Analysis of the Effect of Technology on the Growth of the Information and Communication Sector in the Bali Province 2016-2021

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Abstract. Technology continues to develop and drive economic growth. Bali, as a province that is open to foreign tourists in Indonesia, has a great opportunity to adopt technology more quickly. This study aims to analyze the effect of technology development as well as other variables such as the number of workers in the Information and Communication Technology (ICT) sector, household consumption for ICT, and the amount of accommodation for Gross Regional Domestic Product (GRDP) of the ICT Sector in districts/cities of Bali Province. The analysis to be used is descriptive and inferential analysis with panel data regression from regencies/cities in Bali Province period 2016-2021. The model used is the fixed effect model. In general, the GRDP of the ICT Sector continues to increase, but its growth is decreasing every year. Meanwhile, technological developments in Bali Province tend to increase every year. With a significance level of 5 percent, the percentage of e-commerce users, the percentage of ownership of cell phones, and the number of accommodations have a significant positive effect on the GRDP of the ICT sector. Technological progress has not been fully utilized, therefore the GRDP growth of the ICT sector tends to decrease every year.

1. Introduction

Information and Communication Technology (ICT) has become a part of human life. From a structural point of view, technology becomes the basis for organizational activities by manifesting technology in various types of human activities [1]. ICT is developing rapidly over time, some of the impacts of ICT development are the emergence of several new communication tools which make access to information faster and easier [2]. The use and utilisation of information technology has revolutionalized educational system, banking, industrial and trade. The creation of digital economy-an ecomony based on knowledge creation, dissemination and outsorcing [3]. Technological developments will have an impact on various areas of life. Advances in ICT play a role in economic growth and productivity, apart from that it also has a role in spurring increases in productivity and innovation in various fields such as financial services and the economic sector [4]. Technological progress is the third factor determining economic growth after capital and labor. Technological developments can take the form of increasing labor productivity, increasing capital productivity, as well as increasing overall productivity and will ultimately increase the economic growth of a region [5].

In the economy, the ICT sector is a sector whose main activities are related to the development, production, commercialization, and incentive use of ICT [6]. The ICT sector has become one of the important sectors of the Indonesian economy. This is shown by the total added value of the ICT sector

which continues to increase. The Gross Domestic Product (GDP) growth of the ICT sector is in line with the growth in national ICT development as indicated by the ICT development index. In 2020, the Indonesian economy grew negatively because various economic sectors were affected by the Covid-19 pandemic. However, the GDP of the ICT sector continues to grow positively. Positive growth in the ICT sector's GDP indicates an increase in performance. During 2016-2020, although the order has changed the province with the highest ICT development index in Indonesia is Kepulauan Riau, DKI Jakarta, DI Yogyakarta, Bali, and East Kalimantan Province. Where in 2020 Bali Province will have growth the largest among the other four provinces and greater than the growth of the national ICT development index. The high growth of the ICT development index in Bali Province makes researchers interested in studying more deeply the development of technology in Bali Province and how it affects the economy.

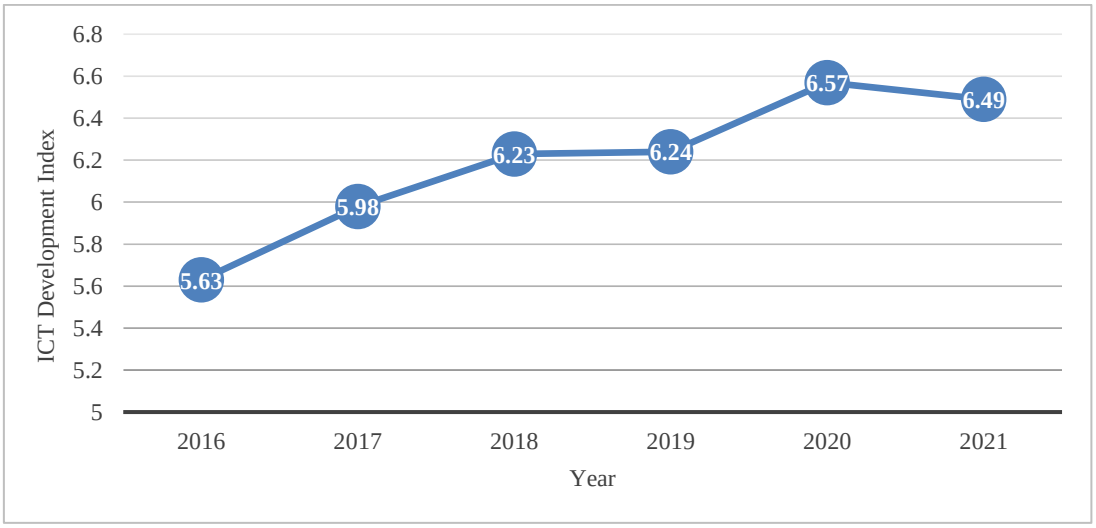

Figure 1. Bali's ICT Development Index 2016-2021
Source: BPS-Statictics Indonesia (processed)

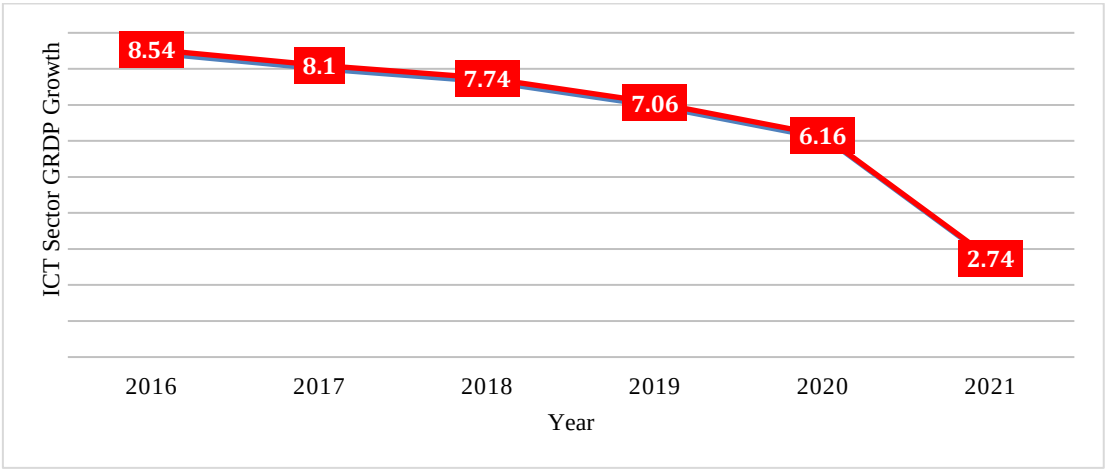

Figure 2. GRDP Growth's ICT Sector Bali Province 2016-2021
Source: BPS-Statictics Indonesia (processed)

Bali's provincial government continues to increase the utilization of ICT developments. This can be seen from Bali's ICT development index, which tends to continue to increase during 2016-2021 (Figure 1). The development of ICT affects various areas of life, including the economy. The development of ICT is expected to improve the performance of various sectors of the economy, especially the ICT sector.

However, in reality, the high development of the ICT development index in the Bali Province has not been followed by the GRDP growth of the ICT sector. Based on Figure 2, it can be seen that the GRDP growth of the ICT sector shows a downward trend from 2016 to 2021. Not compatible with the growth theory which states that technological developments increase economic growth, the development of the ICT development index in Bali Province is in contrast to the declining GRDP growth of the ICT sector. The same thing happened at the district/city level in the Bali Province, where some districts/cities had indicators of technological development that were higher than indicators of technological development at the provincial level but the GRDP growth rate for the ICT sector was lower than the provincial growth rate and vice versa. Bali's economy is strongly supported by the accommodation, food and beverage providers, and the agricultural sector. However, during the pandemic in 2020, these three sectors and almost all sectors in Bali Province experienced negative GRDP growth. Meanwhile, despite the unstable situation, the ICT sector has the largest and most positive GRDP growth. This makes the ICT sector a sector that has the potential to restore the economy of the Bali Province, so its growth must be considered and maintained.

The performance of economic growth as a result of technological developments has attracted the attention of economists. Several studies by Bahrini and Qaffas [7] and Khuong [8] show that the use of technology has a significant positive effect on economic growth in various countries. The intensity of the use of ICT increases the value-added growth of the ICT sector and increases the average productivity of the workforce. Meanwhile, according to Haftu (in [9]) increasing access to cellular phones will play an important role in reducing the poverty rate by increasing the per capita income of the population. On the other hand, research by Kamilla [10] shows that gross fixed capital formation (PMTB), ICT development index, internet users, cell phone users, and household spending on telecommunications significantly affect economic growth. Research by Dharmawan (in [6]) shows that the percentage of the population who own cell phones has proven to affect the growth of the ICT sector in Indonesia. Meanwhile, Triana's research (in [11]) shows that the growth of the ICT sector is influenced by the number of workers in the ICT sector, the average length of schooling, and internet usage. Consequently, ICT plays an important role as a vehicle for economic growth [12].

Technological developments have had an impact on economic growth, including the ICT sector itself. However, research on the ICT sector in Indonesia is still limited, especially at the district/city level. This study uses several variables in previous studies and also adds variables that are characteristic of the Bali Province so that it can be additional information for the provincial government of Bali in developing the ICT sector as well as being an update on this research. The variable is the number of accommodations as approach to the tourism sector in technological development in Bali Province. As a tourism area, technological innovation is utilized in accommodation businesses. Technologies introduced widely during the pandemic turned into must-haves in the accommodation industry from contactless to mobile messaging. Accomodation are investing in technology to improve the guest experience and influence the guest's online reviews afterwards [13]. So technology is widely used by accommodation businesses. The accommodation business is an industry in the tourism sector that adopts innovation technology in business operations, so that the running of the accommodation business is closely related to the use of technology. This study aims to find out the general description and the influence of ICT development and other factors that are thought to have affected the GRDP ICT sector in all regencies/cities of Bali Province from 2016 to 2021.

2. Methodology

2.1. Economic Growth Theory

The neo-classical growth theory developed by Solow shows how growth in the capital stock, growth in the labor force, and technological advances interact in the economy and their effect on overall output [10]. Solow's growth theory explains economic growth by developing the production function.

$$Y = f(K, L) \tag{1}$$

Where Y is output, K is capital and L is labor. The production function shown by equation (1) shows that output depends on the stock of capital and labor. From this function, Solow adds the technological factor to the equation. Technology can increase input-output productivity. By adding the technological progress factor, the Solow growth model equation can be written as:

$$Y = f(A, K, L) \tag{2}$$

Technological progress can bring progress to the economy, meaning that with the same number of inputs, more output will be produced. Developing the Solow growth model, endogenous growth theory explains that the source of growth is an increase in capital accumulation in a broad sense. In contrast to the Solow growth theory, the endogenous growth model tries to incorporate technological processes endogenously. In concert with these two theories, Todaro and Smith [14] explain that capital accumulation, population growth, and technological development are three important factors that play a role in economic growth.

2.2. Data Coverage

The research covers 9 regencies/cities in Bali Province with a research period from 2016 to 2021. The model is built based on the Solow growth theory. The dependent variable used is the Gross Regional Domestic Product (GRDP) (at constant prices; million Rupiah) of the ICT sector as a proxy for economic growth. The independent variables used are workers in the ICT sector (person) as a proxy for labor, household expenditure for ICT (Rupiah) as a proxy for capital, internet users for e-commerce (percent), and cell phone owners (percent) as a proxy for technological development, and the number of accommodations (units) as an approach variable from the tourism sector as characteristic of the Bali Province which is having a high speed in adopting and utilizing technology.

This research is quantitative by using secondary data and the period used is annual. GRDP ICT sector, the percentage of internet users for e-commerce, and the percentage of cell phone owners were obtained from the results of publications from the Central Bureau of Statistics (BPS, 2016-2021). Household consumption data for ICT were obtained from the Indonesian National Socio-Economic Survey (SUSENAS, 2016-2021), data on the workforce in the ICT sector were obtained from the Indonesian National Economic Census (SE 2016), and the Indonesian National Labor Force Survey (SAKERNAS, 2017-2021) and data on the number of accommodations were obtained from the Office Bali Province Tourism (DISPARDA Bali, 2016-2021).

2.3. Panel Data Regression

This research uses descriptive analysis and inferential analysis. Descriptive analysis was carried out to provide an overview of the variables used, while inferential analysis was carried out to analyze the independent variables that are thought to influence the GRDP growth of the ICT sector Bali Province 2016-2021 using panel data regression analysis.

The panel data regression model is a regression model based on panel data, which is a collection of data that has dimensions of space and time. Panel data consists of several individual units (cross-sections) collected over a certain period (time series). In panel data regression, there are three possible models, namely:

Common Effect Model (CEM)

This model assumes that the intercept and slope coefficient are constant over time and the individual, and the error term explains the difference between the intercept and the slope coefficient over time and the individual [15]. There is no individual effect in this model, this is because the CEM assumes heterogeneity between individuals has been averaged. The CEM model equation can be written as:

$$y_{it} = \alpha + \boldsymbol{x}_{it}'\boldsymbol{\beta} + v_{it} \tag{3}$$

Note:

i : 1, 2, ..., 9 regencies/cities in Bali Province

t : 1, 2, …, 6 research period

y_{it} : the value of the dependent variable for the i-th individual and t-th period
α : intercept
$\boldsymbol{x}'_{\boldsymbol{it}}$: the transpose vector of the independent variable for the i-th individual and t-th period
$\boldsymbol{\beta}$: vector of independent variable slope
v_{it} : error between cross-section observations of the research period for the i-th individual and t-th period

Fixed Effects Model (FEM)

This model considers individuality in cross-sectional observations so that the equation has different intercepts for each individual, but each individual intercept does not vary over time. In this equation, the slope is constant for all time and individuals. Thus, the value of the dependent variable for the i-th individu of the t-period depends on the k independent variables that are different for each unit cross-section. The FEM model equation can be written as:

$$y_{it} = (\alpha + \mu_i) + \boldsymbol{x}'_{\boldsymbol{it}}\boldsymbol{\beta} + v_{it} \quad (4)$$

Note:
μ_i = individual effect for the i-th individual

Random Effect Model (REM)

The REM model expresses individual differences in intercept values for each individual in the error term. In REM, individual effects are random (stochastic), so individual effects cannot be combined with the intercept model. The REM model equation can be written as:

$$y_{it} = \alpha + \boldsymbol{x}'_{\boldsymbol{it}}\boldsymbol{\beta} + (\mu_i + v_{it}) \quad (5)$$

The best model was determined using the Chow test, the Hausman test, and the BP-LM test. The Chow test is used to choose between the CEM or FEM model by looking at whether there is an individual influence on the model. The Chow Test has the following formula:

$$F_{stat} = \frac{RSSS_{CEM} - RSS\_FEM/N-1}{RSS_{FEM}/NT-N-K} \quad (6)$$

Where RSS_{CEM} is the residual sum of square from CEM and RSS_{FEM} is the residual sum of square from FEM. If there are individual effects then the model chosen is FEM. Next, proceed with the Hausman test to choose between the FEM or REM model with the formula:

$$W = \left[\hat{\beta}_{FEM} - \hat{\beta}_{REM}\right]' \left[Var\left(\hat{\beta}_{FEM}\right) - Var\left(\hat{\beta}_{REM}\right)\right]^{-1} \left[\hat{\beta}_{FEM} - \hat{\beta}_{REM}\right]' \quad (7)$$

$\hat{\beta}_{FEM}$ is the estimated slope on the FEM and $\hat{\beta}_{REM}$is the estimated slope on the REM. The Hausman test was carried out to see the correlation between individual effects and independent variables. However, if there is no individual effect or the selected CEM model in the Chow test, then continue with the BP-LM test which chooses between the CEM or REM models with the formula:

$$BP - LM = \frac{NT}{2(T-1)}\left[\frac{\sum_{i=1}^{N}\left(\sum_{t=1}^{T} v_{it}\right)^2}{\sum_{i=1}^{N}\sum_{t=1}^{T} v_{it}^2} - 1\right] \quad (8)$$

v_{it} is the residual from CEM. If the best model obtained is CEM then the estimation method used is Ordinary Least Square (OLS). However, if the chosen model is FEM, it is necessary to test the residual variance-covariance matrix. If the model is heteroscedastic and there is no correlation then the estimation method used is Weighted Least Square (WLS), whereas if the model is heteroscedastic and there is autocorrelation then the estimation method used is Seemingly Uncorrelated Regression (SUR). Meanwhile, if the best model chosen is REM, the estimation method used is Generalized Least Square (GLS).

3. Results and Discussions

3.1. Overview of GRDP ICT Sector and Other Variables

Economic growth is one indicator that can be used to find out how the economic development of a country or region is. This study uses constant GRDP of the ICT sector to measure the growth of the ICT sector. An increase in the GRDP value of the ICT sector indicates that there has been an increase in added value generated in that sector.

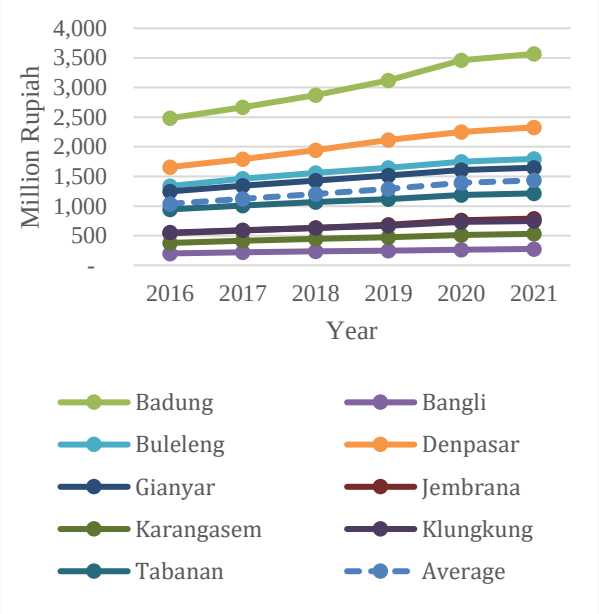

Figure 3. GRDP ICT sector in regencies/cities of Bali Province in 2016 2021
Source: BPS-Statictics Indonesia (processed)

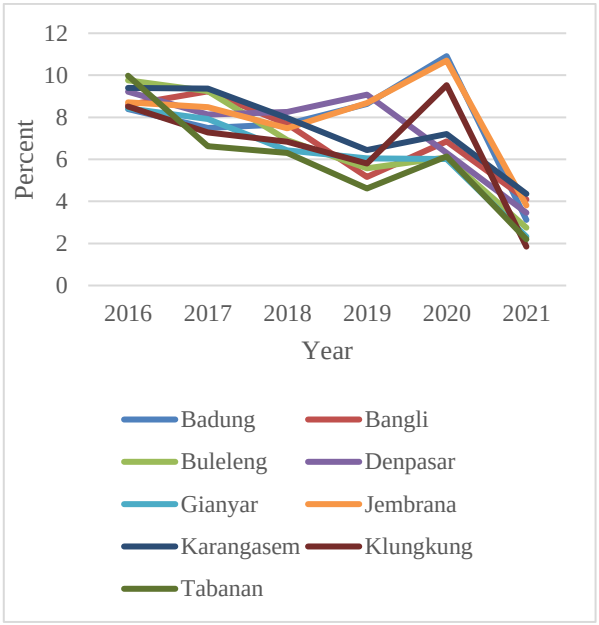

Figure 4. GRDP growth rate of the ICT sector in regencies/cities of Bali Province in 2016-2021
Source: BPS-Statictics Indonesia (processed)

Figure 3 shows that in general the GRDP ICT sector in each district/city as well as the average in all districts/cities of the Bali Province in 2016-2021 tends to increase. Badung Regency and Denpasar City respectively have the highest GRDP ICT sector during 2016-2021. The high GRDP ICT sector in Badung Regency and Denpasar City can be since these two regions are regencies/cities that are considered smart cities in Indonesia. Nonetheless, in general, the growth of the GRDP ICT sector in regencies/cities in Bali Province fluctuated and tended to experience a downward trend during 2016-2021 as shown in Figure 4.

The average level of household spending on ICT in several districts/cities in Bali Province has fluctuated from 2016 to 2021. Nonetheless, the average across districts/cities shows a positive trend. When compared for each district/city, Badung Regency and Denpasar City are the regions with the highest average spending on ICT in Bali Province 2016-2021 (Figure 5).

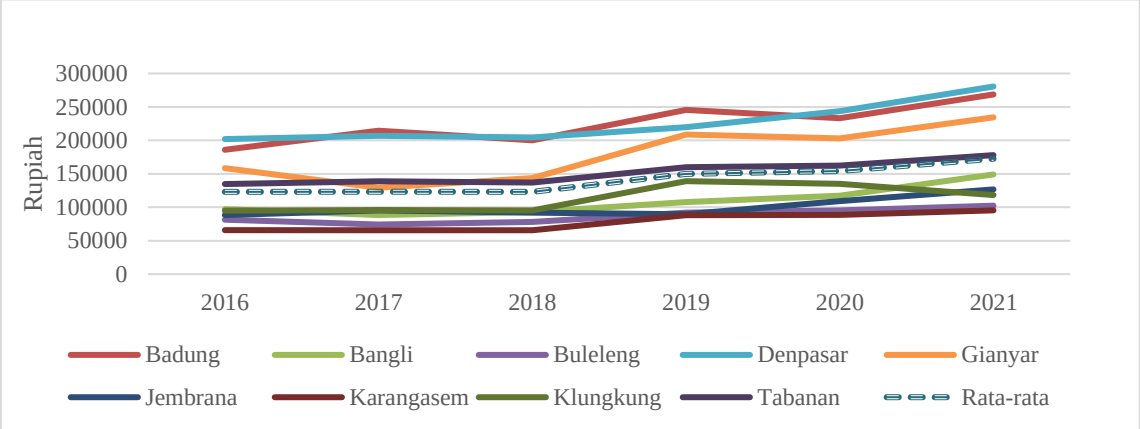

Figure 5. Household consumption for ICT in districts/cities of Bali Province 2016-2021
Source: BPS-Statictics Indonesia (processed)

The high level of consumption for ICT in Denpasar City is since Denpasar is the capital of the Bali Province so this city is the center of government and the economy of Bali. Apart from these two areas, Gianyar Regency and Tabanan Regency are also areas with an average household expenditure on ICT that is higher than the average household expenditure on ICT in the Bali Province. In contrast, Karangasem Regency is the region with the lowest average household consumption for ICT among the regencies/cities of Bali Province from 2016 to 2021. The average household expenditure for ICT in Karangasem Regency was only 65,733 thousand rupiah in 2016 and the highest is 95,342 thousand rupiah in 2021.

Technological advances have contributed to human well-being including in terms of new jobs, goods, health services, travel, and communications. At the same time, technology can affect how workers are hired and how companies operate [16]. Technological developments make competition in the labor market increasingly difficult. With increasingly advanced technology, the systems used by companies are more sophisticated, so companies need workers who have ICT skills. Therefore more developed areas will need more professional and skilled workers. This is following the level of workforce in the ICT sector in the districts/cities of the Bali Province.

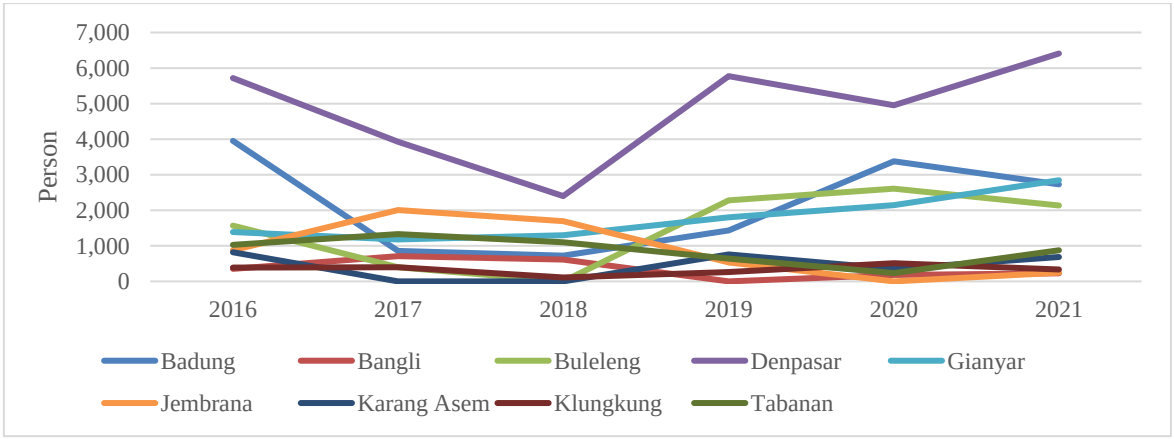

Figure 6. Number of ICT workers in regencies/cities of Bali Province in 2016-2021
Source: BPS-Statictics Indonesia (processed)

Technological developments in the Bali Province are seen in the percentage of internet use for e-commerce and the percentage of cell phone users. Overall these two indicators tend to increase during the 2016-2021 period as can be seen in Figure 7 and Figure 8.

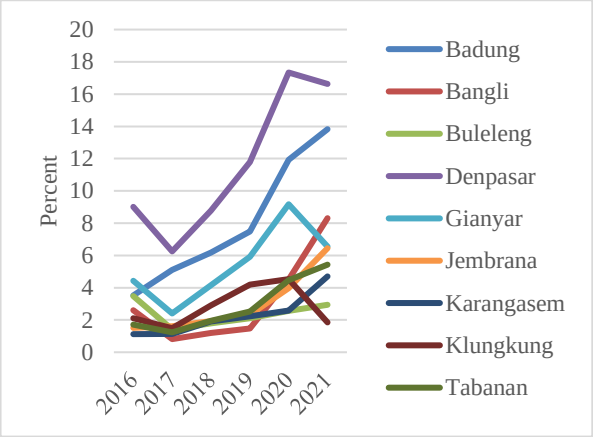

Figure 7. Percentage of internet users for *e-commerce* in regencies/cities of Bali Province 2016-2021
Source: BPS-Statictics Indonesia (processed)

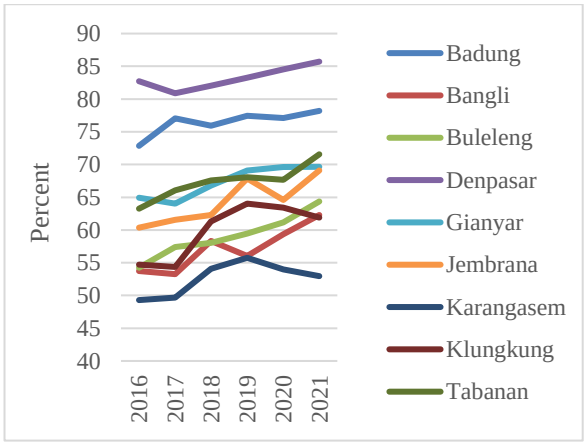

Figure 8. Percentage of cell phone owners in regencies/cities of Bali Province 2016-2021
Source: BPS-Statictics Indonesia (processed)

Figure 7 shows that from 2016 to 2021 Denpasar City had the highest percentage of e-commerce users, which had experienced a decline in 2017 but then continued to increase until it reached the highest percentage in 2020, which was 17.33 percent and again decreased in 2021. A significant increase in the percentage of e-commerce users occurred in several regions in 2020. This is because in 2020 there was a Covid-19 pandemic which caused many people to use online buying and selling services to avoid direct interaction with other people. The e-commerce business in Indonesia has increased by 5 to 10 times during the Covid-19 pandemic, with new customers reaching 51 percent [17]. Nonetheless, the percentage of e-commerce users in Denpasar City, Gianyar Regency, and Klungkung Regency in 2021 has decreased. This is due to the high increase that occurred in 2020 and apart from that, the main obstacle experienced in carrying out e-commerce business activities during 2021 was dominated by the lack of demand for goods and services [18].

Figure 8 shows the percentage of cell phone owners in each district/city in Bali Province fluctuates quite a bit but tends to have a positive trend, which occurs due to the ease of accessing the internet using smartphones and the prices of smartphones that are increasingly affordable for all segments of society. This positive trend also shows that Balinese people are increasingly responsive to the digital era. The highest percentage of cell phone users is in Denpasar City from 2016 to 2021. On the other hand, until 2021 the percentage of cell phone owners in Karangasem Regency was only 52.95 percent, this figure is also the lowest percentage among other districts/cities in Bali Province year 2021.

Tourists need a temporary place to stay (accommodation) while on a tour which will be used as a temporary home and meals during the tour [19]. Various types of lodging continue to grow and experience changes in various aspects gradually. Lodging is considered one of the key elements that support the tourism and transportation industries and other activities [20]. Figure 9 shows the number of accommodations in each district/city in Bali Province.

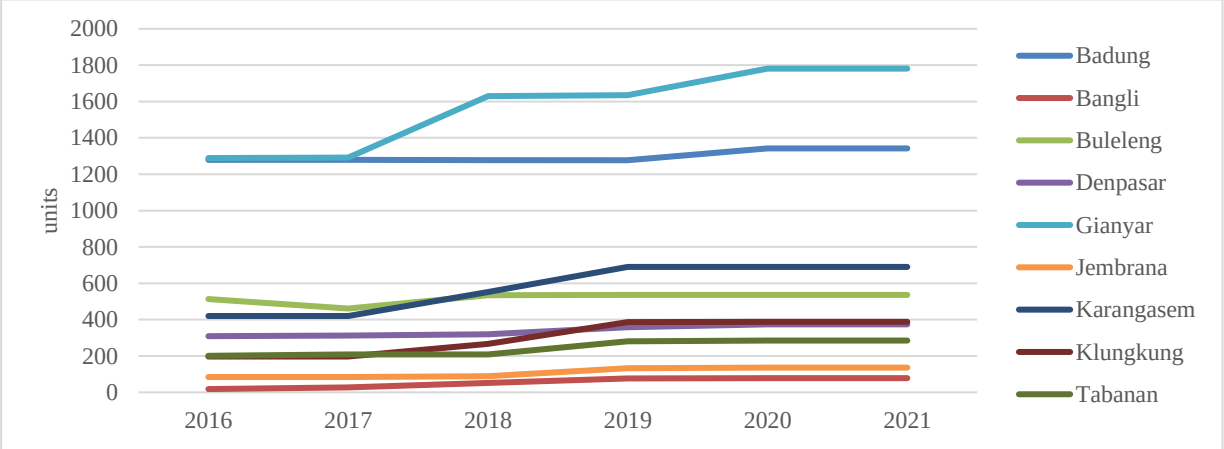

Figure 9. Number of accommodations in regencies/cities of Bali Province in 2016-2021
Source: BPS-Statictics Indonesia (processed)

Gianyar Regency has the most number of accommodations from 2016 to 2021. Gianyar Regency is one of the areas that has many well-known tourist areas in foreign countries and has various arts, culture, and craft tourism objects where this is an attraction for tourists [20]. Meanwhile, Jembrana Regency has the least number of accommodations, reaching only 136 in 2021. Overall, the number of accommodations in Bali Province has increased from 2016 to 2021. Nonetheless, the number of accommodations in several areas such as Badung, Buleleng, and Kota Denpasar tended to be stagnant during the study period, while the rest experienced an increase.

3.2. Variables Affecting the Development of GRDP in the ICT Sector

Determination of the best model in panel data regression is done by conducting the Chow test. Based on the calculation, the F value is 138,611 with a p-value of 0.0000. Thus, it can be concluded that the FEM model is better than the CEM model. Then the Hausman test was carried out to choose between FEM and REM. The value of the chi-square is 26,921 with a p-value of 0.0001 so FEM is better than REM. Because the selected model is FEM, it is necessary to test the residual variance-covariance structure. In the LM test, a statistical value of 4,506 was obtained, this value is smaller than the table value $X^2_{(0,05:8)} = 15{,}50$ so that reject H_0, which means that the structure of the variance-covariance residual model is homoscedastic. In testing, λ_{LM} a statistical value of 4.9464 is obtained, this value is smaller than the value $X^2_{(0,05:53)} = 50{,}99$ so the decision obtained is a failure to reject, H_0 which means that there is no cross-sectional correlation so the best model for FEM is the OLS estimation method. Then testing the classical assumptions. Because the assumptions of homoscedasticity and non-autocorrelation have been fulfilled in the previous test, it is only necessary to carry out normality and non-multicollinearity tests. In the normality assumption test with the Jarque Berra test, the p-value of 0.302 is obtained so that the normality assumption is fulfilled. The non-multicollinearity assumption is fulfilled with the VIF value of each independent variable which is less than 10, thus it can be concluded that the non-multicollinearity assumption is fulfilled.

The estimation results with the FEM OLS method obtained an adjusted value R^2 of 0.993 which means that 99.3 percent of the variation in the dependent variable can be explained by the independent variables in the model while the rest is explained by other variables outside the model. Furthermore, simultaneous testing is carried out with the F-test, the value is obtained p-value 0.000 so that a decision is withdrawn H_0. Thus it can be concluded that with a significance level of 5 percent, there is at least one independent variable affecting the dependent variable.

Table 1. Estimation results with FEM OLS

Variable	Coefficient	std. Error	t-Statistics	Prob
C	10.748	1.081	9.945	0.000*
lnExpen	0.117	0.109	1.068	0.292
Work	-6.63E-06	1.15E-05	-0.575	0.568
EC	0.016	0.005	2.973	0.005*
Cell	0.015	0.005	2.849	0.007*
lnAccom	0.104	0.050	2.079	0.044*
R- *Square*				0.994
Adjusted R-Square				0.993
F statistics				609.189
Prob. (Statistic F)				0.000*

**) significant at 5% test level*

Based on the results obtained as shown in Table 1, the following equation can be formed:

$$\text{lnGRDP\_ICT}_{it} = (10.747^{*} + \mu_i) + 0.116 lnExpen_{it} - 6.63E^{-06}\text{Emp}_{\text{it}} + 0.015 EC^{*}_{it} + 0.0152 Cell^{*}_{it} + 0.103 lnAccom^{*}_{it} \quad (9)$$

Note:
lnGRDP_ICT : natural logarithm of GRDP ICT sector
lnExpen : natural logarithm of household consumption for ICT
Work : ICT worker
EC : internet users for e-commerce
Cell : cell phone owners
lnAccom : natural logarithm of accommodation

Household consumption for ICT has no significant effect on the GRDP ICT sector. Household consumption for ICT between districts/cities in Bali province does not have huge differences. Apart from that, the average expenditure on ICT in Bali Province is quite low, ranging between 123 - 172 thousand rupiah from 2016 to 2021. Following the research of Dharmawan [6] and Triana [11] which concluded that the consumption behavior shown through the average consumption for ICT does not show a significant difference so that the average household consumption for ICT is unable to explain the diversity of GRDP ICT sector. This result is also in concert with research conducted by Martaningsih and Marhaeni (in [21]) which shows that household consumption expenditure has no effect on economic growth in the districts/cities of the Bali Province. Household consumption does not affect economic growth due to low household consumption [22].

The ICT sector workforce variable does not significantly affect the ICT sector GRDP. Workers in the ICT sector require special skills, for local workers who do not have competence it will be difficult to compete, especially for those who do not have specific expertise certificates in the ICT sector [23]. In addition, the absorption of labor in the ICT sector in the Bali Province is still not optimal, this is evidenced by the fluctuating number of workers in the ICT sector even though technological developments in the Bali Province tend to continue to increase. Large population growth tends to affect slow economic growth if it cannot cope with a workforce that is not absorbed by jobs [24]. Therefore, the ICT sector workforce does not have a significant effect on the GRDP ICT sector in Bali Province.

The variable percentage of internet users for e-commerce has a significant positive effect on the GRDP ICT sector. The coefficient of 0.01580 multiplied by 100. This is because the equation is a semi-log model, that is an equation in which only one variable (regressand) appears in logarithmic form. By multiply the coefficient with 100, coefficient will give the percentage change in GRDP ICT for an absolute change in internet users for e-commerce [16]. Then, the coefficient of 0.01580 indicates that every one point percent increase in internet users for e-commerce will increase the GRDP of the ICT

sector by 1.580 percent assuming ceteris paribus. The Internet allows people from different organizations or locations to work together as a virtual team to develop, produce, market, and maintain a product or service. The internet makes marketing companies, products, and services more interactive [10]. This makes the use of e-commerce increase among the public. The use of the internet for e-commerce is evidence of technological developments in the economy [25]. This utilization leads to increased productivity which then has implications for increasing the flow of ideas and information dissemination which encourages the growth of technological innovation and will ultimately increase the GRDP ICT sector.

The percentage of cellular phone users has a significant and positive effect on the GRDP ICT sector. As well as percentage of internet users for e-commercer, the coefficient value of cellular phone also multiply by 100. The coefficient of 0.01529 indicates that every cellular phone users increases by one point percent, the GRDP of the ICT sector will increase by 1.529 percent assuming ceteris paribus. Cellular phones can be used by the public to access information and communication more easily and at lower costs. Based on BPS data, the use of cellular phones continues to increase among the public, this increase has an impact on increasing output procurement and opening up job opportunities in the ICT sector so that it will encourage economic growth, including growth in the ICT sector.

Furthermore, the accommodation variable has a significant positive effect on the GRDP ICT sector. A coefficient value of 0.103 means that if accommodation increases by one percent, the GRDP of the ICT sector will increase by 0.103 percent assuming ceteris paribus. The accommodation industry is one of the supporters of the economy in the Bali Province. This industry is key and contributes to economic growth because it can increase employment opportunities and people's welfare [26]. Along with technological developments, accommodation managers take advantage of technological advances in managing their business. The accomodation industry leverages the smart use of business technology in many ways, from guest service operations to marketing. Accomodation technology offers a variety of cost savings and revenue opportunities and allows innkeepers to reach new levels of profitability [27]. Technological innovations used in the accomodation industry will increase hotel productivity, reduce operational costs, and at the same time add value to the services and products offered to customers [28]. This is what underlies the use of technology in the accommodation business as a result of technological advances. Some of the innovations that have been carried out by the accommodation industry in Bali include the use of telephones as key cards, the implementation of self-check-in using mobile devices, ordering various services using mobile devices, self-service check-in kiosks, hotel service optimization system, and so on [29]. Then the level of service provided by service companies has increased and provided better services as a result of continuous innovation. This was accomplished through anticipating customer needs and desires, increasing loyalty, growing the customer base while reducing operational costs, and increasing effectiveness and productivity [30]. The use of technology in the accommodation business will drive an increase in demand for goods and services in the information and communication sector. Therefore, the number of accommodations has a significant and positive effect on the growth of the information and communication sector.

4. Conclusion and Reccomendation

GRDP ICT sector in the regencies/cities in Bali Province continues to increase but its growth tends to decline during 2016-2021. This can be seen from the pattern of growth rates which have a downward trend but the numbers are positive. While technological developments are indicated by the percentage of internet users for e-commerce and the percentage of internet users both show a tendency to increase every year. Based on panel data regression, it was found that the variable percentage of internet users for e-commerce and the percentage of cell phone owners as technology proxies is significant and has a positive effect on GRDP growth in the CT sector. The variable number of accommodations indicates that the adoption of technology in the tourism sector has accelerated the GRDP growth in the ICT sector. Meanwhile, the labor variable in the ICT sector and the average household consumption for ICT cannot be proven to affect the GRDP growth of the ICT sector in the regencies/cities of Bali Province in 2016-2021. This sector tends not to require a lot of labor because of its capital-intensive and technology-

intensive characteristics. This requires support from the government so that the policies taken are following their characteristics. Future researchers can use other variables as proxies for technology at the district/city level and pay attention to the spatial interrelationships between regions.

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