	(-0.14)	(4.12)	(-0.14)	(0.77)
Business factors						
direct_selling	-0.209	-0.275	-0.355*	0.471	-0.0237	-0.0233
	(-0.71)	(-1.47)	(-1.74)	(1.59)	(-0.12)	(-0.10)
onlinepay_other	2.073***	0.451	1.247***	2.354***	0.985***	1.347***
	(6.68)	(1.32)	(4.29)	(7.67)	(2.61)	(4.78)
consumer_onlinepayment	1.348***	0.718***	2.109***	1.951***	0.601***	2.278***
	(4.34)	(3.68)	(10.51)	(5.95)	(2.72)	(9.85)
Firm factors						
firm_age	-0.476***	-0.440***	0.0220	-0.165	-0.255*	0.0577
	(-3.22)	(-3.21)	(0.18)	(-1.16)	(-1.81)	(0.46)
age_owner	-0.0518***	-0.0574***	-0.0349***	-0.0573***	-0.0328**	-0.0666***
	(-3.59)	(-3.87)	(-2.92)	(-4.11)	(-2.27)	(-5.18)
educ_owner	0.0340	0.0120	0.284***	0.149	0.207**	0.142
	(0.25)	(0.12)	(2.69)	(1.12)	(2.10)	(1.30)
d_gender_male	-0.707**	0.258	-0.0532	-0.241	0.747***	-0.0676
	(-2.49)	(1.38)	(-0.26)	(-0.87)	(3.77)	(-0.30)
owner_fund	0.689*	0.476*	0.129	0.0661	-0.168	0.433
	(1.84)	(1.88)	(0.50)	(0.18)	(-0.64)	(1.51)
tech_user	0.114	0.0792	-0.0243	0.255*	0.148	0.0572
	(0.77)	(0.97)	(-0.25)	(1.82)	(1.58)	(0.54)
d_internet	1.092***	0.161	0.720**	0.711*	1.293***	0.409
	(2.59)	(0.40)	(2.01)	(1.95)	(3.08)	(1.36)
d_smartphone	0.575	-0.392	0.0984	0.482	-0.538	-0.0257
	(1.13)	(-0.97)	(0.24)	(1.02)	(-1.25)	(-0.06)
Banking factors						
d_KUR	0.0773	0.104	-0.293	-1.061***	0.0729	-0.593*
	(0.22)	(0.34)	(-1.02)	(-3.10)	(0.21)	(-1.90)
d_depositor	0.143	0.843**	0.750**	0.391	0.781*	1.348***
	(0.29)	(2.13)	(2.21)	(0.86)	(1.93)	(3.77)
account_time	0.0325	0.0487**	0.00519	-0.0122	-0.0111	0.0363
	(1.35)	(2.18)	(0.26)	(-0.47)	(-0.44)	(1.59)
distance_finance	-0.499**	-0.0649	-0.147	0.247	0.210	0.138
	(-2.35)	(-0.48)	(-1.00)	(1.23)	(1.59)	(0.90)
Control variables						
owner	-0.267	0.317	-0.179	0.936**	-0.0819	-0.0982
	(-0.52)	(0.80)	(-0.49)	(2.31)	(-0.21)	(-0.27)
income_gross	0.278	0.447***	0.105	0.0186	0.244**	0.403***
	(1.41)	(3.58)	(0.76)	(0.12)	(2.15)	(3.00)
asset	-0.181	0.297*	0.132	-0.230	0.244	-0.00843
	(-0.67)	(1.75)	(0.65)	(-1.14)	(1.47)	(-0.05)
_cons	-0.388	-2.738**	-3.182***	-3.285**	-5.164***	-3.511***
	(-0.28)	(-2.56)	(-3.07)	(-2.55)	(-4.80)	(-3.39)
N	787	787	787	836	836	836
pseudo R^2	0.472	0.151	0.308	0.570	0.154	0.430

t statistics in parentheses

$^{*}p<0.1, ^{**}p<0.05, ^{***}p<0.01$

4. Conclusion and Policy Implications

In this paper, we estimate an empirical model on the determinants of the use of technological-based innovation by surveying 2,222 micro and small enterprises in Indonesia. We find that some business factors as well as firm and owner characteristics play significant role in explaining the barriers of adopting digital innovation. Our results show that firms with lower direct selling, facing competitive markets, and having consumers payment preference have higher probability to adopt digital technologies. Younger firms and younger owners with access to internet are also associated with higher probability of digital technology adoption. We also find that firms with higher income and selling during Covid-19 pandemic mostly adopt digital technologies in their business activity.

Therefore, it is essential to identifying practical steps that can be taken to address barriers to digital adoption of micro and small enterprises. For instance, practical digital literacy should be addressed to less educated and relatively elder owners. The internet coverage should also be widened to accelerate the digital technology adoption in daily business activity of micro and small enterprises.

Authorship contribution statement

Irwan Trinugroho: Conceptualization, Writing, Formal Analysis, Project administration

Putra Pamungkas: Methodology, Software, Formal Analysis, Data Collection

Jamal Wiwoho: Conceptualization, Review, Supervision

Sylviana Maya Damayanti: Conceptualization, Review, Data Collection

Teddie Pramono: Review, Validation

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