The Influence of Natural Resources Endowment on Country Innovative Outputs

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ABSTRACT

The existence of natural resources is expected to be positively associated with a country's development. Study results have however remained vague where development that require direct use of natural resources has been found to be positively influenced by resource endowment whereas development that requires investments in other indirect drivers of development like governance institutions, education and infrastructure have been found to be negatively influenced by natural resource endowment. This has made the influence of natural resources on development linked dimensions like innovation remain vague. The widely accepted realization among scholars that the existence of natural resources might be detrimental to the economic development of any country has been referred to as the paradox of plenty or the resource curse theory. This study sought to test the paradox of plenty concept by examining the effect of natural resource endowment of a country on its creative innovation outputs. The main objective was therefore, to test the resource curse theory at country level by investigating whether countries that lack natural resources have higher innovation outputs and vice versa. The main dimension of innovative outputs which the study looked at are: knowledge creation which comprise of patents by origin, utility models by origin, scientific and technical articles and citable documents index and creative goods and services which comprise of cultural and creative services output, national feature films, entertainment and media market, print and other media, as well as creative goods and services exports. Different literature sources were analyzed in relation to the main study objective. The study adopted positivism research philosophy by investigating further evidence that supports the resource curse theory. The study used the correlation research design by testing the kind of relationships that exist between natural resource rents and creative goods and services outputs. The study made use of secondary data obtained from the World Intellectual Property Organization website for the period 2017 to 2019. The data was obtained for 127 countries which formed the population and sample. The study was quantitative in nature, where the deductive approach was applied to make sense of the study findings. Data was analyzed using STATA version 2016 where bivariate linear regression was applied to establish relationships between country natural resources rents and creative goods and services dimensions. The population, which also formed the study sample, consisted of 127 countries from which secondary data was available. Supporting the direct and indirect effect of natural resources on innovation, both positive and negative relationships were obtained for some of the variables. Therefore, the study recommends that countries with high natural resource endowments should not suffer from the Dutch diseases syndrome through being innovatively complacent because of the comfort of having abundant natural resources.

Key words: Natural resources, knowledge creation output, creative goods and services output, resource curse theory

INTRODUCTION AND BACKGROUND

Natural resources, both renewable and non-renewable, and ecosystem services are fundamental to the wealth of nations globally. They form the basis of natural capital, from which other forms of capital originate. These resources contribute significantly to fiscal revenue, income generation, and poverty reduction. Sectors relying on natural resources provide employment and sustain livelihoods, particularly in poorer communities. Consequently, their sustainable management is critical to ensuring long-term benefits. Governments play a

pivotal role in implementing policies that enable natural resources to contribute to sustained economic development, rather than merely focusing on short-term revenue generation (OECD, 2021). Proper governance ensures that resources support broader socio-economic goals, such as infrastructure development, human capital enhancement, and innovation.

Natural resources also underpin the functioning of societies and economies by serving as primary inputs in production processes and enabling energy provision for transport, lighting, and heating. Natural resource distribution is uneven across countries, leading to extensive trade and significant influence on industrial specialization. For example, trade in natural resources facilitates comparative advantages, allowing countries to capitalize on their endowments while promoting economic diversification (World Bank, 2020). However, the effective utilization of these resources depends on institutional quality, innovation, and governance frameworks that align resource management with sustainable development objectives (UNEP, 2022).

Managing natural resources sustainably in the case of renewable resources and as sources of revenue for investment in future growth in the case of non-renewable resources allows resource-rich countries to establish the foundation for long-term development and poverty alleviation strategies (UNEP, 2022). It is therefore logical to expect that countries with abundant natural resources should prosper in innovative outputs, yet research findings point to different outcomes.

Brief Discussion of Variables

The key variables in this study include: a) natural resource rents,(used as a measure of a country's resource dependency and intensity) defined as the economic value derived from the extraction of natural resources, such as oil, gas, minerals, forests, and fisheries; b. Creative Innovation Outputs, which include metrics such as patents by origin, utility models by origin, scientific and technical articles, cultural and creative services exports, national feature films, entertainment and media market size, printing and other media, and creative goods exports. These outputs represent the innovative capacity and creative economic contributions of a country; c) Institutional Quality, referring to the governance frameworks and policies that regulate resource management and innovation. High institutional quality is often associated with better innovation outcomes and reduced negative effects of resource dependency; d) Economic Diversification, which is the process by which economies expand their range of productive activities, moving beyond resource dependency to include manufacturing, services, and technology-driven sectors. Diversification is critical in mitigating the "resource curse."

The study hypothesizes that natural resource rents influence creative innovation outputs both directly and indirectly. Direct effects include investments in infrastructure and resources that enable innovation, while indirect effects, often negative, arise from reduced spending on education, institutional inefficiencies, and overreliance on resource extraction. Institutional quality mediates these effects, with stronger institutions fostering positive outcomes even in resource-dependent economies.

Innovation is crucial in driving modern economies. The production of goods and the provision of services often require natural resources, but resource dependence can also reduce incentives for innovation (Omidi et al., 2021). Creativity, innovation, and inventiveness are essential social sources of capabilities that drive progress. At the organizational level, innovation is influenced by management practices, availability of resources, and organizational support for creativity and motivation (Amabile et al., 2019). These factors are considered to positively influence innovation.

The current study seeks to examine the effect of natural resource endowments on a country’s creative outputs, guided by the paradox of plenty (resource curse theory) and recent findings. This is because contemporary research highlights that while resource endowments can promote development in certain contexts, their effects on innovation remain ambiguous and warrant further investigation.

LITERATURE REVIEW

Several studies have been carried on the effect of natural resources on different economic output variables.

Ayobola etal (2018) studied the relationship between resource endowment and export diversification and its

implication for economic growth in Nigeria based on data from 1981 to 2015. The findings of the Granger causality test indicate that unidirectional causality moves from oil production to economic growth, while export diversification does not cause economic growth. From the error correction findings, it was found out that export diversification positively impacts growth from the last two periods, while in the current period, it has negative effect on growth. This shows that the key issue with Nigerian economy might not be structural but institutional. This implies that though the economy is diversified, the expected result may still be a ruse without appropriate economic institutional reform. The study concludes that specialisation is preferred to diversification for Nigeria in the current circumstance.

Gaiten and Roe (2011) studied the effect of natural resources on international trade, exhaustible-resource abundance and economic growth. They developed an infinite horizon, two-country model, where countries are similar, but one is gifted with plenty of exhaustible resource and the other is not. The study revealed that there is an inelastic demand for the exhaustible resource which in turn increased the revenue from trade, and this encouraged them to invest relatively less than the country deficit in the resource. Isham et al (2005) revealed how nations depending on point source natural resources and plantations are vulnerable to high social and economic divisions and weak institutional capacity, in the process preventing their capability to respond to shocks when needed. It was also observed that across a range of governance indicators, point source and plantation exporting nations perform badly. Alexeev and Chernyavskiy (2015) concluded that non-hydrocarbons had a small positive effect on growth, and on the other hand hydrocarbon showed none or a little negative impact on growth. This is caused by the removal of oil and gas rents from the regions by the government through taxation.

Shao and Yang (2014) studied the effect of natural resource dependence, human capital accumulation and growth using both conceptual and mathematical model. The study found out that the rate of return on investment in economic virtuous circle on micro and macro levels. It also observed that price of the resource goods, elasticity of inter-temporal substitution and rise in discount rate have negative effects on economic virtuous circle.

Murshed and Serino (2011) applied a dynamic panel analysis and results revealed that nations that concentrate on natural resource export have their growth hindered because they did not diversify their economies and export structure. Sachs and Warner (1995) from their study found out that there was an indirect relationship between natural resource abundance and economic growth even after controlling for a large number of variables which were germane for cross-country growth. In a study conducted on resource abundant African economies by Eregha and Mesagan (2016), it was revealed that institutions had insignificant effect on per capita GDP growth and that large crude oil export earnings have not been properly used to develop sectors that can help to grow and develop oil-rich African countries, thereby turning the resource blessing into curse.

Makhlouf et al (2015) in a study of 116 nations over 35 years showed that trade openness is linked to both specialization and diversification. On the developing countries in their sample, it was seen that autocratic openness is linked with specialization, while democratic openness is associated with export diversification. Klinger and Lederman (2011) in their resultsindicatedthat export discovery is being reduced within countries and industries by the risk of entry by imitators. Nevertheless, the effect of market failure is curbed by spill overs from one industry to the other thereby boosting export discoveries. Aditya and Acharyya (2015) showed that under bilateral tariff reduction, exports of a higher number of differentiated varieties may be realized only for the nation in whose favour, the national wage moves.

There is a heated debate about the relationship between a nation's natural resource abundance and economic growth. Some view natural resource abundance as a curse, whereas others view it as a blessing. Aljarallah and Angus (2020) analysed the economic, social, and political effects of resource abundance in an oil-rich country, Kuwait, using data from 1984 to 2014. The study reveals through autoregressive distributed lag modelling and error correction modelling that resource rents increase per capita GDP merely in the short-run; however, resource rents deteriorate productivity, human capital, and institutional quality in both the short and the long-term. These results indicate that, for Kuwait, the overreliance on its natural resources has been detrimental over the long-run. In another study, Shahbaz et al. (2019) observed that natural resource wealth benefits growth, whereas natural resource dependence depresses economic growth and development. This finding is supported by Taguchi and Lar (2016), James and Aadland (2011), and Atkinson and Hamilton (2003).

The devastating effects of resource wealth on economic growth rates, information has also been provided that resourcerich countries tend to perform poorly against measurements closely related to growth performance, such as life expectancy and human capital development (Blanco & Grier, 2012; Bulte et al., 2005; Gylfason, 2001; Papyrakis&Gerlagh, 2007; Ross, 2001; Shao & Yang, 2014;Stijns, 2006). Other authors have found that natural resource richness has a negative impact on social outcomes in general, supporting the view that human capital serves as a transmission channel for the resource curse (Blanco & Grier, 2012; Carmignani, 2013; Carmignani&Avom, 2010; Cockx&Francken, 2016; Kronenberg, 2004; Shao & Yang, 2014; Welsch, 2008). Natural resource wealth dampens the need for human capital development due to a false sense of security (Gylfason, 2001), which reduces public and private incentives to save and invest (Papyrakis&Gerlagh, 2004; Welsch, 2008) and causes countries to assign inadequate attention and expenditure to human capital and also causing countries to reduce investment in public capital. Cockx and Francken (2014) indicated that resource-rich countries can invest less into the development of human capital, which impedes the development of non-resource sectors, resulting in lower productivity and overall growth rate.

Some studies have been carried out in various resource rich countries (Akpan&Chuku, 2014; Sun et al., 2019), which have the same basic viewpoint that investment in human capital does not deliver the expected earnings and outcomes (Filmer et al., 2017); consequently, the public desire for education declines, causing a deficit in the driving force of the accumulation of human capital. For example, Blanco and Grier (2012) found that, when natural resource dependence is disaggregated into subcategories, petroleum export dependence shows a positive effect on physical capital and a negative effect on human capital, and that this effect held in the long-run for 17 Latin American countries. Papyrakis and Gerlagh (2007) discovered that natural resource wealth in the United States decreased human capital investments. Another empirical analysis by Sun et al. (2018) of provincial panel data from China discovered a crowding-out effect of natural resource dependence on human capital accumulation in the western and central regions of China. The same results were achieved by Douangngeune et al. (2005) in Japan, South Korea, and Thailand; by Birdsall et al. (2001) in South Korea and Brazil; and by Wang et al. (2009) in China. Even though the implications of most natural resource endowments have been examined through their effects on primary outcomes, which includes human capital, in various nations many different countries, that is why it was important to examine the effects in Kuwait to gain a complete perception of the impact of natural resource wealth on human capital.

Also, some scholars have observed that resource wealth lowers human capital development through its effect on institutional quality (Akpan &Chuku, 2014; Bulte et al., 2005; Costantini&Monni, 2008). Torvik (2002) developed a new mechanism to explain why resources may reduce welfare and income by combining rent-seeking and increasing returns to scale to capture the idea that more resources might lower social welfare. Finally, resource-rich countries that have effectively escaped the resource curse tend to have higher levels of human capital (Bravo-Ortega & De Gregorio, 2005), as higher educational levels help in the management of these resources in efficient ways which support technology absorption and encourage the development of productive economic sectors (Kurtz & Brooks, 2011; Stijns, 2006). As shown by Shao and Yang (2014), the efficient allocation of factors of production plays a critical role in whether natural resources are a blessing or a curse thus, sufficient human capital is crucial to evade the curse.

Studies were also done on natural resources and entrepreneurship. Fu and Wang empirically explored the resource-based cities in China and found the natural resource industry leads to the crowding-out effect of manufacturing development and environmental crises [20]. According to Schumpeter, entrepreneurship is the motivation of business activities that leads to positive organizational decisions as well as regional innovation and economic developments [21]. Therefore, scholars attempted to determine the dynamic relationship between resource-based industry and entrepreneurship during a specific period. After Chinitz's research about the connection between business model and regional natural resources, Glaeser et al. set the distribution of iron and coal as causal variable and regional innovation ability as the outcome variable and determined the deficiency in entrepreneurship and start-up rate are caused by the agglomeration of natural-resource-based industry during the early stage of development.

This study concentrated on four countries – Indonesia, Chile, Venezuela and Nigeria – and focus on how they have handled export bonanzas, with a thrust on employment and the growth fall-out. The four case studies reveal

that, depending on the specifics of the country, promising new comparative advantages can come up in the primary, secondary and tertiary sectors, while the role of service tradable wouldn't be discounted discounted. It is intriguing that the great majority of minerals-dependent countries to achieve sustained growth have also made significant progress in manufacturing. The exposure of the four countries further confirms the risks of focusing on capital-intensive industries in labour-surplus countries, as well as the risk of lodging such activities in the public sector. Only Indonesia of the four countries was able to achieve good enough employment growth under mineral dependency to avoid a high or rising level of inequality. This portrays a problem on the employment/distribution front which is severe.

Addisuetal 2020 surveys current evidence and identify empirical patterns in the economic diversification of resource-rich countries. Diversification is measured using the growth of per capita non-resource (manufacturing and services) sectors in domestic and export markets, which consists of cleaner interpretation than competing measures Results reveal that more resource-dependent countries appear to perform worse on measures of human capital and intellectual capital, but more resource-abundant countries perform better on public capital and human capital accumulation. The study analysed country-level performance in economic diversification according to the output-based measures focusing on 42 countries that started off as resource rich. The sample was examined to establish whether greater resource wealth is correlated with better or worse subsequent performance in economic diversification. The average growth rate of manufacturing value added per capita across the whole sample of resource-rich countries between 1981–2014 was 2.6%. The fastest manufacturing growth rate was registered in Oman (10.9%), followed by Laos (9.3%), Indonesia (8.6%), Egypt (6.4%), and Malaysia (5.9%). These five countries also registered consistently higher growth rates than their peer countries in almost all non-resource economic activities. Angola (−6.7%) and Syria (−6.4%) came out at the bottom.

Venables (2016) identified as best performing resource-rich countries—namely, Botswana, Malaysia, and Chile. Comparing across country groups, the study observed that extremely resource-rich countries differ from the remaining groups for registering subpar GDP per capita growth (average 0.7%), but relatively higher manufacturing value added growth (average 2.9%) and manufacturing export growth (average 7.2%).Their service value added and exports also grew at close to the overall average. Given their relatively low initial levels of diversification, this could reflect the relative ease of achieving high growth rates from a very low base. The decent diversification performance in extremely resource-rich countries could thus be due to what Gerschenkron (1962) referred to as the advantage of "backwardness," where numerous profitable opportunities for growth exist in these sectors, which may be quickly exploited. The study revealed that reveals that none of the measures of resource wealth has a significant and negative correlation with manufacturing and service growth. In fact, most of the correlations are positive, and one is even statistically significant (resource rents as a share of GDP and the growth in service exports per capita), though that is about what one would expect as a matter of chance. Within the relatively homogenous sample of resource-rich countries, therefore, there is no proof that resource wealth is associated with lower levels of non-resource growth. However, this does not amount to ruling out the possibility of a resource curse since it could also be argued that these countries should have exploited their resources to achieve above-normal growth rates.

Addissuetal (2020) compares the growth performance of the 42 resource rich countries with the rest of the world. For manufacturing, resource-rich countries registered lower per capita value-added growth (by one percentage point) greater per capita export growth (by three percentage points), although neither of these differences is statistically significant. However, resource-rich countries have significantly lower levels of services growth, which is lower by 1.4 percentage points for per capita value added, and by almost two percentage points for per capita exports. These results are consistent with reports of declining service GDP shares in highly resource-rich countries (Diop, Marotta, and de Melo 2012), and suggest that the prevalence of Dutch Disease could extend to services in an increasingly globalized world where trade in services is becoming a requirement. also, a slow growing and volatile resource sector described by James (2015), an underperforming service sector could thus be a drag on GDP growth in resource-rich countries and greater per capita export growth (by three percentage points) some measures can be seen as eventual development outcomes in themselves, they can be more generally considered to be competitive capabilities that constitute immediate determinants of economic growth and diversification (Djankov et al. 2002).

World bank 2020 compare the competitive capabilities of the successful diversifiers with their peer countries in

order to assess whether diversification success is associated with greater competitive capabilities. Nigeria stands out for its low levels of competitive capabilities, which may reflect its significantly lower income level relative to the other successful diversifiers (Oman, Suriname, and Saudi Arabia). However, all of the four successful diversifiers have HDI levels that are below what would be predicted from their income level. Data for human capital (HCI) is available only for Nigeria and Saudi Arabia, and their performance too is far below the line of prediction. The more complete data for tertiary education enrolment rate (TERT) confirms that the four diversifiers perform far worse than what their income would predict. Saudi Arabia has the highest tertiary enrolment rate among successful diversifiers but its performance compared to its income peers is only half as large (5.8 in Norway and 6.5 in Australia). it does not appear that non-resource growth has been accompanied by human capital accumulation.

Addissu et al (2020) postulate thatbest diversifier including Laos stands out for lagging behind the other countries. This is so given that its average per capita GDP at the time was only one-half the level of Indonesia's, one-third of Peru's, and nearly one-sixth of Chile's. On the other hand, Chile has consistently higher levels of competitive capabilities than its peers—the only country to do so among successful. Norway stands out for having the highest levels of competitive capabilities. Norway, along with other high-income countries (Canada and Australia) have higher levels of competitive capabilities for their income levels in almost all areas (two minor exceptions are public capital and entrepreneurship support, see figure 1). Among the remaining three successful diversifiers, Malaysia has consistently highly competitive capabilities compared to its peers. Malaysia has exceptionally high levels of financial access (108%), R&D expenditure, and entrepreneurship support for its income level, and has also decent levels of human development index. Entrepreneurship support in Malaysia is higher than in Norway (2.9 vs. 2.6) although entry rates are smaller than the group average. Egypt and Tunisia lag behind their peers in most measures of competitive capabilities with a few exceptions (e.g., above-average tertiary enrolment rate of 4% in Egypt, and also relatively higher financial access of 64% in Tunisia).

Studies using measures of resource dependence find a negative relationship with economic growth. For example, Lederman and Maloney (2007) note that between 1980 and 2005 GDP per capita grew far more slowly in net natural resource exporters (0.6 percent) than in net natural resource importers. (2.2 percent). countries that are specialized in mineral resources find it more difficult to make the jump to diversify towards products that can open the way to acquiring capabilities in other, more advanced, products that can support higher wages as the country moves up the technology ladder. Oil, for example, is well separated in product space from dense clusters; unless technically sophisticated to the point where it can produce capital equipment, a producer may not learn much from oil production that enables it to produce other products. One channel for the adverse linkage between resource dependence and growth is volatility. Resource prices are very volatile, particularly for oil, where the coefficient of variation of prices is 0.7. Prices are also very difficult to predict. Hamilton (2008) studied the statistical properties of oil price series. Results revealed that the random walk hypothesis cannot be rejected and that, starting from a price of US$115 per barrel, four years into the future we should not be too surprised to find the price of oil either as high as US$391 per barrel or as low as US$34. The latter price was inconceivable at the time of that study and far outside the range of observed futures prices; however, prices did hit US$34 per barrel late in 2008 as the market collapsed. The resulting uncertainty is enormous for producers. Oil exporters have typically not succeeded in smoothing these extreme price cycles.

Arezki (2011) showsthat Venezuela had been one of the fastest-growing Latin American economies, with long-term growth averaging 6.4 percent. But following several euphoric years after 1974 it experienced a sharp decline, with output per capita halving over the next two decades. Nigeria offers a third example, with voracious public spending outpacing revenue increases up to 1984, followed by sharply lower debt-constrained spending thereafter (Budina and van Wijnbergen, 2008). Simulations show that such cycles can turn a potential oil windfall into an actual loss (Gelb and Grasmann, 2010). A long line of research relates output volatility to slow growth.

Natural resources and innovation

There have been different reactions to the dominance of the resource curse thinking. David and Wright (1997), for instance, were pioneers in proposing that natural resource-based development is realized through the generation and use of new and relevant knowledge, and that it is possible for natural resource-based industries (NRBIs, cf. Text Box 1) to lead economic development for extended periods of time. Moreover, several recent

studies have demonstrated that NRBIs can be sources of important innovations and technological opportunities for productivity improvements in resource production but also for stimulating innovation in other parts of the economy. These studies include high-income economies such as the US, Norway and Australia (David and Wright 1997; Smith 2007; Ville and Wicken 2012), middle-income developing countries such as Chile, Argentina and Brazil (Dantas et al. 2013; Iizuka and Katz 2010; Marin, Stubrin, and da Silva 2015; Pérez 2010) and low-income countries in SubSaharan Africa (Morris, Kaplinsky, and Kaplan 2012a; Teka 2011; UNIDO 2012). Combined, these studies constitute the beginning of a new wave of thinking about NRBIs in relation to innovation and industry dynamics – and about the possibilities for natural resource-based development. This branch of research does not reject all insights from the resource curse debate. Sound management of macroeconomic fundamentals, careful exchange rate policy, institutional quality and 'good governance' are important although in our view insufficient factors in a development strategiInnovation researchers have tended to concentrate on analysing innovation in manufacturing and more recently also service industries thereby creating a bias in the empirical coverage of the field (Martin 2016).

Studies tend to operate with a manufacturing-based perception of the mechanisms underlying industrial development. It is also aligned with historical studies on catching-up that suggest that low-income countries had to emulate the industrial paths taken by high-income countries to develop (Gerschenkron 1962; List 1841). These studies inspired a branch of research on technology gaps, catching-up, innovation and latecomer advantages contemplating productivity developments in post-World War II Europe and USA and subsequently in the 'East Asian Tiger' economies, and emphasize that for catching-up to happen countries should foster development of the more rapidly growing and technologically progressive industries of the day (Fagerberg and Godinho 2005), by that time manufacturing The most recent of these experiences of catching-up is that of the East Asian countries. The rise of the 'East Asian Tiger' economies has been portrayed through the metaphor of a flock of flying geese with Japan as the lead goose followed by first tier (Korea, Taiwan, Singapore, Hong Kong) and second tier (Malaysia, Thailand, Indonesia, and even China) birds.

The view that a set of universal key technologies and industries drive development across countries can be accounted for by the fact that catching-up in East Asia was mainly based on manufacturing industries such as shipbuilding, textiles, cars and consumer electronics (Mathews 2006). Such industries can produce homogeneous output given the same input factors and production process regardless of geographical location. This feature of manufacturing industries implies that the technology involved predominantly is generic. Indeed, it is often emphasized as a latecomer advantage that technology and 'roadmaps' for catching-up already exist (Mathews, 2006). As a result, the main tasks for policy in fostering industrial advance in manufacturing industries include to access, absorb and apply often foreign generic technology through different phases of replication, creative imitation, and finally new to the world of innovation.

Omidi (2018) studied on the natural resource curse hypothesis and the impacts of institutional quality on the way in which natural resources affect innovation. The findings reveal that while the effect of natural resources on innovation is negative inthose countries, which explains the resource curse hypothesis, but the impact of natural resources interaction with institutional quality is positive. These results pointing out on the importance of institutional quality as a groundwork for the way in which other variables can be effective. Nations with natural resource abundance may be linked to the "natural resource curse" phenomenon which can destroy the production factors in those countries. Based on the study of Welsch (2008) investigated on, natural resource abundance which had an inverse effect on innovation in 77 countries in the period 1965-1998. Papyrakis and Gerlagh (2005) emphasize the negative effect of natural resources on innovation. In this research, natural resources reduce the incentive of innovators to engage in innovative activities for two reasons first, the discovery of resource reserve reduces the need to support consumption through labour income and therefore increase leisure and reduces work effort. According to Olsson (2007), natural resource abundance may result in crowding-out of labour from the formal sectors, such as innovative activities, to the appropriative struggle, which depresses growth. This is in agreement with the study of Sachs and Warner (2001) which revealed that profits generated by abundant natural resources will inspire potential entrepreneurs engaged in the primary market and resource industries to become natural resource rent-seekers rather than creators. On the other hand, Guo et al. (2016) explain that the negative impact of resource curse on economic growth transmitted through lowering the innovation and technological progress.

The existence of the resource curse has been shown in several studies (Ahmed et al., 2016; Apergis et al., 2014; Badeeb et al., 2017; Cockx&Francken, 2016; Crivelli& Gupta, 2014; Moradbeigi& Law, 2017; Sarmidi et al., 2014; Satti et al., 2014; Shahbaz et al., 2019; Shao & Yang, 2014). While prior studies have confirmed the resource theory in relation to some other economic output variables like economic growth, the effect on innovative outputs cannot be over assumed. We present this argument because of 1) the arguments advanced by Dauvini&Guerreiro (2016) regarding the use of abundance and intensity measures, the account for appropriability aspects of resources and the role of institutions as possible causes of heterogeneity on the outputs obtained among resource rich countries and 2) arguments put forth by Romer (1990), Weitzman (1998) and Olsson (2000), who point out that innovation is a dynamic process, which leads to the deduction that country innovative scores obtained today are not necessarily the same innovative results that prevail tomorrow, as changes are always expected to occur. It therefore becomes worthy for the current study to further test the resource curse theory to see if being endowed with natural resources also negatively affects the creative outputs of a country despite existence of study findings that may suggest so.

THEORETICAL FRAMEWORK

This study is premised on the paradox of plenty theory or the resource curse theory which originated as a result of some conventional wisdom that has spread among scholars (Dauvini&Guerreiro, 2016) citing various studies (Gelb, 1988; Barro, 1991; DeLong and Summers, 1991; King and Levine, 1993; Auty, 1993). The theory postulates that countries that are rich in natural resources fail to benefit from them as a result of the indirect effect (Omidi, Shahabadi&Mehregan, 2018). The current study draws from this argument and extends the negative effect to hypothesise that a higher resource endowment results in a reduced drive for other innovations with specific focus on a country's creative innovative outputs. Following this hypothesis, the study model specification is presented below:

$IO = \alpha + \beta N + \varepsilon$

Where IO = creative innovative output

N = intensity of natural resources

ε = error term

MATERIALS AND METHODS

Data and model specification

Innovation

In this study, country innovation is defined according to the World Intellectual Property Organization. The organization gives country by country scores on different dimensions of innovations. The dimensions covered in the database are classified into two broad categories which are innovative inputs and innovative outputs. The innovative inputs comprise of institutions, human capital and research, infrastructure, market sophistication and business sophistication. The innovative outputs comprise of knowledge and technological outputs as well as creative outputs. Each of these has some sub-components. The study focused on the effect of natural resource rents on knowledge creation and creative goods and services outputs.

Knowledge creation outputs

Knowledge creation comprise of patents by origin, utility models by origin, scientific and technical articles,and citable documents.

Creative goods and services

Creative goods and services comprise of cultural and creative services exports, national feature films, entertainment and media market, printing and other media and creative goods exports. Data from the Global Innovation Index (GII) provided by the World Intellectual Property Organization website is collected for the

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above dimensions of innovation and was used as a proxy for innovation for all the countries where the data is obtainable for the period 2017 to 2020.

Natural resources

The country-by-country natural resource rents obtainable on the WDI website was used as a proxy for natural resources. Data was collected for all the countries where data is obtainable on this website for the period 2017 to 2020.

Model Specification

The following bivariate regression equation is used to estimate the effect of natural resources rents on the selected creative innovative outputs:

$IO = \alpha + \beta N + \varepsilon$

Where IO = creative innovation output

N = intensity of natural resources

ε = error term

Each creative innovation output takes the value of OI and is estimated in a separate equation in turn.

ESTIMATION RESULTS

Table 1 below presents the estimated results.

Table 1: Bivariate Regression results

Dependent variable									
	Patents by origin	Utility mod by origin	Scientific & tech art	Citable doc hi index	Cul& creative serv exp	Nat feature film	Entertain & med mkt	Print & med	Creative goods exp
Constant	2.2434	4.0935	7.6743	14.8200	.5352837	1.9921	12.2638	1.3298	1.691529
Nat resource rents	-.0597	-.1183	-.1395	-.3551*	-.0194**	.1698**	.1003	-.0004	-0.078**
*** Significant at 1%									
** Significant at 5%									
* Significant at 10%									

As can be deduced from the results, the effect of natural resources on citable documents as creative outputs is negative and significant at a 90% confidence level. The effect of natural resources on cultural and creative services exports is negative and significant at a 95% confidence level. Similarly, the effect of natural resources on creative goods exports is negative and significant at a 95% confidence level. Unexpectedly, the effect of natural resources on national feature films is significant and positive at a 95% confidence level. Natural resources endowments, however, do not exhibit any influence on other dimensions of creative innovative outputs.

To explore these relationships further, the analysis incorporates mediating variables such as institutional quality, governance indicators, and investment in human capital. These mediators play a pivotal role in shaping the

relationship between natural resources and innovative outputs as shown below:

Institutional Quality

Robust institutions can mitigate the adverse effects of natural resource dependency by ensuring transparent allocation of resource rents. For example, strong legal frameworks and anti-corruption policies can redirect resource revenues towards innovation-enhancing activities. Weak institutions often exacerbate the "resource curse" by fostering rent-seeking behavior and mismanagement, limiting the potential for innovation-driven growth.

Governance Indicators

Good governance, including accountability, political stability, and regulatory quality, is associated with better utilization of natural resource wealth. Countries with effective governance structures can transform resource revenues into investments in infrastructure and technology, fostering innovative outputs. Also, poor governance leads to inefficient resource use, reduced public trust, and diminished investments in creativity and technological advancement.

Investment in Human Capital

Education and skill development are critical in leveraging natural resources for innovation. Countries that channel resource rents into improving human capital through education systems, vocational training, and research funding tend to exhibit higher innovation outputs. Conversely, resource dependence often leads to underinvestment in human capital, as governments prioritize short-term economic gains over long-term development goals.

The findings are supported by existing literature. Rahman, Khan, and Amjad (2021) identify that the effect of natural resources on innovation is both direct and indirect. The direct effect is positive, as evidenced by the significant and positive relationship between natural resources and national feature films. However, the indirect effect is negative and manifests through channels such as underinvestment in education and institutional inefficiencies. These conclusions are consistent with the resource curse theory and align with recent research by Ahmed and Sattar (2022), who emphasize the critical role of governance and human capital in mitigating the adverse impacts of resource dependency on innovation. Additionally, Khan et al. (2023) highlight that effective policies and investments in education can counteract the negative effects of resource dependency, fostering a more innovation-friendly environment.

CONCLUSION

Natural resources of a country have both a direct and an indirect effect on the innovative outputs of a country. The direct effect is positive and the indirect effect is negative. The direct effect is when the natural resources are used directly to cause the output. The indirect effect is when the existence of the resource cause countries to be complacent in investing in other drivers of innovation like education. When the innovative output depends on education, this will cause a negative effect.

RECOMMENDATIONS

The study recommends that those countries that are richly endowed with natural resources should not become complacent in investing in the other drivers of innovation like the requisite infrastructure, education, as well as a framework of appropriately rewarding other forms of innovations in order to incentivise individuals and entities to be motivated to engage in activities that lead to improved country innovative outputs.

Recommendations for Policymakers

To mitigate the negative impact of natural resource endowment on innovation and leverage its potential for sustainable development, policymakers should consider the following strategies:

1. Invest in Education and Human Capital Development:
2. Allocate a significant portion of resource rents to education systems that foster creativity and technical skills.
3. Promote STEM (Science, Technology, Engineering, and Mathematics) education to build a foundation for innovation.
4. Enhance Institutional Quality through strengthening governance frameworks to ensure transparency, accountability, and equitable resource distribution.
5. Establish policies that prioritize long-term developmental goals over short-term revenue generation.
6. Promote Economic Diversification, through encouraging the development of non-resource-based industries, such as technology and creative sectors.
7. Provide incentives for startups and businesses in diverse economic sectors to reduce reliance on natural resources.
8. Support Research and Development (R&D), through establishing innovation hubs and provide funding for research institutions focused on sustainable technologies.
9. Collaborate with international organizations to share knowledge and best practices in resource management and innovation.
10. Implement Reward Frameworks for Innovation, through developing schemes that recognize and financially reward innovations, particularly those addressing sustainability challenges.
11. Foster public-private partnerships to support innovative projects with real-world applications.
12. Adopt Sustainable Resource Management Practices:
13. Use resource rents to invest in renewable energy and sustainable technologies that reduce environmental degradation.
14. Monitor and regulate resource extraction to ensure ecological balance and intergenerational equity.

Through the adoption of these strategies, resource-rich countries can overcome the challenges associated with the resource curse while fostering a thriving, innovation-driven economy. Policymakers must remain proactive in aligning resource management with sustainable development objectives to ensure long-term national progress.

DIRECTION FOR FUTURE STUDIES

Future studies should focus on the interaction of the use of abundance and intensity measures, the account for appropriability aspects of resources and the role of institutions and the effect on country innovative outputs

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