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A Panel Data Analysis of the Roles of Education Level and Financial Capacity on E-government Adoption for Higher Transparency and Efficiency in ASEAN Countries

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ABSTRACT

E-government is an emerging phenomenon that refers to the use of new and innovative technologies to provide services to citizens, which results in increased transparency and efficiency. Financial capacity of a country refers to the ability of a country or a government to manage the expenses and finances of the country and to make rational decisions related to finance. Level of education means the literacy rate or the number of knowledgeable people in the country. The basic plan of this study is to analyze the impact of education level and financial capacity on the e-government adoption by using the two control variables which are per capita income and GDP growth. The data for this study has been collected for the ASEAN countries for 28 years. In the research process, several techniques are used such as IPS unit root test, Pedroni cointegration test, coefficient test of FMOLS, Granger causality test, etc. The results of the study explain that financial capacity and education level have an impact on the GDP growth. However, per capita income does not have any impact on the GDP growth. This study has several implications and benefits which are related to practical, theoretical and policy making benefits for e-government adoption.

KEY WORDS:

Panel data analysis, level of education, financial capacity, e-government adoption, ASEAN.

JEL Classification: H52, I26.

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1. Introduction

E-government is the process of applying innovative practices with latest technology in the government process and information management system to increase transparency, efficiency and effectiveness of government (Sriyukul & Jermsittiparsert, 2020; Boonratmaitree et al., 2020). Venkatesh et al. (2016) suggested that e-government involves the incorpora-

tion of information and other communication technologies in various aspects of public administration during the delivery of its responsibilities towards its citizens. E-government also leads towards the transparency in government activities, participation of citizens towards the decision-making processes of government and collaboration of public and government towards the economic development and growth (Schnoll, 2015).

Figure 1 shows different aspects that are related to the concept of e-government. Financial capacity refers to the knowledge, skills and information about how to

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make appropriate financial decisions that are sufficient for a person's life. Financial capacity also involves the ability of a person to handle all their financial expenses effectively. Althonayan & Althonayan (2017) as well as Dodel & Aguirre (2018) have argued that financial capacity of a country shows the financial strength of that country in context of per capita income and GDP growth. A country having a greater per capita income and a greater GDP is said to be financially strong and vice versa. Education level can be defined as the ratio of people who are educated in a particular country. This can also be referred to as literacy rate. Education is very important for every country, as the educated people are the foundation of all countries and lead it towards the financial stability, growth, and development of economy of that country. They can also participate in different processes of decision making with government and may also collaborate with government in various activities for the betterment of the country. Levels of education may be understood in such a way that how much people are educated to how much extent. The demographic data related to different dimensions of demographics such as age, gender, occupation, education, etc., can be collected and used for different purposes as also elaborated by Ebbers, et al. (2016) and Gerstenecker et al. (2016) in their studies.

Higher levels of education and higher financial capacity of a country is really important to adopt e-government process but unfortunately ASEAN countries are not giving enough required attention towards education system and different factors related to financial capacity or strength. Due to this, they are facing difficulties and resistances in applying e-government practices in their countries. Sá et al. (2016) described the fact that other than ASEAN countries, other developing and underdeveloped countries are also facing issues in the adoption of e-government solutions. If this problem prevails for a longer period of time, it will result in slow progress of a country because of inability to adopt e-government. Therefore, it is important to improve the conditions of education sector and financial strength of their countries as soon as possible (Gupta et al., 2017; Lichtenberg et al., 2015).

There are several researches conducted in order to study the levels of education, financial capacity, and e-government adoption. However, no study has been conducted to see the impact of levels of education

and financial capacity on adoption of e-government (Kurfah et al., 2017). Therefore a research paper of Khan & Majeed (2019) has recommended studying the impact of levels of education and financial capacity on e-government adoption in ASEAN countries. The main objectives of this research are as follows:

- 1) To analyze the significant impact of Levels of Education on e-government Adoption in ASEAN countries
- 2) To analyze the significant impact of Financial Capacity on e-government adoption in ASEAN countries

As it is evident that ASEAN countries are growing economically with every passing day, so it has become very important for them to shift to and adopt e-government practices in their country. The scope of this study revolves around the idea of seeing an impact of levels of education and financial capacity on e-government adoption (Güler et al., 2019). The significance of this study is that it will provide enough literature and information about the impact of levels of education and financial capacity of a country on e-government adoption. This paper will also assist the governments of ASEAN countries to make the education conditions better and strengthen the financial situation of their countries in order to adopt e-government practices (Martin et al., 2018). It will also help their governments to make certain policies and regulations that are in favor of education and financial situations of these countries.

2. Literature Review

2.1. Social Construction of Technology

Social construction of technology refers to the concept that technology cannot determine the human behaviors but human behaviors can determine the ways through which technology can be developed (Bijker et al., 1989). The usage of technology cannot be understood until unless the sense in which technology is introduced in the society is completely understood. In addition, in order to get the reasons behind acceptance and rejection of technology, one must understand the society in which then technology is actually introduced. If a person regards a technology as the best, it must be made clear that what does the feedback "the best" means and how it can be measured (Klein & Kleinman, 2002). This is possible if a person has proper education and knowledge and information about a

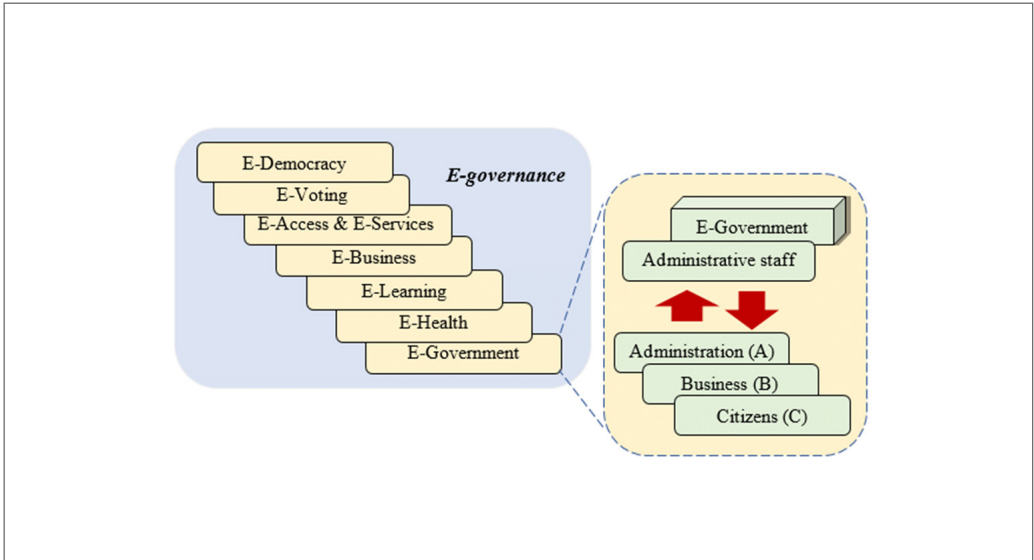


Figure 1. Different factors of e-government.

Source: Dziekański (2017)

particular technology so that they can fully understand technology and its various aspects. Basically this theory is all about the study of reasons behind acceptance and rejection of technology. As in our study, levels of education and financial capacity are being studied in the context of their impacts on e-government that consists of use of latest technology and innovations in various government services, so it can also be studied under this theory (Pinch & Bijker, 1984; Hussain et al., 2020).

2.2. Impact of Level of Education on E-government Adoption

Education plays a crucial role in the growth and progress of any country. Educated people readily adopt latest technology products and innovative practices in certain aspects of life. But still there are very contradicting views of researchers in this regard. Some researchers argue that people having higher levels of education are more into latest technology products and innovation as compared to the people with lower levels of education. On the other hand, Buffat (2015) discussed in his studies that the people who are more educated do not pay much attention to the new technology products as they do not have enough time for that as compared to the people who are less educated.

These are two conflicting statements or ideas present in literature. The most accepted view in this regard is that the educated people are having better jobs and are more exposed to the highly innovative and technology-oriented products and services in the form of part of their routine life (Mensah & Mi, 2017; Morin et al., 2019). They are habitual to use these technologies. So in our case, it is quite evident that in any country, the level of education plays a vital role in the adoption of technology and innovation and in our case e-government. Studies have shown that a country having more people who are educated will be at ease to introduce the concept of e-government as compared to the countries with less educated people. According to Anthopoulos, Reddick, Giannakidou, and Mavridis (2016), the reason behind this aspect is that the educated people know how to use technology and its related products and they can make better use of it as compared to uneducated people. Studies have shown that educated people know the importance and significance of e-government and they can get maximum benefit out of this system (Morin et al., 2019). They can also participate in decision making processes of government based on their education and also collaborate with government in giving ideas, suggestions and opinions and leading towards

the economic growth and development of that country (Mensah et al., 2017). From all the above discussion we can conclude that education plays a chief role in the adoption of e-government in a particular company and ASEAN countries in our case. We can make the following hypothesis:

H1: Levels of Education have significant impact on e-government Adoption in ASEAN Countries

2.3. Impact of Financial Capacity on E-government Adoption

Financial capacity or strength is the basic tool or pillar for the strong and growing economy of any country. Financial capacity of a government can be characterized through its share in GDP growth and per capita income of that particular country. Al-Hujran et al. (2015) emphasized that a country having higher per capita income and higher GDP growth actually show high financial strength as compared to the countries having less per capita income and GDP growth rate. Studies and researches have discussed the fact that a government is able to apply the concept of e-government only if it is financially strong enough to do that (Niccolai et al., 2017). Otherwise it will depend on the old and conventional methods and practices of providing different services to the citizens. As e-government is a technological and innovative tool of any country, therefore it requires a significant part of the budget set for that country (Alam, 2017). If a government is not financially strong enough, it will have to pay attention towards its various functions in order to increase its financial capacity. After having enough financial strength it can finally move towards the adoption of e-government. Okunola et al. (2017), Rajan and Ramcharan (2016) and Tracy et al. (2017) have discussed that in order to get financially strong; a government must improve its services and hire skilled people that may lead it towards prosperity. They must know each and every aspect of finance and its related concepts such as fiscal and monetary policy formation, financial accounting tools, finance of businesses etc. so that they may contribute towards different sectors of that country (Abu-Shanab, 2017; Zheng, 2017). This will not only get that government a step closer to the adoption of e-government but will also help it to increase the growth and development of the economy of that country. From all the above discussion we can conclude that improvement

and increase in the financial capacity of a country leads towards the feasibility of application and adoption of e-government practices in that country and in our case ASEAN countries. We can generate the following hypothesis in this regard:

H 2: Financial capacity has significant impact on e-government adoption in ASEAN Countries

3. Research Methodology

3.1. Data

Data collection is one of the most important parts of any research as the whole research is based upon it. This research also needed some specific data related to the variables given in the topic. There are three kinds of variables in this study i.e. control variables, dependent and independent variables. The independent variables of this study include level of education and financial capacity while the dependent variable is e-government adoption. Similarly, there are two control variables in this study that include per capita income and GDP growth. The data has been collected about all these variables from the most authentic and accurate sources such as World Bank, e-government development index etc. The collected data is comprised of 28 years and for 10 ASEAN countries. These countries include Brunei Darussalam, Laos, Cambodia, Indonesia, Myanmar, Malaysia, Philippines, Thailand, Singapore and Vietnam.

3.2. Model Specification

The purpose or motive of this research is to study the impact of two independent variables, namely, level of education and financial capacity on the dependent variable namely, e-government adoption. This impact may also be affected with control variable presence, namely, per capita income and GDP growth. Therefore these control variables are also significant in this study. All these variables can be denoted by specific forms and measured in various units. The first independent variable level of education (EDU) can be measured by the units of gross percentage of people getting education at a specific level. The next independent variable in this study is financial capacity (FIN) that can be measured by different units such as amount of money or knowledge about finance etc. E-government (EGOV) is the dependent variable used in this study which is measured by the number of people adopting the concept of e-government.

Per capita income (PCI) a control variable is measured by the amount of money in dollars. The last control variable, GDP growth (GDP) can be measured by change in GDP. All these variables are the backbone of this study as they are the base of data collection as well as the research process. All these variables can be used to derive the final equation of regression. The regression equation is given below:

$$EGOV_{it} = \alpha + \beta_1 EDU_{it} + \beta_2 FIN_{it} + \beta_3 PCI_{it} + \beta_4 GDP_{it} + \varepsilon_{it} \quad (1)$$

Where, EGOV is the adoption of e-government, EDU is level of education, FIN is financial capacity, PCI is used for per capita income, GDP is GDP growth of a country, α is used to denote constant, i is used for denoting the cross-sectional data, t shows time series data and ε_{it} is the error term.

3.3. Estimation

After enough and appropriate data has been collected from different sources, the next step of every research is to analyze that data through the use of various techniques and approaches. Different studies use different techniques for research purpose based on their types of variables and types of study. In this study, the author will be using panel data approach for research. In this regard, different panel tests will be used by the author. These tests include panel cointegration test, panel unit root test, coefficient estimation and granger causality test only if required or necessary. All the above-mentioned tests have different characteristics and functions that are used for various research purposes. There are different characteristics and functions for each technique and method explained above. All the techniques and approaches have their own advantages and benefits, which are described in detail in this section along with their generally used equations.

3.4. Panel Unit Root Test

The first and most vital test for panel research used in the concerned study is panel unit root test. As the name implies, this test is based on the null hypothesis, according to which a variable has a unit root and data related to it is stationary. This test can be applied on cross sectional and time series data in this study. Panel unit root test can be carried out in either of the

two ways: Levin-Lin-Chu (LLC) or Im-Pesaran-Shin (IPS). These tests are actually the extensions of Dickey-Fuller extension tests for panel unit root. IPS unit root test provides different or heterogeneous autoregressive results in case of cross-sectional data while LLC provides homogeneous autoregressive results when applied to cross sectional data. Pedroni (2004) supported the same idea in his study. In addition to that, these tests are more accurate and authentic as compared to the other unit root tests used in the past researches and studies. Another important benefit of this test is that it provides the standard normal distribution of data before conducting research that has several benefits (Hussain et al., 2019). Another important significance of these tests is that they give more accurate and firm outcomes in case of time series data having more variations in context of the observations as well as numbers of data collected. The conventional and old tests do not provide any such benefit. As this study is about ASEAN region which contains many countries, therefore the data collected from those countries provide great variation in the data which ultimately results in the more accuracy of the panel unit root tests. The results of these tests show that whether the variables are integrated or not and also tells whether the data is stationary or non-stationary (Pedroni, 2001b). All these points show the importance of these tests. In this particular study, author has chosen IPS test for research purpose, the general equation of which is given below:

$$\Delta y_{i,t} = a_i + \rho y_{i,t-1} + \sum_{j=1}^{p_i} a_j \Delta y_{i,t-j} + \varepsilon_{i,t} \quad (2)$$

Where $\Delta y_{i,t}$ is the difference of $y_{i,t}$ for i^{th} country in time period $t = 1 \dots T$.

3.5. Panel Cointegration Test

After panel unit root test, the next important test is panel cointegration test that is employed specifically in panel research methods. From the unit root test, the integration and unit root of the variables is identified. After identification of integration, it is really important to check the cointegration of different variables used in our study i.e. level of education, financial capacity, e-government adoption, per capita income and GDP growth of the country. Again in this case, two different tests can be used for research

purpose. These tests include Kao and Pedroni. These tests are based upon the Engle-Granger (1987) two-step (residual-based) cointegration tests. Both these tests provide homogeneous autoregressive results for cross sectional data just as was provided by LLC unit root test. These tests are basically used in order to identify any cointegration among various variables of this study. Stationarity from the unit root tests play an important role in this regard. The non-stationary data in the level series represents various kinds of variations in that data which can be converted to a stationary form in first difference series of data. The non-stationary state of the data actually shows that there exists some long term relationship between the variables. Pedroni (1996) explained that these tests use two different approaches at the same time while research process. These approaches include within dimension and between dimension approaches. Both of these approaches use different types of statistics. In this study, the author has used Pedroni cointegration test, the general equation of which is given below:

$$y_{i,t} = \alpha_i + \delta_{i,t} + \beta_1 X_{1,i,t} + \beta_2 X_{2,i,t} + \dots + \beta_n X_{n,i,t} + \varepsilon_{i,t} \quad (3)$$

3.6. Coefficient Estimation Test

After checking the integration and cointegration among the variables, the research process leads towards the identification and evaluation of relationships and impacts of various variables used in this study, namely: level of education, financial capacity, e-government adoption, GDP growth, and per capita income of the country. This test is basically used to check the status of hypotheses made by the author in literature review section whether these are accepted or rejected and to what extent and significance level. There are two different types of coefficient estimation techniques, namely, FMOLS and DOLS according to Pedroni (2001a). In the past, just OLS was used for coefficient estimation, but it did not provide satisfactory results. Therefore FMOLS (non-parametric) and DOLS (parametric) were derived from OLS by modifying it in one way or the other. Both of these parametric and non-parametric techniques can be used to deal with problem of serial correlation. In this study, in order to check the association between different variables, the author has used FMOLS technique, the

general equation of which is given below:

$$\hat{\beta}_{FM} = \left(\sum_{i=1}^N \sum_{t=1}^T (x_{i,t} - \bar{x}_i)^2 \right)^{-1} \sum_{i=1}^N \left(\sum_{t=1}^T (x_{i,t} - \bar{x}_i) EGOV_{i,t} - T \hat{\delta}_{\varepsilon u} \right) \quad (4)$$

Here $EGOV_{i,t}$ is the transformed variable of e-government adoption.

4. Empirical Analysis

4.1. Results of Unit Root Test

This test can be used to identify the stationarity and non-stationarity of the data in level and first difference series. In addition, the unit root that is related to the null hypothesis is also identified. The null hypothesis in panel unit root test illustrates that the variables are in zero order and the data is stationary. The results of panel unit root test are shown in Table 1. The table shows that the null hypothesis of zero integration at level form of the data is not rejected which depicts the stationary state of data included in level series. On the other hand, when the same procedure is used at first difference in the series, it is clearly found that data rejected the null hypothesis of zero integration. This rejection is of significance level of both one and five percent at random places. This means that data at first difference series is non-stationary and the variables are in order one. We can say that the data in level series is stationary while the data in first difference series is non-stationary.

4.2. Results of Panel Cointegration Test

After checking and identifying integration among variables of the study, the author will now check the cointegration among various variables of this study. For this purpose, panel cointegration test has been used, the results of which are presented in Table 2. The table shows two different approaches i.e. within dimension and between dimension approaches along with their own statistics and p-values. It can be seen that "within dimension" approach; the null hypothesis is rejected by the panel rho statistics having a level of significant of 1%, the null hypothesis is again rejected by panel PP statistics at 1% significance level while the null hypothesis is rejected by ADF test at 5% significance level. On the other hand "between dimension" approach, the null hypothesis

Table 1. Panel Unit Root Test

Variable	Level	First Difference
EGOV	-3.39554 (0.7245)	-1.82462* (0.0023)
EDU	-2.37593 (0.2653)	-2.84733** (0.0013)
FIN	-2.47837(0.2383)	-1.02862**(0.0025)
PCI	-1.37498(0.2942)	-2.37847* (0.0132)
GDP	-0.36493 (0.1983)	-3.24922* (0.0023)

Note: *, ** indicates rejection of the null hypothesis with significance of 1% and 5 %

Table 2. Panel Cointegration Test

Dimension	Tests	Statistics	T-value
Within Dimension	Panel v statistic	-0.82362	-1.27365
	Panel rho statistic	-0.48262*	-3.28365
	Panel PP statistic	-1.92642**	-3.28647
	Panel ADF statistic	-2.23864**	-2.95736
	Group rho statistic	-1.26357**	-2.02472
Between Dimension	Group PP statistic	-0.27365**	-2.82647
	Group ADF statistic	-3.23875**	-3.23876

is rejected by the PP statistics at 5% and null hypothesis is rejected by the group ADF at 1% significant level. Thus, it is clear that 5 out of 7 statistics show's rejection of null hypothesis either 1 or 5% significant level. Thus it is concluded that all the variables are cointegrated with each other.

4.3. Coefficient Estimation Test

In order to estimate the coefficients of different vari-

ables, this study aimed to identify the impacts of control as well as independent variables on dependent variable, FMOLS test has been used by the author. The results of FMOLS have been presented effectively in Table 3. The coefficients of the first independent variable, level of education, are 0.753 and 1.372 for pooled and grouped variables respectively. The significance levels of these coefficient values are five and one percent respectively depicting the significant

bond between level of education and e-government adoption. The next independent variable, financial capacity shows the coefficient values 1.286 and 1.352 for pooled and grouped versions respectively. In addition, the one and five significance values of these coefficients show that financial capacity has significant impact on e-government adoption. Impact of one of the two control variables of this study, GDP growth has been accepted as its coefficients show five and one percent significance levels respectively in pooled and grouped data. On the other hand, the impact of the other control variable is rejected due to insignificant results. We can conclude that the two major hypotheses along with a control variable GDP growth has been accepted and only one control variable, per capita income has been rejected.

5. Discussion

This study was aimed to check the effect of independent variables, level of education and financial capacity on the dependent variable, e-government adoption by using two control variables i.e. GDP growth and per capita income. For this purpose, the past literature was studied and different hypotheses were made as a result. The first hypothesis in this regard was that level of education has significant impact on e-government adoption. This hypothesis was scrutinized by applying several tests and techniques and as a result of this, the hypothesis was accepted. This is because of the reason that education increases the awareness of people regarding e-government practices and thus more people adopt e-government. This result was also presented in a past study conducted by Arendsen, Peters, Ter Hedde, and Van Dijk (2014). In addition to this, another hypothesis was made that financial capacity has significant impact on e-government adoption by people. This hypothesis was tested effectively, and the result of the tests showed that this hypothesis was also accepted. The same result was shown by a similar research by another author, Bowman (2011). The impact of per capital income, which is a control variable, was rejected, when different tests applied. People's income will not affect the adoption of e-government by the people. This result is same in other studies too such as Jiménez-Rodríguez* & Sánchez (2005). The impact of the last variable, GDP growth in this study, however, has been accepted by the author after evaluating various results shown by the tests and

approaches. The same behavior was shown in another study by Steckel (1983) conducted in the past.

6. Future Directions and Limitations

There are many limitations of this study. Let them discuss one by one. The first limitation in this regard was that data was collected from only ASEAN countries, which could be collected from other countries too. In addition, a few selected tests were used in this study such as panel unit root test, panel cointegration test, co-efficient estimation test. Future researchers may also use some other tests regarding the research purpose. Moreover, sample size of the data was very less. So in order to increase the spectrum of research, future researchers may also increase the sample size of data. Variables other than those used in this study may also be considered in future.

7. Discussion

Education is very important in all aspects and areas of life, as it provides knowledge and information about latest practices taking place in the world. Financial capacity refers to the capability of a person or a government to bear and manage all the expenses in an efficient way by using various important concepts of finance. E-government is an emerging and important concept that refers to the use of innovative practices and latest technology in the provision of information management to the citizens of that country. The main objective of this study was to check the impact of level of education and financial capacity on the dependent variable, e-government adoption. In addition, per capita income and GDP growth are also used as control variables in this study. The data was obtained from the ASEAN countries for 28 years from reliable sources. The data was then examined by different methods and techniques including cointegration test, unit root test, test of co-efficient estimation etc. Resultantly the two hypotheses developed in literature review section were accepted. Additionally, the impact of the GDP growth is also accepted. But, the effect of other control variables used in this study i.e. per capita income has been rejected.

7.1. Implications

Various, practical, theoretical can policy implication benefits from this study are present. On theoretical grounds, this study provides various information and

Table 3. Estimating Coefficients

Variables	Pooled	Grouped
EDU	0.753**(2.816)	1.372*(2.723)
FIN	1.286*(2.132)	1.352**(3.748)
PCI	0.836(0.535)	-0.027(-0.027)
GDP	-1.672**(-2.926)	1.234*(2.113)
Adj. R-Square	0.825	0.796

Note: Here *, ** and *** show the level of significance at 1, 5 & 10% respectively.

literature for doing further research. The information provided is related to e-government adoption, financial capability and education level. Additionally, this study also helps in providing the directions to the government for improving the conditions of financial capacity and education to increase the spread of e-government. Beside that, this study also provide assistance to the government to develop policies which are favorable for financial capability and education of the country, so that e-government awareness is developed among the people.

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