Impact of institutions and ICT services in avoiding resource curse: lessons from the successful economies

Birku Reta Entele *

Department of Technology and Innovation Management, Adama Science and Technology University, P.O. box 1888, Adama, Ethiopia

ABSTRACT

Countries endowed with abundant natural resource have not shown similar economic growth. Thus, the study investigates why some resource-abundant countries are not successful while others are. By using the fixed effect panel data model, the study examines the role of institutions and ICT services in overcoming the resource curse problem. The study employed panel data from World Bank database for the period of 25 years (1995–2019). The result shows that natural resource abundance and institutional performance indicators have significant negative effect on economic growth in the case of some group of economies, confirming presence of resource curse and institutional curse. However, these economies have the potential to escape the resource curse provided that they able to build human capital, adopt ICT services and build quality of institutions. Therefore, policies that firmly promote building human capital, quality institutions, adoption and usage of ICT services in resource curse economies could help them to escape the curse.

1. Introduction

Natural resources can be used as factors of production in the domestic industry and as a primary commodity export to earn foreign currency, particularly in developing countries. At least in either of the case, it adds capital accumulation and increases the economic growth of the nation endowed with abundant resources. For instance, countries such as Canada, Norway, Australia, and the United States significantly depend on the export of primary commodities during the early economic development stage (Hongyan, 2010; Lange and Wright, 2004). However, after the 20th century, the role of natural resources considered less important than the role of labor and capital in generating economic growth. Even on the other hand, there is much-growing evidence, which suggests that natural resource abundance may be dangerous to the economic growth of low-income countries. This kind of argument brings the so-called resource curse puzzle (Kangning and Jian, 2006; Liu and Bai, 2008; Feng et al., 2010). For instance, to explore the contribution of natural resources in the economic growth rate of some countries, the correlation between per capita GDP growth rate and the average natural resource rent as a percentage of their GDP is plotted as Figure 1.

From Figure 1 above, we observe that countries with higher natural resource rent as a percentage of their GDP have lower GDP per capita growth rate such as Congo Republic, Saudi Arabia, Venezuela, Sierra Leone, Cote d’Ivoire, etc. On the other hand, we observe that countries with high natural resource rent as a percentage of their GDP have high GDP per capita growth rate such as Chile, Botswana, Canada, etc. Hence, the disparity raises a question of why some resource-abundant economies succeeded while others do not. Furthermore, to get a clear picture of the disparity between the countries, the annual trends of natural resource rent as a percentage of their GDP are depicted as in Figure 2.

Figure 2 above shows that the highest percentage share of natural resource rent to their GDP over time are countries such as Congo and Saudi Arabia while they have the lowest economic performance in contrarily compared to the other countries in the study. Therefore, the research question is why some resource-rich countries are not successful while others are successfully succeeded. Different previous studies have investigated the contributions of institutions to overcome resource curse problem, but no studies have investigated the role of information communication technologies (ICT) in bridging and strengthening the institutional gap and accelerating economic growth via avoiding resource curse problem yet.

According to the World development report of 2016, ICT can create inclusion, efficiency, and innovation World Bank Group (2016). The adoption of ICT services into firms and public service institutions is an innovation since it has significant improvement in productivity and overall efficiency. Furthermore, ICT affects economic activities from both
supply and demand sides. In the demand side, the consumer's economic behavior through utility function and in the supply side on the producer's behavior through productive function will be affected. In the supply side, ICT associated with other complementary infrastructure components resulted in capital deepening, and reorganization of economic processes and ultimately increasing the economic growth and productivity of productive factors in developing countries.

Since ICT products and services are both outputs from the ICT industries and inputs into ICT-using industries, it can impact economic growth through four major channels (Jalava and Pohjola 2007): (i) Production of ICT goods and services which directly contributes to the aggregate value-added generated in an economy, (ii) Increase in productivity of production in the ICT sector which contributes to overall productivity in an economy (TFP); (iii) Use of ICT capital as in input in the production of other goods and services, (iv) Contribution to economy-wide total factor productivity (TFP) from an increase in productivity in non-ICT producing sectors induced by the production and use of ICT (spillover effects) (Samimi, et al., 2015). For instance, African firms that use IT service increases productivity compared to non-users (Cirera et al., 2016). Concerning institutions, the contribution of ICT to business institutions, the democratization process, and public service institutions are; ICT augments business institutions via a cross-border
flow of information, promote international trade, and help to attract foreign direct investment. ICT also helps the democratization process by fostering good governance and streamlining bureaucratic procedures through intra-governmental networking and by reducing corruption. And finally, ICT augments public service institutions, such as the areas of e-government, e-health service, e-education, environmental protection, licensing, controlling, and other sectors too (World Bank Group, 2016). Even in the case of external shock and disaster to the economies, the role of ICT in controlling the situations and survival is of paramount importance. For instance, in the case of pandemic Novel Coronavirus (COVID-19) outbreak, countries with better ICT infrastructure could be able to minimize the potential effect of the virus on their economic activities via working at home, teaching and learning online and online service delivery compared to countries without enough ICT infrastructure.

Therefore, given the potential contribution of ICT to the country’s economic growth and institutions, this study assumes ICT adoption as an innovation in the resource-abundant but cursed countries. In addition to building human capital, the adoption of ICT helps to augment labor and capital productivity and strengthening institutions.

To realize and obtain objective evidence for the aforementioned research questions, the study investigates factors behind explaining why some resource-rich countries are not successful while others are. From institutional and ICT service perspectives, the specific objectives of the study are; (1) to identify the role of the institution in avoiding resource curse problem, (2) to investigate the role of ICT service (digital technologies) in strengthening institutions and avoiding resource curse problem, (3) to identify the threshold level of institutional quality and ICT services to overcome resource curse problem, and finally, (4) to review the successful countries policies and practices which can be a lesson for resource curse countries.

The organization of the study is as follows: Section one is all about the introduction part including research questions and objectives. The next section is a literature review that summarizes previous research output related to the topic, followed by section three, which is the methodology part. Section four discusses results and analysis and, section five presents conclusion and policy implications.

2. Literature review

Many speculations have been said concerning the natural resource abundance curse from different perspectives and conditions. Some of the theories explain the channels of effects of the resource curse is discussed below.

The Dutch disease theory hypothesizes that an endowment of natural resource abundance leads to a decline in other sectors' development for their economic growth rather depends on the windfall resources (Larsen, 2006). This leads to declines in the production and export of the manufacturing sector that has a high global value chain and which could make an economy benefited more than exporting the primary commodity. Hence, this leads to a decline in investment in human capital which is more important for economic development in the long run and hence leads to a decline in a country's competitiveness. According to (Burnside and Dollar, 2000) the damaging consequences are even worse if resources are used for consumption instead of investment for future return.

The rent-seeking synthesis problem may also emerge in resource abundance countries particularly if their institutions are weak. Torvik (2002) suggests that firms in resource-abundant countries have a high probability to engage in rent-seeking activities, leaving only a few to engage in productive ventures. Such rent-seeking behavior is more common in economies with low institutional quality because they are less likely to attract entrepreneurs into productive activities than are good institutions (Wang and Wang, 2009; Mehlum et al., 2006). The problem of rent-seeking behavior and weak institution is the reflection of the extent of the practices of governance. Governance is the process whereby organizations or resources are managed with the insurance of participation, transparency, accountability, and the rule of the law, which determines the path for sustainable change (Sheng, 2009). Thus, good governance is how the effective interactions of the state civil society and the private sector take place. The practices of good governance lead to more efficiency, economic growth and development, effective and efficient service delivery to the public, and fighting corruption (Gisselquist, 2013). Hence, the role of institutions in shaping economic behavior and utilizing economic resources is important. In addition to these two theories, there are also different arguments by different scholars broadly categorized into those who say resource curse existed unconditionally, and those who argue the resource curse is conditional.

Some of the authors such as Kangning and Jian (2006) assume the existence of unconditional resource curse, which means that presence of correlation between resource abundance with a measure of economic development without accounting for other social, and economic and institutional factors that may affect this relationship. But this argument is not more convincing since it fails to explain why economies such as Botswana, which is rich in diamond, is not resource cursed while Sierra Leone, which is also rich in diamond but does appear to be cursed. Another example may be Norway and Nigeria, in which both countries are endowed with abundant oil, but have different economic and living standards status. Norway had able to properly utilize its resources and become the world's richest economies while Nigeria is notorious for its mismanagement of resources, corrupt tendencies, and low economic growth (Sala-i-Martin and Subramanian, 2003).

Other arguments focus on divergent growth experience of countries, despite similar resource type and abundance (Mehlum et al., 2006; Arezki and Van der Ploeg, 2007; Boschini et al., 2007; Humphreys et al., 2007) These researchers have identified that the quality of institutions is the main channel through which natural resources can be extracted and affect economic growth. Hence, the resource abundance countries have the potential to escape the resource curse given that they have capable institutions. Therefore, the main point of this argument is that “the stylized facts that natural resource abundance is bad for growth should be abandoned” Lederman and Maloney (2007), instead, suggest that this should be understood under what circumstances the resources curse does and does not hold.

From technology to institutions and economic growth perspectives, studies on the role of ICT in affecting institutions and economic growth reveals a positive contribution in the case of developed countries. However, there is a growing consensus among economic growth theorists and development specialists that technology innovation and diffusion can play a critical role in stimulating economic growth and productivity (Erdil et al., 2010). Economists such as Simmie (2013) has emphasized technological innovation in explaining economic growth and productivity gains. Simmie (2013) argues that economic growth and technological change are inextricably linked. Thus, widespread technology diffusion creates the possibility of increasing returns to investment, World Bank Group (2016). A study by Hall et al. (2013) find that R&D and ICT are both strongly associated with innovation and productivity, with R&D being more important for innovation, and ICT investment being more important for productivity. Another study by Sapparser (2010) shows that the role of ICT on economic growth is positive and significant. On the other hand, a study by Veeramacheni et al. (2007), Farahani (2010), Pilat and Lee (2001), and Erdil et al. (2010) reveals that there is two-way causality between ICT and economic growth in countries that participated in the study. Yet, this does not necessarily imply that just having ICT services is a guarantee to have better economic growth. Perhaps, the institutions, mindsets and cultural elements may play a crucial role in the process of adapting and adopting the ICT in the resource abundant countries and transform into productive activities. For example, countries like Saudi Arabia, Qatar, and others have good ICT infrastructure, but could not be able to build good institutions complementing with human capital. The overall point is that the adoption of information communication technologies has a potential effect to
strengthen institutions and good governance via accelerating competitiveness, reducing transaction costs, creating efficiency, and then bringing productivity and growth.

Another problem arises from precision to estimation techniques and found no evidence of the unconditional resource curse. Using the same cross-country OLS empirical methodology for the conditional resource curse also incorrectly predicted that all resource abundance economies are destined to be cursed. Hence, by using a panel estimator, this problem can be solved Asongu and Nwachukwu (2017). Hence, this study adopts the later argument and investigates the extent of institutional quality and ICT service investment, helps countries to escape the resource curse problem. By doing so, this paper supplements few studies by Anderson and Aslaksen (2008), Bakwena et al. (2009) which consider the role of the institutional performance on economic growth, and studies by Ahmed & Ridzuan (2013), Erdil et al. (2010), Pilat and Lee (2001), and Farahani (2010) which consider the role of the ICT on economic growth and sectoral productivity.

Theoretically, the study basis on the Resource-based and knowledge-based theory of institutions. The resource-based theory of firms/institutions emphasizes that the correct choice of combination of the resources of a firm may reposition the firm and enhances it to reach a competitive advantage. To gain a competitive advantage, a firm needs to possess specific resources, competency, and capabilities that are valuable, scarce, and durable (Ahmed, 2006). Hence, one of the resources can be ICT. According to the knowledge-based theory of institutions, the primary role of the organization is rather an application of knowledge (Chang and Gurbaxani, 2012.) This is where information technology can play a major role in effectively applying existing knowledge to create knowledge and take the first steps toward forming a competitive advantage (Alavi and Leidner, 2001). For instance, the role of ICT in education sectors, the health sector, the agriculture sector, the public service sector, and all other sectors are significant. Therefore, this study argument is that institutions become stronger given they have digital technologies (ICT) that enable them to run the game the particular institution supposed to play. Hence, ICT services can have the power to equip and strengthen institutions if they properly deploy and use it. ICT may have strong influences on institutional quality and performance, which directly influence the growth rate of the economy. Particularly internet service reduces the transaction cost of public and private services, saves time, and facilitates innovation by small enterprises by easing information access. Therefore, based upon these theories, the study investigates the role of digital technologies (ICT) in building strong institutions and enhancing economic growth in different resource-abundant countries. The human capita (ICT-skilled and non-ICT capital) is considered in the model (see Figure 3).

3. Methodology of the study

3.1. Source of the data

The study used secondary data from the World Bank data set that covers from 1995 to 2019 (25 years of data). Nine countries were considered in the study based on data availability and their resource management practices focusing on the share of their natural resource level to GDP. Four among the nine countries are resource-rich successful countries such as Botswana, Chile, Canada, and Norway, whereas the remain five countries are resource-rich but unsuccessful economies such as Congo Republic, Cote d’Ivoire, Russia, Saudi Arabia, and Venezuela. In fact, the sample size seems small although there are no evidences that states the minimum number of sample size researcher should use for

![Figure 3. Conceptual framework of the study. Figure 3 above shows the framework of information communication technology service contributions to institutional quality and economic growth.](image-url)
estimation of panel data models, as far as our knowledge is concerned. However, it is clear that as the sample size increases the confidence in our estimate increases, and we have greater precision. Study that rely on case study or on macroeconomic variables using countries as a unit of analysis, may not be able to employee large number of countries as a sample size compared to study whose unit of analysis are other microeconomic variables. The same is true for binary data models which there is no consensus bound with regard to sample size (Agresti and Min, 2002). However, in our case a 25 years longitudinal panel data were used which can be sufficient to make econometrics estimation. This is in line with the study by Guo et al. (2013) sample size should be at least 25 in order to meet the bound ratio requirement. But the cross sectional case might be not that much sound enough, but still considerable to make panel data estimation. For instance study by Santos and Barrios (2011) have used within-groups (WG) estimator and the first difference generalized method of moments (FD-GMM) estimators to estimate the dynamic panel data model and confirm no significant different between small and large sample size. Further, it confirms that the cross section dimension N has no effect on the biases of the within group estimators and hence bootstrapped WG and FD-GMM estimators are optimal for small samples. Study by Hayakawa (2007) also provide an evidence that by using systems GMM estimator, possible to reduce the small sample biases in the panel data model. The variables and data used for this study is from the World Bank database1 and its appropriateness is explained as follows. To capture the natural resource abundance, the study uses natural resource rent as a percentage share of GDP. This is because instead of using the percentage share of primary exports, which does not show the stock of natural resources, rather it may show the economic structure of the nation, as stated by Bakwena et al. (2009); this study uses natural resource rent as a share of GDP.

To measure institutional quality, the study considered the combination of legal institutions (just using property right index), political institutions (focusing democratic index, corruption perception index) and economic institutions (index of economic freedom, regulatory index) which called country's policy and institutional assessment (CPIA) index by World Bank report. The lowest index is zero and the highest index is ten, which shows the lowest institutional quality and the highest institutional quality respectively. The highest property rights index, the better the institutions. The other interesting variable of the study is the role of ICT service in strengthening overall institutional quality, which influences the economic growth of the country. Therefore, the ICT service variable is captured by the amount of ICT capital investment in each economy as a proxy. Transforming the data into a logarithmic form the variable is captured by the amount of ICT capital investment in each decade. The highest property rights index, the better the institutions, and others, the growth rate is modeled as follows:

\[
\hat{g} = \beta_0 + \beta_1 \log \text{RPCGDP}_{t-1} + \beta_2 \text{L}_t \gamma + \beta_3 \text{K}_t + \beta_4 \text{NR}_t + \beta_5 \text{INSTQ}_t \\
+ \beta_6 \text{ICT}_t + \beta_7 (\text{NR}_t \times \text{INSTQ}_t) + \beta_8 (\text{INSTQ}_t \times \text{ICT}_t) + \epsilon_t
\] (1)

Where \( \hat{g} = \log \text{RPCGDP}_{t-1} \log \text{RPCGDP}_t \) is economic growth rate from 0 to T years interval, \( \text{RPCGDP}_{t-1} \) is real per capita GDP at year T, \( \text{RPCGDP}_0 \) is real GDP per capita at year 0, \( \text{NR}_t \) is resource abundance at time T (natural resource rent as a percentage of GDP), \( \text{INSTQ}_t \) is the institutional quality, \( \text{ICT}_t \) is the amount of ICT capital expenditure, \( \text{K}_t \) is the non-ICT capital, \( \text{L}_t \) is human capital, \( \text{NR}_t \times \text{INSTQ}_t \) is the interactions terms of resource-abundant indicator and institutional quality level, \( \text{INSTQ}_t \times \text{ICT}_t \) is interaction terms of institutions and ICT capital investment, and \( \epsilon_t \) is set of other explanatory variables such as investment, domestic credit to the private sector, inflation, openness, and regional dummies. Translating equation one above in to words, it becomes ‘the growth rate equals to the real per capita GDP + human capital + non-ICT capital + natural resource share of GDP + institutional quality + ICT + interaction between natural resource and institutional quality + interaction between institutional quality and ICT + other macroeconomic variables such as openness, credit ratio and inflation rate’. Based on the above model, the researcher is aimed to test the following hypothesis.

H01. Natural resources (as factors of production and source of income) have a significant positive effect on economic growth throughout the models.

H02. The interaction term of natural resource with institutions will have a significant negative effect on economic growth throughout the models.

H03. The interaction term of natural resource with institutions will have a significant positive effect on economic growth throughout the models.

H04. The interaction term of natural resource with institutions will have a significant negative effect on economic growth throughout the models. From model 1 above, the marginal partial impact of an increase in natural resources on economic growth is derived as follows:

\[
\frac{\partial g}{\partial \text{NR}} = \beta_4 + \beta_7 \text{INSTQ}
\]

Now, the resource curse hypothesis implies that \( \beta_7 < 0 \) whereas the quality of institutions that enable to alleviate the resource curse problem implies that \( \beta_7 > 0 \). In general, the resource curse will be get rid of when the coefficient of institutional quality is greater than the ratio of resource impact over institution impact \( \left(-\frac{\beta_4}{\beta_7}\right) \) i.e. \( \beta_4 + \beta_7 \text{INSTQ} \geq 0 \).

Concerning the partial impact of an institutional quality on growth can be derived as follows

\[
\frac{\partial g}{\partial \text{INSTQ}} = \beta_3 + \beta_7 \text{NR}_t + \beta_6 \text{ICT}
\]

From this equation, an economy has an institutional curse if that \( \beta_3 < 0 \) (which implicitly shows weak institutions, incompetency, corrupt, rent-seeking behavior, etc.) whereas the adoption of ICT services that enable to alleviate or strengthen the institutional quality implies that \( \beta_6 > 0 \), assuming other things are normal. Besides, natural resources should also

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1. https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.D.EPL.KD.ZG.
need to have a positive impact on economic growth (in not resource curse case) which implies \( \beta_7 > 0 \). Hence, the institutional curse will be eliminated when the influence of the sum of ICT service and natural resource is greater than the ratio of \(( -\beta_7/\beta_8 + \beta_9) \) which means, \( \beta_5 + \beta_7 NR_{1:1} + \beta_8 ICT \geq 0 \)

**H03.** The adoption of ICT service will have a significant positive effect on economic growth throughout the models.

**HA3.** The adoption of ICT service will have a significant negative effect on economic growth throughout the models.

**H04.** The interaction term of ICT service use and institutions will have a significant positive effect on economic growth throughout the models.

**HA4.** The interaction term of ICT service use and institutions will have a significant negative effect on economic growth throughout the models.

Another interesting variable of this study is the partial impact of ICT services on economic growth that can be derived as follows:

\[
\frac{d\varepsilon}{dICT} = \beta_7 + \beta_8 INSTQ
\]

From this equation, the ICT service curse implies that if \( \beta_7 < 0 \) (if ICT service does not add any value to the economic growth of a nation), whereas the quality of institutions that enables or converts ICT services to a useful application implies the value of \( \beta_7 > 0 \) assuming other things are normal. Hence, the ICT service curse will be eliminated when the influence of institutional quality is greater than the ratio of \(( -\beta_7/\beta_8 + \beta_9) \) which means, \( \beta_5 + \beta_7 NR_{1:1} + \beta_8 ICT \geq 0 \) However when both \( \beta_7 > 0 \) and \( \beta_8 > 0 \) there is no ICT service curse at all i.e. ICT service increases the efficiency of services, innovation, and productivity and eventually increases economic growth.

With regard to method of analysis, the study used Panel data model and Instrumental variable model. Thus, using panel data and instrumental variable models, the study investigate the effects of the natural resource, ICT and Institutional quality on the economic growth rate of the countries considered for this study.  

### 4. Results and analysis

#### 4.1 Descriptive analysis

The study tries to consider economies that reveal characteristics of both successful and unsuccessful but resource-abundant economies. The average real GDP growth rate for resource-rich successful nations is higher than that of resource curse economies, whereas the average natural resource share of their GDP is lower than that of resource curse countries. Furthermore, the average non-ICT investments as a percentage of GDP, openness as a percentage of GDP, average ICT capital investment, and other macroeconomic variables are summarized in Table 1 below.

Table 1 summarizes the economic and resource aspects of the economies considered in the study. Countries with a higher percentage share of natural resource rent to GDP have lower e-government index and ICT investment expenditure except for Russia and Saudi Arabia. In addition to resources, institutional factors also play a great role in influencing economic growth performance.

With regard to institutional aspects of these countries, Table 2 shows that, the institutional indicators measure reveals a clear difference between the two groups of economies. For example, in terms of property rights index, except Saudi Arabia, all the remaining resource curse countries have a very low level of property right effectiveness. If property right is not strongly protected, investors including foreign direct investment (FDI) are less likely to invest in those economies and as a result, the economy will hardly grow. In terms of corruption index, all the resource curse countries considered in the study are highly corrupt economies although their degrees of corruption are varied. Perhaps, the degree of corruption may depend on the structure of the economy and the market. For instance, countries such as Saudi Arabia, Congo Republic, Venezuela shows the highest percentage of natural resources to their GDP and high corruption index with low economic freedom index (high index for corruption means more clean economy, and high index for economic freedom means better private sector than government). It implies that natural resources are converted to corruption because of less economic freedom, weak institution, and rent-seeking behavior of institutions in resource-rich countries and as a result retards their economic growth.

The same is true for democracy index attributes. All the resource curse economies have a lower level of democracy index and economic freedom index. If the economy is not free from the unnecessary involvement of the government, it discourages the private sectors' economy and as a result, it harms the economic growth of a country. Although it would be good to consider a country's policy and institutional assessment (CPIA) data index as a proxy for institutions, the index capture very diversified social, economic and political aspects and hence difficult to use as a single variable for the proxy of institutional quality in the econometrics estimation. The CPIA index² broadly includes the economic management clusters policies, structural policies, policies for social inclusion cluster, governance clusters, and infrastructure and regional integration clusters, World Bank (2018). Therefore, considering the resource curse problem in resource-abundant countries, it is more or less mainly related to resource management, governance, and efficient

2 The CPIA index data is an aggregation (ratings) of many diversified variables and difficult to consider all together as a proxy for a single variable and at the same time no data for those developed countries. So, need to be specific in selecting a proxy for institutional quality and thus the property right and rule-based governance is an appropriate proxy variable according to this study context.

### Table 1. Resources and economic growth summary.

| Group of economies | Economies | GDP per capita growth (in million US $/year) | Average non ICT investment (%GDP) | Openness (in million US $/year) | Average patent application (number) | Average natural resource rent (%GDP) | Aver. ICT investment (in million US $/year) | E government development index (EGDI) | Labor input (% of total population ages 15–64) |
|--------------------|----------|--------------------------------------------|----------------------------------|-------------------------------|------------------------------------|-------------------------------------|-----------------------------------------|---------------------------------|----------------------------------------|
| Resource blessed   | Botswana | 2.45                                       | 7.32                             | 2.04                          | 5.2                                | 4.76                                | 1564                                    | 0.4531                          | 73.02                                   |
|                    | Chile    | 3.49                                       | 3.58                             | 1.83                          | 1.283.9                            | 15.46                               | 2115                                    | 0.6949                          | 68.14                                   |
|                    | Norway   | 1.57                                       | 1.02                             | 1.84                          | 2374.5                             | 2.58                                | 3520                                    | 0.8117                          | 77.84                                   |
|                    | Canada   | 1.49                                       | 2.16                             | 1.79                          | 17561.2                            | 3.91                                | 7586                                    | 0.8285                          | 78.12                                   |
| Resource cursed    | Congo, Rep | 1.63                                      | 16.37                            | 2.17                          | NA                                 | 47.77                               | 75                                      | 0.2497                          | 70.69                                   |
|                    | Ivory coast | 1.12                                    | 37.32                            | 1.93                          | 26                                 | 6.40                                | 189                                     | 0.2185                          | 58.49                                   |
|                    | Russia   | 2.02                                       | 0.13                             | 1.69                          | 27124.3                            | 15.22                               | 15177                                   | 0.7215                          | 73.85                                   |
|                    | Saudi Arabia | 2.77                                     | 6.14                             | 1.91                          | 357.4                              | 42.79                               | 11512                                   | 0.6822                          | 57.38                                   |
|                    | Venezuela | 1.01                                       | -2.61                            | 1.68                          | 33                                 | 16.91                               | 523                                     | 0.5128                          | 65.95                                   |

Source: Data from WDI and UN e-government survey report. EGDI range from highest 1 to lowest 0.
utilization of the resource. Thus, the study considers the governance cluster indicator particularly the property right and rule-based governance index as a proxy for institutional quality to measure the extent of the impact of institutions on economic growth, for model estimation purposes. Property rights are theoretical socially enforced constructs in economics for determining how a resource or economic good is used and owned. Hence, strong property right is believed to enable and facilitate for efficient resource utilization, extraction, and development, unlike many other countries where the abundant resource is the cause of conflict than the potential of development (Heltberg, 2002).

Comparing the annual GDP growth rate for both categories of economies, the relative mean GDP growth varies across each sampled countries as depicted in Figure 4 below. The first four economies from the left that are Botswana, Chile, Canada, and Norway are those successful economies based on the endowed natural resource while the last five economies i.e. Congo Republic, Cote d'Ivoire, Russia, Saudi Arabia, and Venezuela are those which are not successful economies yet. The differences in economic growth depicted in Figure 4 above, are not necessarily happening because of differences in endowed natural resource, rather it could be because of institutional and technological differences. For further empirical analysis, the next econometrics section will investigate the causes of the differences in detail.

### 4.2. Econometrics analysis

The study estimated model by categorizing the economies into the resource-rich successful economies, resource-rich curse economies, and pooled economies. By testing the Hausman effect, eventually, the fixed effect panel model is found to be appropriate model and it enables to capture of unobservable country’s effect. The estimated result of the model is presented in Table 3 below.

The author believe that the estimated result, shown in Table 3 above, is to some extent robust despite the relative small sample size used for estimation of panel data. This is because of the reason that since the study rely on macroeconomic variables related to governance and resources and no other country specific variables at micro level are used, such as at firm level, the author believe that the results of the study could be roughly robust with regard to stated study objectives. However, this is with the presence of some strong assumptions. For instance, the initial conditions of the countries, technological capability level, governance system, policy variables and others were assumed same (strong assumptions). With this assumption, we believe that the study findings are to some extent relevant and give insightful policy implication with regard to ways how resource cursed countries can escape the curse. With this mindset, the interpretation and detail discussion of the estimated results are as follows.

### Table 2. Institutional quality indicator summary.

| Type of economy | Economies          | Average property right index (10 highest) | Average economic freedom index (max: 100%) | Strength of legal rights index (0 – weak to 12 – strong) | Democracy index rank (out of 167 countries) | Corruption index (near to 100 — more clean economy) |
|-----------------|--------------------|--------------------------------------------|--------------------------------------------|-----------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------|
| Resource blessed| Botswana           | 6.14                                       | 70.18                                      | 5                                                         | 28                                            | 60                                                 |
|                 | Chile              | 6.69                                       | 78.18                                      | 4                                                         | 30                                            | 66                                                 |
|                 | Norway             | 8.27                                       | 71.71                                      | 6                                                         | 1                                             | 85                                                 |
|                 | Canada             | 7.99                                       | 79.75                                      | 11                                                        | 7                                             | 82                                                 |
| Resource curse  | Congo, Rep         | 2.52                                       | 43.41                                      | 6                                                         | 144                                           | 20                                                 |
|                 | Cote d'Ivoire      | 3.94                                       | 55.68                                      | 6                                                         | 132                                           | 34                                                 |
|                 | Russia             | 4.54                                       | 51.07                                      | 5                                                         | 132                                           | 29                                                 |
|                 | Saudi Arabia       | 6.24                                       | 62.95                                      | 2                                                         | 160                                           | 46                                                 |
|                 | Venezuela          | 3.14                                       | 36.58                                      | 1                                                         | 99                                            | 17                                                 |

Source: Data from WDI database.

Figure 4. GDP growth rate Heterogeneity across countries.
Table 3. Economic growth rate estimation result (Fixed effect panel data model).

| Fixed-effects model: | Successful economies. Model 1 | Unsuccessful economies. Model 2 | Pooled economies. Model 3 |
|---------------------|-------------------------------|--------------------------------|--------------------------|
| Dependent variable (RGDP growth rate) | Log of initial per capita income | .6330 (1.15) | -.3005 (2.96)*** | -.0896 (1.85) |
|                     | Natural resource rent % of GDP | .2465 (3.82)*** | -.0965 (2.16)*** | .0045 (1.96)* |
|                     | Institutional quality | .3121 (3.30)*** | -.2005 (2.86)*** | .0554 (2.54)*** |
|                     | ICT infrastructure investment | .0603 (2.25)** | .7890 (1.98)* | .0562 (3.31)*** |
| Resource * Institution | .0360 (3.80)*** | .0191 (2.56)** | .0679 (2.11)** |
| ICT infrastructure * Institution | .0156 (2.36)** | .0015 (2.78)*** | .0396 (1.58) |
| Log of capital Investment (non-ICT) | .0271 (3.00)*** | .0817 (1.53) | .0635 (1.25) |
| Log Labor active input (15-65 years) | .1365 (4.24)** | .0465 (2.16)** | .053 (1.98)* |
| Domestic credit to private sector (% of GDP) | .2560 (2.04)** | -.3640 (2.16)** | .0864 (1.54) |
| Log of openness | .0.3537 (1.97)* | -.3440 (4.24)*** | -.4761 (3.57)*** |
| Inflation (GDP deflator) | .0.0710 (2.16)** | -.0320 (1.98)* | .0523 (1.59) |
| Latin America | 1.8538 (0.64) | 1.2998 (5.20)*** | .2086 (1.96)* |
|Africa | .3720 (0.51) | -.8855 (4.39)*** | .0414 (1.94) |
|cons | -1.7446 (-1.32) | 7.8648 (4.28)*** | .62497 (3.13)*** |
| R-square within | 0.6793 | 0.7908 | 0.6601 |
| Between | 0.9581 | 0.8137 | 0.9498 |
| Overall | 0.8186 | 0.8022 | 0.8049 |
| Number of obs | 100 | 125 | 225 |
| Prob > chi2 | 0.0001 | 0.0088 | 0.0065 |

Notes: The figures in parenthesis are t value. *, **, *** indicate statistical significance at 10, 5 and 1 % respectively. Regional dummies are Africa, Latin America and others. Others are reference dummy.

4.3. Discussion and findings

According to the resource-rich, successful economies model (model 1), the contribution of a natural resource to economic growth is significant and positive which confirms the absence of resource curse situation. Contrary, in the case of unsuccessful economies, the effect of natural resource rent on economic growth is negative and significant at 5 percent significance level, which implies the presence of a resource curse. In the case of pooled economies, the natural resource contributes positively although insignificant to economic growth rate. For instance, the results show that a one percent increase in resource share of GDP leads to increase economic growth of successful economies, unsuccessful economies and pooled economies by 24.6 percent, -9.65 percent and 0.45 percent respectively. This result reveals a significant presence of resource curse in the unsuccessful economies, which is in line with study’s findings by (Bakwena, et al., 2009; Fuhr, 2015; Torvik, 2009). This shows resources instead of being used as a factor of production and income; it is a cause of conflict, and corruption when institutions are weak. In addition, the role of institutional performance on economic growth is that, it has positive significant impacts on the economic growth of the successful economies. However, in the case of unsuccessful economies the institutional quality have significant negative effect on economic growth rate whereas for that of pooled economies it shows significant positive effect on economic growth. The extent of the partial impact is that a one percent increase in institutional quality index will have a 31.21 percent increase, -20.05 percent decrease and 5.54 percent increase on economic growth of the Successful, unsuccessful and pooled economies groups respectively.

With regard to the interaction term between resource and institutional quality, it shows positive and significant impact on economic growth of all the three groups of economies. In fact, this for unsuccessful economies implies that, the institutional quality could help to overcome the problem of resource curse with some minimum thresholds level of institutional quality. Furthermore, the initial income level shows a positive but insignificant effect on the real GDP growth rate for the successful economies, which is an unexpected result according to the neoclassical convergence theory (Bayraktar-Saglam and Yetkiner, 2014). However, in the case of unsuccessful economies the initial income level shows a negative significant impact on the economic growth rate, which is an expected result according to the neoclassical convergence theory (Bakwena et al., 2009).

The ICT infrastructure investment/services have positive and significant effects on economic growth of all the three groups of economies. Other macroeconomic variables considered in this study are such as capital investment, labor input, domestic credit to the private sector, openness, and inflation rate all have positive and significant effects on the economic growth of the successful economies. However, the domestic credit to the private sector, openness, and inflation rate variables have negative effects on the economic growth rate of the unsuccessful economies. With regard to openness, the result may tell that because of the primary export items with low prices and the huge expense incurred to import high value-added products such as machinery, that devastate their economic performance, it revealed negative impact on the economic growth of unsuccessful economies. Because of weak institutions in these countries no FDI inflows and hence no more economic growth via openness. From the basic neoclassical growth model, the capital and labor input are basic factors of production that lead to economic growth. The domestic credit to the private sector also shows the degree of flexibility of the private sector in the economy and the result reveals that the private sector has a positive contribution to economic growth in the successful economies. Concerning inflation, it is used as a stimulant for producers and production activities and hence encourages a supply-side economy that leads a positive contribution to economic growth in the successful economies since they have proper and quality institutions to control it.

On the other hand, labor active is the source of growth of the economy in many developing countries compared to other factors of production and hence, the result confirms the same. However, concerning domestic credit to the private sector, the degree of flexibility of the private sector is quite low in these resource-rich but cursed countries due to institutional weakness and lack of good governance. The same logic holds for the effects of inflation as well. The effect of inflation is negative and significant in these resource curse countries and it may be because the weak institutions could not be able to have a strong anti-inflationary policy that converts it into an economic growth opportunity.

Back to the variable of interest in detail, the result obtained for resource-rich successful economies is not in line with those by Mehlum et al. (2006)
and Boschini et al. (2007). The impact of natural resource is significant and positive and that of the interaction term between an institution and natural resources have positive significant. This implies that the natural resource is already properly being utilized and contributing to the economic growth of the country. It confirms that there is no resource curse problem in model 1 and there are no institutional curse problems too.

But in the case of resource-rich unsuccessful economies (model 2), the impact of the natural resource coefficient is negative significant and the interaction term with institutional quality is positively significant and which shows the presence of resource curse could be overcome by combining with strong and capable institutions. This result is in line with the studies by Bakwena et al. (2009), Fuhr (2015), Torvik (2009). The marginal partial impact of an increases in natural resource abundance on economic growth (keeping other variable constant) of the resource-rich but unsuccessful economies (model 2), is

$$\frac{\partial g}{\partial NR} = -0.0965 + 0.0191INSTQ$$

According to this partial effect, the institutional threshold for avoiding the resource curse problem is 5.05 out of the 10-point index. For countries with greater than 5.05 institutional quality index, the contribution of resource abundance on economic growth is higher for resource-rich countries compared to low resource countries and the opposite is true for institutional index less than 5.05 threshold. As a result, countries with higher institutional quality above 5.05 can escape the resource curse problem given other things are constant. Countries such as Congo Republic, Cote d’Ivoire, Russia, and Venezuela have institutional quality index less than 5.05, which implies that these countries have less likely of escaping the resource curse. Thus, assuming other things are constant, these countries need to work hard in building their institutions to manage the resource efficiently and transform it into productive opportunities.

Considering the pooled economies, (Model 3), the natural resource has positive significant and the interaction term of natural resource with institutions have a positive impact on economic performance. This implies that no evidence shows the problem of the resource curse and institutional curse.

The other interesting variable is the role of ICT infrastructure services and its interaction terms with institutional performance on economic growth. The result of model 1 shows that ICT service and its interaction with institutions both have positive and significant effects on economic growth. This finding is similar with studies result by scholars such as (Johnson, 2016; Veeramacheni et al., 2007; Ahmed and Ridzuan, 2013; Samimi et al., 2015; Niebel, 2018). In the case of resource curse economies, the interaction of ICT service with Institutions has a positive impact on economic growth. This implies that no evidence shows the problem of the resource curse and institutional curse.

$$\frac{\partial g}{\partial ICT} = -0.7890 + 0.0015INSTQ$$

According to the partial effect of ICT services investment on economic growth, the ICT service investment threshold level for strengthening institutional capacity and supporting economic growth is 526 million US dollars per year. For instance, countries such as the Congo Republic, Cote d’Ivoire, and Venezuela have an ICT service expenditure less than the estimated threshold level (526 million USD per year). Thus, the higher the ICT service infrastructure and technology penetration and usage, the better the institutional performance that enables to overcome the problem of the resource curse in the resource-rich low-income countries. It is realized that the ICTs facilitate the information distribution, cross-border flow of information, promote international trade, particularly high technology, and help to attract foreign direct investment. In the process of democratization, ICTs also can contribute to political development by fostering good governance and streamlining bureaucratic procedures through intra-governmental networking and by reducing corruption. The creative use of ICTs, particularly the Internet and computer, in the areas of health care, education, environmental protection, and in other developmental and social sectors can substantially contribute to the advancement of developing societies (Cukor and McKnight, 2001). Therefore, at the same time, these resource-abundant unsuccessful economies should properly invest on education, digital skills to enable to properly harness the advantage of digital dividends and gradually transform their economies into high tech productive structure than entirely depending on the windfall resources.

Putting all the estimated partial coefficients into the economic growth equation (Eq. (1)) of all models, shows that the economic growth rate for successful, unsuccessful and pooled economies group are 35.47, 1.87, and 15.52 percent respectively. It revealed that the variables considered in the study that are institutional quality, ICT investment and others macroeconomic variables were significantly contributes towards economic growth rate for the successful economies compared to the other groups, perhaps, due to the good precondition and capability of transforming resources into productive economic activities.

The regional dummy variable in Model 2 and 3 shows that African economies are more resource curse than other regions. This may tell the extent of the weakness of their institutions compared to other countries and the presence of the problem of good governance. This result is supported by the previous studies finding of Bakwena et al., (2009). However, this curse can be escaped given those good institutions, and better ICT services are put in place.

Furthermore, as discussed in many of literature, the panel model may suffer from endogeneity problem during estimation. For instance, institutional quality may depend on the economic status and capability of the country, there may be a possible potential endogeneity problem, Dollar and Kraay (2003), because they are rich, they may have good institutions. Many studies have used a different instrumental variable for institutional quality such as Acemoglu et al. (2002) used settlers mortality in the ex-colony country as an instrument for institutional quality, Hall and Jones (1999) used distance from the equator (latitude) and several western languages are spoken as instrument for quality of institutions in his studies, Mauro (2004) used ethnolinguistic diversity as an instrument for corruption. This study uses the number of refugees by country of origin, and the interaction term of number of refugees and natural resource as an instrumental variable (IV) for institutional quality. By the same logic, there can also be an endogeneity problem with ICT service infrastructure and adoption. That means the extent of ICT service investment may depend on the economic status and capability of the country and therefore suspect potential endogeneity problem. Thus, the study proposed western language spoken (English or French) as an instrumental variable for ICT service infrastructure investment. It is believed that in the cases of endogeneity problem, instrumental variable, or simultaneous equation model estimation such as two-stages least square (2SLS) and three stages least square (3SLS) are appropriate to estimate the model. Although the 2SLS estimation has a computational edge, the 3SLS is more efficient. The result of the three-stage least square (3SLS) is presented as in Table 4 below.

According to the result of 3SLS in Table 4 above, the endogenous variables are real GDP growth rate, institutional quality, and ICT service investment. The endogenous variable institutional quality is instrumented by the number of refugees by country of origin and interaction terms of the number of refugees and resource abundance. For the ICT service investment, the instrumental variables are the language spoken and the interaction of language spoken with resources. It is expected that

$$3$$ Endogenous variables: rgdp growth rate, Institutional quality index, log ICT capital investment.Exogenous variables: logrgdp0 natural resources rent so fgd, logopenness, capital investment annual growth, labor input, domestic credit to private sector, inflation GDP deflator, Africa, Latin America, number refugee by country of origin, language spoken, refuge*resource, language*resource.
Table 4. Three stage least square (3SLS) estimation result.

| Dependent variable | Resource rich successful economies | Resource rich unsuccessful economies | Resource rich pooled economies |
|--------------------|------------------------------------|-------------------------------------|--------------------------------|
| 1st stage: Real GDP growth rate | Model 1 | Model 2 | Model 3 |
| Log initial Per capita income | .5039 (1.18) | -.0660 (2.30)** | -.0916 (1.95)* |
| Natural resources % of GDP | .1622 (2.37)** | -.0377 (2.31)** | -.0355 (2.28)** |
| Log capital Investment | .0593 (2.08)** | .01202 (1.95)* | .0423 (2.45)** |
| Log Labor input | .0823 (2.27)** | .0171 (2.36)** | .0214 (1.98)** |
| Domestic credit to private | .0782 (1.99) | -.0412 (3.75)** | .1875 (1.51) |
| Log Openness | .0615 (2.27)** | -.2276 (1.96)** | -.3083 (1.67) |
| Inflation (GDP deflator) | .0615 (1.27) | -.2445 (2.75)** | -.1454 (2.44)** |
| Institutional quality | .3673 (3.40)***** | .5646 (1.56) | .0296 (2.51)** |
| ICT services investment | .2605 (2.43)**** | .0234 (3.46)***** | .0789 (2.31)** |
| Institution*resource | .0656 (2.80)***** | .0352 (2.88)***** | .0476 (1.68) |
| Institution*ICT services | .3452 (2.56)** | .01202 (1.95)* | .0789 (1.95)** |
| Africa | 1.809 (1.29) | 1.912 (2.36)** | .4593 (1.95)** |
| Latin America | .5176 (1.34) | 1.298 (1.95)** | .0942 (0.87) |
| const | -1.874 (-1.97)** | .0148 (1.02) | .3904 (0.61) |
| 2nd stage: Institutional quality equation | | | |
| No. refugee by country of origin | -.0208 (-3.53)***** | .0754 (3.04)***** | -.0247 (-2.05)** |
| Refugee*resource | .0619 (1.16) | -.0317 (-1.69) | .0270 (1.37) |
| const | .4455 (4.58)***** | 1.8312 (6.13)***** | 3.2403 (5.47)***** |
| 3rd stage: ICT service investment equation | | | |
| Language spoken | -.0928 (-0.42) | .3891 (2.10)** | -.3256 (-1.14) |
| Language resource | .2310 (1.11) | .3012 (1.51) | .4311 (1.53) |
| Const | 1.2786 (8.14)***** | 2.8751 (2.25)** | 1.7301 (4.57)***** |
| RGDGrowth — e ’R-sq’ | .07352 | .08903 | .08245 |
| Institutional quality ‘R-sq’ | .09854 | .8413 | .08796 |
| logICTcap — investment ‘R-sq’ | .89398 | .8865 | .7316 |

Regional dummies are Africa, Latin America and others. Language spoken is dummy variable denoted 1 if the country official language is English/French, 0 = otherwise.

countries with better ICT service investment and Institutional quality have more likely to obtain higher growth from their resource endowment than countries without good ICT service and institutions. The result of 3SLS shows that better ICT service adoption and usage can mitigate the weakness of institutions on growth, but only economies of good ICT infrastructure can fully overcome the institutional curse. The same is true for institutional quality interaction with resources. That means economies with the better institution can mitigate the negative potential effects of resource abundance on economic growth with some minimum threshold level. Concerning instruments for model 1 and 2, the number of refugees by country of origin is negatively related to the institutional performance, which means that a greater number of refugees for lower institutional quality countries. That means as a number of refugee increases by one percent it shows the institutional quality deteriorates by 2 percent index, which indirectly has negative impact on economic growth rate. However, the opposite is true for resource cursed economies. Concerning the western language spoken (English or French) instruments, countries whose official language is either English or French have better ICT service investment that can augment the performance of their institutions. That means countries whose official working language is either English or French has more ICT service investment and adoption by 9.3 percent than countries whose language is neither English nor French. The regional dummy variable for model 2 shows that Africa is more resource curse economies than other regions.

The overall goodness of the models are shown by the values of coefficient of determination (R square). The explanatory variables considered in the model explain the variation of economic growth rate of the successful economies, unsuccessful economies and pooled economies by 73.52 percent, 89 percent and 82.5 percent respectively. To ensure the reliability and unbiasedness of the estimated result, the study conducted tests of heteroscedasticity and multicollinearity. Assuming the null hypothesis of homoscedasticity, the result of Modified Wald test for group-wise heteroscedasticity in fixed effect regression model shows that there is heteroscedasticity in the case of model 3 (pooled economies) whereas in the case of successful economies model 1, and unsuccessful economies model 2, the null hypothesis is failed to reject. Concerning the multicollinearity test, the estimated model reveals no strong presence of multicollinearity among the variables.

4.4. Natural resource utilization policies of the successful economies

Countries have their policies to utilize natural resources towards bringing economic development. However, some countries may have a good policy for utilizing endowed natural resources without having good institutions and others may have both good policies and institutions together and vice versa. Hence, to draw a lesson for resource curse economies, the study summarizes the natural resource utilization policy of successful economies as in Table 5 below.

As summarized in Table 5, governance including regulatory body and resource ownership i.e property right aspects of institutions matter a lot relative to others. According to most of the successful economies' experience, the natural resources are partially owned by the local community with local government engagement to able to avoid the possible resource-based conflict. There should be also strong regulatory institutions at the federal or central government integrated with local government so that it can minimize corruption and transform the resources into fully productive sectors. Another good experience from the successful economies is that the governments do not depend on the resources; rather planning the future without the natural resources, save resources for the future.

## Table 5. Natural resource utilization policy of successful economies

| Policy Area | Successful Economies | Unsuccessful Economies | Pooled Economies |
|-------------|----------------------|------------------------|-----------------|
| Resource Endowment | - | - | - |
| Natural Resources | - | - | - |
| Policy Instruments | - | - | - |
| Regulatory Body | - | - | - |
| Ownership | - | - | - |
generation, and making an investment in human capital, which is the most important in the long run.

5. Conclusion and implication

The estimation of the impact of natural resource rent, Institutional quality, ICT investment and their interaction terms towards economic growth have different impacts on different groups of economies. This explain for the causes of why some resource abundant economies are remain cursed while others are successful. The natural resource rent and institutional performance indicator have a significant negative impact on the economic growth rate of the unsuccessful economies whereas positive significance effect on the successful economies. For instance, the result shows that a one percent increase in resource share of GDP leads to decrease economic growth of unsuccessful economies by -9.65 percent whereas, it increase economic growth of the successful economies by 6.0 percent. This result reveals a significant presence of resource curse in the unsuccessful economies, which is in line with study's findings by Bakwena et al. (2009), Fuhr (2015), Torvik (2009). However, using the interaction term of institutions and natural resources, the resource curse countries can abate the curse provided that they built good quality of institutions. Accordingly, for economies with an institutional quality index above 5.05 the contribution of natural resource rent on economic growth is higher for resource abundant countries compared to low resource country. Thus, countries with higher institutional quality above the threshold level have potential to escape the resource curse problem.

On the other hand, the role of ICT service investment on economic growth had shown a positive contribution to economic growth in the case of all group of economies model. For instance, a one percent increase in ICT investment expenditure will result in 6.0 percent, and 5.6 percent increase on economic growth for the successful and pooled economies respectively, although insignificant on the unsuccessful economies. However, the interaction of the ICT service investment with institutional quality has a positive impact on the economic growth of resource curse economies. According, countries with an average investment of ICT services more than $26 million USD per year contributes positively to economic growth via capacitating institutions. This study finding is in line with studies result by scholars such as (Johnson, 2016; Veenamacheneni et al., 2007; Ahmed and Ridzuan, 2013; Samimi et al., 2015; Niebel, 2018). Due to endogeneity problem during fixed effect estimation for variables such as institutional quality and ICT investment expenditure on the economic growth, the study used instruments; number of refugee by country of origin for institutional quality and foreign language spoken for ICT investment. As a result, the 3SLS estimation result shows that the number of refugees by country of origin is negatively related to the institutional performance, which means that a greater number of refugees for lower institutional quality countries. To be precise, as a number of refugees increases by one percent it shows the institutional quality deteriorates by 2 percent index, which indirectly has negative impact on economic growth rate. The same logic is also holds for ICT investment instrument. That means countries whose official working language is either English or French has more ICT service investment and adoption by 9.3 percent than countries whose language is neither English nor French.

This research study presented an insightful lesson for the governments and policymakers on how they might take advantage of their abundant resources, and ICT service investments to escape from the curse and pursue higher economic growth rates. In particular, the following policy implications are worth considering:

a) Pay attention to building the quality of institutions. This is because economies with higher institutional quality can be capable to manage their abundant resources and convert into productive opportunities. Higher institutional quality comprises of low or no level of corruption, law, and order, and good governance that leads to low rent-seeking activities and efficient property rights. However, Institutional quality may require a huge investment in human capital (capable public servants), rules and regulations, and others as well.

b) Pay attention to information communication technologies and services. This is because countries with better ICT service adoption and diffusion have an efficient way of running public services and private business, low transaction costs that lead to economic growth. Thus, resource cursed countries should invest in information communication technology services such as e-government services to build a strong capable institution which can be able to run the system to be able to escape from the curse. In addition to this, the countries also need to invest in human capital particularly on those with ICT skills to be able to harness the benefit of digital dividends in the Bing bang of digital technology generation.

c) Pay attention to resource ownership right and governance. This is based on the lesson from the successful economies concerning how

| Table 5. Summary of natural resource utilization policy of successful economies. |
|---------------------------------------------------------------|
| Policies | Canada | Norway | Botswana | Chile |
| Regulatory body and its role | Federal energy board oversees regulation but provincial body collect taxes, incentives, permits and licensing for oil and natural gas | The Norwegian Petroleum Directorate regulates, oil company pay tax rate up to 78 percent, transparent system | Mineral affair division, It divested revenue, and invested surplus revenues from minerals with proper economic diversification policy | Chilean Commission on Copper and the Mining Ministry: publish information, offer licensing |
| How able to avoid possible Dutch disease problems | By developing a network of the sector which focuses on creating investment and employment; big industries | Spending on oil revenues has increased gradually to avoid appreciation, higher wages, and prices. | Public investment in infrastructure, human capital, it did not adopt a policy of import substitution | State-Oriented Institutional Approach, Value-Chain Framework |
| Governance system | Parliamentary democracy | Parliamentary democracy | Parliamentary democracy | Presidential system democracy |
| Institutions | Strong governing institutions and social capital | producer friendly institutions and rule of law | Good property right, and rule of law | Secured property rights and rule of the game |
| Population diversity | The diversified origin with no conflict | Diversified ethnicity with no conflict | Homogenous population | Small diversity with strong integration |
| Mineral/resource ownership | Provincial governments with indigenous communities settle issues. Allocating rights to access and use of public lands and natural resources. | The government has retained a 67 percent majority ownership. | A mineral resource is owned by tribal authority | Community foundation with local leadership shareholder state-owned firm (Ford, 2015) |
| Other supportive policy | Government invest more on the importance of human capital (Parlee, 2015) | Every year, 4 percent is taken out from resource revenue and used for public services, saved a large share of the petroleum revenues for a future generation (Holden, 2013) | Planning for a future Without minerals (Lewin, 2011) |
| Source: literature review (Parlee, 2015; Ford, 2015; Lewin, 2011; Holden, 2013).
they managed their abundant natural resource and convert into productive activities and growth. Thus the resource cursed economies should learn that the natural resources should at least partially owned by the local community with local government engagement to be able to avoid the possible resource-based conflict and there should be also strong regulatory institutions at federal or central government integrated with local government so that it can minimize corruption and transform the resources into fully productive sectors.

Although the study has good insightful policy implications for resource curse economies, it has focused on a limited number of economies considered in the study. Thus, the study recommends any interested researcher in the future to exhaustively consider many countries as much as possible to get comprehensive results and implications. Additionally, from a methodology perspective, the study used the number of political refugees by country of origin as an instrument for institutional performance, and western language spoken as an instrument for ICT service adoption and investment. As a result, the study recommends other researchers to come up with other or similar instrumental variables by challenging this argument. The research result and findings depend on the institutional proxy variables used in the study and should be curiously interpreted since it cannot capture the whole institutional aspects.

Declarations

Author contribution statement

B.R. Entele: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data will be made available on request.

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The authors declare no conflict of interest.

Additional information

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