



Transitioning to a knowledge-based economy: Challenges and enablers for Papua New Guinea

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Abstract

Papua New Guinea's economic structure has been reliant on the extraction of natural resources such as minerals, crude oil, and gas. While the extractive industry has driven national growth and ensured economic stability since independence, it has limited diversification and innovation. There are studies on higher education, research and human capital development. However, there is limited and disparate literature on science policy and knowledge-based economy models and its application to the PNG context. This paper examines the challenges and enablers for PNG to transition toward a knowledge-based economy. The study identifies significant policy, infrastructural, and socio-cultural challenges. Conversely, realigning research institutions, investment in research infrastructure, and collaboration are key enablers. The paper concludes that investment in research, science and innovation is crucial for a knowledge-driven economy.

Keywords: Science, research, knowledge, knowledge-based economy, innovation

1. Introduction

1.1. Background and context

Since independence, Papua New Guinea has depended on the abundant natural resources, particularly in the agriculture, forestry, fisheries, mining, oil, and gas sectors to drive economic growth (DNPM, 2023; Gavin et al., 2020). This heavy reliance on the extractive industry exemplifies the characteristics of a brown economy (Rhode, 2017). A brown economy refers to a country whose economic structure depends on the extraction of natural resources such as agriculture, forestry, fisheries, gold, copper, oil and gas. The mining and petroleum sectors contribute over a quarter of the PNG's GDP and more than eighty percent of export revenue (ADB, 2019). Liquefied Natural Gas is PNG's largest export commodity with K20.6 billion in 2024. This is followed by gold with K9.8 billion, copper ores with K5 billion, and petroleum oil with K2.9 billion. Palm oil also cocoa are also major export commodities with K2.6 billion and K1.6 billion respectively. The table below shows the industry values of the agriculture and mining sectors from 2019 to 2024 in PNG.

	2019	2020	2021	2022	2023	2024
A AGRICULTURE, FORESTRY AND FISHING	10,394	10,588	10,703	11,035	11,141	11,374
Crop and animal production	8,777	9,052	9,455	9,686	9,909	10,099
Forestry and logging	692	605	494	601	521	502
Fishing and aquaculture	925	931	754	747	712	772
B MINING AND QUARRYING	20,889	18,977	16,774	17,636	17,867	18,293
Extraction of crude petroleum and natural gas	13,057	12,961	12,035	12,198	12,347	12,190
Other Mining	7,832	6,016	4,740	5,438	5,519	6,103

Table 1: Industry Gross Value Added, Constant Price Estimates (Kina Millions). National Statistics Office, 2026.

Although the extractive industry has driven national growth and ensured macroeconomic stability for PNG in the last five decades, it has limited economic diversification and value creation. The economy is exposed to external uncertainties and commodity price volatility (Rena, 2009). The recent increase in fuel prices and fuel shortage due to the war in Iran (ICCC, 2026) raised serious concerns about the stability of energy resources and the economy in PNG. Another dilemma associated with the brown economy is the depletion of non-renewable resources. With the closure of several mines such as Porgera and Ok Tedi scheduled within the next decade, the issue of sustainability has become a key concern for affected communities (Carr & Filer, 2012). The brown economic system involves significant environmental degradation and pollution (Setiawan, Fadillah & Ridwan, 2024). It is harmful to the environment (Shaikh, 2020) and unsustainable in the long term. For instance, the Porgera Gold Mine in Enga Province has caused downstream pollution, habitat destruction, and biodiversity loss (Kennedy, 1996).

Globally, many countries are transitioning to knowledge-based economies to enhance productivity, innovation, and economic growth. The emergence of a knowledge-based economy as a sustainable model in modern economies (OECD, 1996) is driven by science, technology and innovation. Powell and Snellman (2004) and Czarniewski (2016) describe the knowledge-based economy as a production of knowledge or knowledge-related activities that contribute to economic growth and scientific advancement. Emphasis is placed on knowledge creation and intellectual capabilities rather than natural resources. Studies by Edoun et al., (2020); Acharya and Pathak (2019) shows countries that have invested in research, science, technology, and innovation have experienced inclusive economic growth.

For PNG, the knowledge-based economy presents a sustainable pathway to transition from resource-dependence to an innovation-driven growth model. PNG continues to be a consumer of innovation, imported technologies and knowledge products despite having a rich biodiversity and cultural heritage (Anis, 2025; Mulung et al., 2025). Overall, the state of research in the country continues to remain below expectation. This study identifies the challenges and enablers that PNG can consider in its effort to move towards a more innovation-driven economy.

1.1. Significance of the Global Knowledge Economy

Numerous studies including Vlasov et al., (2022) reiterate that Knowledge-Based Economy is the economy of the future. It drives economic growth, innovation, and sustainability. An innovation-driven growth fosters diversification beyond traditional sectors, enhances economic resilience, and supports sustainability even in volatile global markets (Dadashzade, 2025). This study provides context specific insights for PNG to transition towards the global knowledge economy.

1.2. Challenges in transitioning to a Knowledge-Based Economy

Papua New Guinea faces a plethora of challenges in transitioning from a resource-dependent economy to a knowledge-based economy. Lack of funding continues to be the major challenge (Baje & Itaki, 2022). Universities and research institutions are underfunded and disconnected from the industry. There is little to no support to commercialize scientific research. Another challenge is the shortage of scientists

and researchers (UNIDO, 2016). The majority of the scientists with doctorates are reaching retirement age and have no observable scientific outputs (Kaupa et al., 2024).

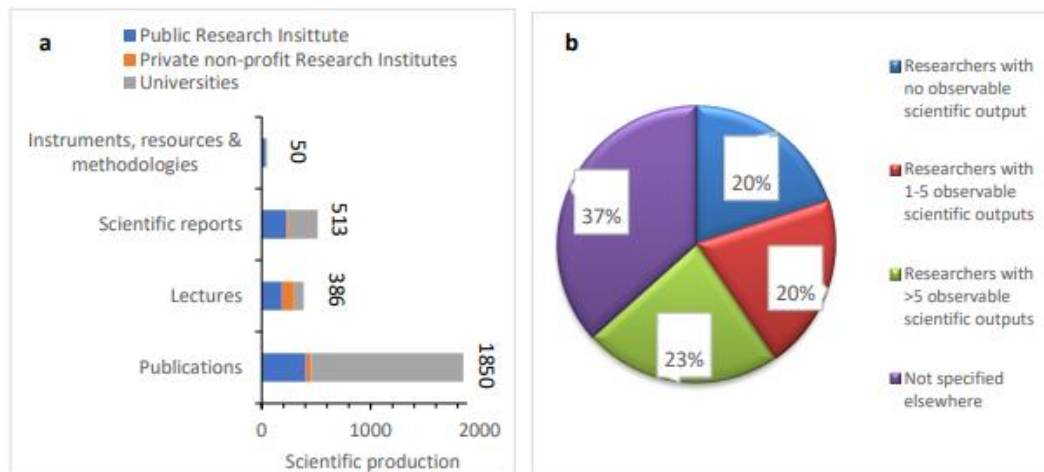


Figure 1. Number of scientific production and outputs (Kaupa et al., 2024).

Apart from the human capital gap, there is a need to assess current research infrastructure capacity, and rehabilitate aging infrastructures and establish state-of-the-art research facilities to support research activities. Additionally, there is a lack of mechanisms to promote innovation and patent protection. There are socio-economic factors such as low internet coverage (Logan & Suwamaru, 2017), high internet costs, and infrastructure challenges. With limited internet access and a high illiteracy rate (DNPM, 2023), many Papua New Guineans will not benefit fully from the transition to a knowledge-based economy.

1.3. Knowledge gaps

While existing literature focuses on higher education, research and human capital development, Mulung et al., (2025) observed that there was no significant study on science policy and knowledge-based economy models and its application to the PNG context. There is limited data on innovation systems (Anis, 2025) and incongruent views on innovation and entrepreneurship. In making such an assertion, it is necessary to acknowledge the difficulties of gaining accurate and reliable data on expenditure, local scientific capacity and the impact of science in PNG.

1.4. Objectives and scope of the study

This study evaluates the current science and innovation landscape in PNG and attempts to create an enabling environment for innovation and scientific advancement. These are the main objectives:

1. Evaluate the current state of research, science, and innovation in PNG.
2. Identify challenges and critical enablers for an effective transition
3. Provide policy and strategic recommendations for an effective transition to a knowledge-based economy.

2. Methodology

2.1. Research design

This study used a systematic review of disparate literature and studies to synthesize present realities by using the Triple Helix Model (Fabiano & Ricardo, 2023). The Triple Helix Model addresses the current fragmentation by strengthening institutional collaboration and cross-sector coordination between government agencies, academia, and industry. Given PNG's socio-cultural and environmental diversity, integrating the model with community engagement further enhances its relevance as an appropriate and

effective framework for PNG. The study provides an overview of the challenges and enablers for PNG to transition to a knowledge-based economy.

3. Definitions and theoretical perspectives

3.1. Definitions

Science is the search for truth and new knowledge (Neal et al., 2008). The key challenge for Papua New Guinea is to produce economically useful knowledge. There is a disconnect between research for knowledge generation and research for development and economic growth (Mulung et al., 2025). Research is the examination of a specific topic or issue to generate solutions, new data or information (Adams, 2021). This process leads to the creation of knowledge for the advancement of relevant disciplines, industries and people in general. Knowledge is important in building a better society, socially and economically (Okoye et al., 2022). Knowledge is therefore, an intellectual property that has commercial value according to Robertson (2008). Innovation is important for economic growth as it transforms knowledge into a tangible product or service.

3.2. Theoretical perspectives: Models of Knowledge-Based Economy

The theoretical models of the knowledge-based economy revolve around the interactions of key societal actors and evolving modes of knowledge production that drive innovation-led economic growth. The most prominent models include the OECD Knowledge-Based Model, World Bank's Knowledge Economy Index (KEI), Triple Helix Model, Quadruple Helix Model, Quintuple Helix Model, and the Innovation Systems Approach. These models emphasize the importance of research, knowledge, and innovation in driving economic growth and development.

OECD Knowledge-Based Economy Model. This model theorizes economic growth to be driven by the creation, dissemination, and application of knowledge (OECD, 1996) rather than traditional factors of production like labour and capital. It emphasizes investment in human capital, innovation, and information infrastructure.

World Bank Knowledge Economy Index (KEI). This framework measures a country's ability to generate, adopt, and diffuse knowledge as an economic asset (World Bank, 2003). It captures multidimensional aspects such as education, innovation, ICT infrastructure, and institutional frameworks (Chen & Dalman, 2006).

Triple Helix Model. This model focuses on the interaction and relationship of three main actors: universities as producers of knowledge, industry as knowledge users, and the government as the regulator and policy body (Cai & Etzkowitz, 2021). Innovation is a result of the interactions and exchange of knowledge between these actors.

Quadruple Helix Model. This model includes four major actors in the innovation system: science, policy, industry, and society (Schütz, et al, 2019). It includes culture, values, lifestyle, and creativity in innovation. Thus, recognizing the role of society in shaping innovation and economic development.

Quintuple Helix Model. This model further integrates the environment and sustainability as essential dimensions. Carayannis and Campbell (2012) frame innovation within the broader socio-ecological system, emphasising sustainability as imperative when transitioning to a knowledge-based economy.

Innovation Systems Approach. This model goes beyond the linear views of innovation to include the complex and systematic nature of knowledge creation, diffusion, and application. Fromhold-Eisebith (2007) emphasizes the importance of interactions and network between institutions, organizations, and individuals in driving innovation.

4. Importance of transitioning to a Knowledge Based Economy

4.1. Transitioning to a Knowledge-Based Economy

The ability of any society to acquire knowledge, skills and technology to meet its social and economic needs is vital for its development. However, Baje and Itaki (2022) pointed out that not enough attention has been paid to research, science and innovation and its role in the national development process. The consequence of this neglect, over the years, has been the deterioration of the socio-economic development of the country. World Bank (1998) observed that countries are poor because they lack knowledge.

There is a strong relationship between a healthy economy and knowledge development, where success in business and marketplace has largely been attributed to policies that support investment in research, science and technology. The World Development Report (World Bank, 1998) recommends that we look at the problems of development in a new way - from the perspective of knowledge.

4.2. Barriers to an effective Transition

An effective transition involves mitigating diverse barriers which include socio-cultural challenges, infrastructural limitations, and political issues.

Socio-cultural challenges: The knowledge-based economy favours the skilled and educated workforce whilst the uneducated population will be marginalized. This goes against traditional values such as communal ownership and shared wealth (Narakobi, 1980; UNIDO, 2016).

Infrastructural limitations: Internet and banking access are limited to urban areas (Barak, 2022).

Political Issues: Political interests override development priorities (Mulung et al., 2025). Often times, politicians divert funds for short-term priorities and neglect research and innovation (UNIDO, 2016).

5. Current status of science, technology and innovation in Papua New Guinea

5.1. Overview of scientific research and innovation capacity

Currently, there are numerous universities and research institutions that are diverse and have international partnerships. These institutions have published work that have generated international interest. Apart from research activities conducted by local universities and research institutions, PNG has been a hotspot for research activities for many decades, especially for biological, cultural and anthropological investigators from all over the world (Cámara-Leret et al., 2020).

Universities and research institutions are at the forefront of research and knowledge creation in Papua New Guinea. They share a common mandate of conducting researching and developing innovative practices that could lead to socio-economic development. However, the universities and research institutions operate under different legislations and are funded under different sectors, implementing various research agendas and sectorial plans. Each institution has its own research programs and have partnerships with foreign universities and research institutions (Baje & Itaki, 2022). This multiple or pluralistic system is fragmented and makes it difficult to coordinate research activities in the country.

Public investment in research and innovation currently represents about 0.03% of GDP (PAS, 2026). The state of research in the country continues to remain below expectation due to persistent lack of funding to implement research programs. Most of the research laboratories are in dire need of maintenance, equipment replacement, and expansion in some cases. Many researchers are redundant with no scientific output (Kaupa et al., 2024).

5.2.Key actors

Below is a summary performance by the key actors in Papua New Guinea using the Triple Helix Model.

5.2.1. Universities and research institutions

There is a large number of universities and research institutions in Papua New Guinea (PAS, 2026). They cover many disciplines and domains of knowledge. Several of them have broad domains, whilst others focus on specific domains.

State universities doing research:

1. University of Papua New Guinea (UPNG) is the largest university in PNG with eleven (11) research centres or clusters in the areas of economics and human capital, Biodiversity, environmental sustainability, health, people, and culture.
2. University of Goroka (UoG) was previously known as the Goroka Teachers College. It gained university status and has research projects in many disciplines in the sciences and humanities.
3. Papua New Guinea University of Technology (Unitech) was established to provide the country's technical workforce and conducts research on technology, engineering and applied sciences.
4. University of Natural Resources and Environment (UNRE) does research in agriculture and marine resources.
5. Western Pacific University (WPU) is a new university that has research programs in business, computer science, and cybersecurity.
6. Innovative University of Enga (IUE) is an initiative of the Enga Provincial Government and does research on education, nursing, mathematics, and natural sciences.
7. University of Medicine and Health Science (UMHS) was formerly known as the School of Medicine and Health Sciences with the University of Papua New Guinea.

Church affiliated universities doing research:

8. Pacific Adventist University (PAU) is an Adventist Church university and focuses on very specific research projects in sciences, education, and health.
9. Divine Word University (DWU) is a Catholic Church university that has acquired expertise in media and nursing. DWU occasionally conducts research programs in political sciences, business, health sciences and fundamental sciences.
10. Lutheran University of Papua New Guinea (LUPNG) is a Lutheran Church university that does research in theology, agriculture, nursing, engineering, education and business.

Private higher education institutions doing research:

11. IBSUniversity (IBSU) does research in business, finance, economics, and ICT. IBSU has its own journal.
12. International Training Institute (ITI) also does research in business, finance, economics and ICT.

State funded research institutions doing research:

13. National Research Institute (NRI) is mandated to conduct research and advise the Government on social, economic and political issues such as unemployment, financial inclusion, elections, education, decentralization, environment, law and order.

14. National Agricultural Research Institute (NARI) is the leading institution that addresses food security in Papua New Guinea. It has research centres around the country. It tests the introduction of new crops, new livestock, and new agricultural techniques. Many of their research activities have industrial or semi-industrial applications.
15. Institute of Medical Research (IMR) is the leading medical research institution in the country. IMR has built up international expertise in the fight against malaria and works in close cooperation with hospitals and health centres throughout the country. Their research is widely published in academic journals in Papua New Guinea and abroad.
16. Forest Research Institute (FRI) is based in Lae. It studies the impact of logging in the country and design research projects to implement sustainable logging mechanisms that minimize its impact on the social and natural environment.
17. Institute of Papua New Guinea Studies (IPNGS) is a branch of the National Cultural Commission. It is devoted to the scientific studies in Melanesia. It has received international recognition for its studies in ethno-musicology and has a recognized expertise on traditional copyright management.
18. Cocoa Board of PNG (PNGCB) regulates the cocoa industry in PNG and provides support to farmers and the cocoa industry through various programs and initiatives, including training and capacity building, research and development, and extension services.
19. Kokonas Industri Koporesen (KIK) regulates the coconut industry in PNG and provides capacity building of farmers through comprehensive research programs.
20. Coffee Industry Corporation Limited (CIC) regulates the coffee industry and conducts research activities to improve and maintain the quality and quantity of PNG coffee as well as providing extension services to growers in the industry.
21. Nago Island Mariculture Research Facility (NIMRF) does research on mariculture and serves as a training centre for students from the National Fisheries Centre.

Non-state research institutes that conduct research:

22. PNG Oil Palm Research Association (PNGOPRA) is the research arm of the oil palm industry. The organisation is membership-led and does research in agronomy, entomology, plant pathology, smallholders, and socioeconomics.
23. Summer Institute of Linguistics (SIL) is a mission-based organisation that documents languages and cultural anthropology.
24. The Melanesian Institute does research in anthropology, sociology and theology. Some of the key research areas of focus include marriage and family life, disability, politics, drug and alcohol use, as well as sorcery related accusations.
25. Mahonia Na Dari Research Centre (MND) supports marine biology students and researchers conduct their postgraduate research in Kimbe Bay.
26. New Guinea Binatang Research Institute (BRI) is devoted to the study of biological biodiversity. They have trained many young researchers in environmental sciences and in the preservation of natural diversity of the country.
27. PNG Institute of Biological Research (PNGIBR) is a non-government organisation based in Goroka and does research in biodiversity and conservation.
28. Institute of National Affairs (INA) is a private sector research institute based in Port Moresby. It focuses on political issues as well as general social issues affecting PNG.

Additionally, there are international organizations that conduct research activities in PNG. They are funded by development partners or international aid. These include ACIAR (agriculture), CGIAR (agriculture), Burnet Institute (medical), CSIRO (energy, mining), UNESCO (education), WHO (health), World Vision (water, sanitation), FAO (food security, agriculture), and EU-FCCB (forestry, biodiversity, climate change). These organisations support capacity building and fund research programs to promote sustainable development (ACIAR, 2018).

Much of the scientific studies undertaken is basic research to attain a postgraduate qualification. Little emphasis is given to product development and innovation (UNIDO, 2016). A capacity assessment survey done by PNGSTCS (2016) shows that between 2012 and 2016, research grants comprised of 55% basic research, 28% applied research, and 16% development research. Universities and research institutions are unable to commercialize their findings due to the lack of adequate funding and the legislative mandate of their institutions (Mulung et al., 2025).

5.2.2. Government

The government plays a crucial role in a knowledge-based economy. PNG recognized the need to embrace scientific research and innovation to support an inclusive green growth pathway into the future (DNPM, 2014; Hualupmomi, 2013). Some of the early policy efforts by the Office of Higher Education to drive research and innovation in Papua New Guinea include;

- Science and Technology Policy (1991)
- PNG Science and Technology Council Act (1992)
- Papua New Guinea National Higher Education Policy and Implementation Strategy: White Paper on Higher Education, Research, Science, and Technology (2000)
- National Higher Education Plan II 2000 – 2004: A Reform Plan and Action Strategy to Stabilize and Develop Higher Education, Research, Science and Technology (1999)
- OHE: Policy for Supporting Research and Development under the Science and Technology Initiative (2007)
- National Higher Education Plan III 2010 – 2040: Innovation through Entrepreneurialism (2009)

The PNG Science and Technology Council was established in 2014 to provide science policy advise to the government and coordinate all research, science, and technology activities (Forsyth, 2015). The Council also provides grants to support research and development in science, engineering, technology, and innovation that are relevant to PNG's development needs and priorities. As stipulated in the PNG Science and Technology Council Act (Office of Legislative Counsel, 1992), the Council serves to facilitate, inform, and adopt science policies based on evidence provided by research that is applicable to PNG context in order to progress socio-economic growth and environmental sustainability of the country.

PNG Science and Technology Council has developed key policy documents such as the National Research Agenda, the Science, Technology and Innovation Plan, and the National Research Code of Conduct (Forsyth, 2015). These documents form the policy basis to re-align research agencies with a unified research agenda, ensure research governance, and foster effective collaboration between research agencies and statutory bodies. However, there is no policy to protect the intellectual property and patents of researchers (UNIDO, 2016).

Some government agencies have research units and grants to support their mandated roles. These agencies include:

1. Department of Health (Health Research Unit)
2. National AIDS Council and Secretariat provides grants for research on HIV/AIDS and have developed the National Research Agenda for HIV/AIDS in Papua New Guinea.
3. Department of Petroleum & Energy (plan to build an Energy Research Institute or Centre)
4. Office of Climate Change and Development (OCCD)
5. Conservation and Environment Protection Authority (CEPA)

5.2.3. Private Sector

Partnerships and collaboration between research institutions, universities and the private sector is limited and have not proven to be effective. The private sector plays an important role in research and development especially in the manufacturing industry. Some companies involved in research activities include:

1. South Pacific Brewery Limited (cassava production)
2. Vitis Industries Limited (alcohol and noni cultivation)
3. Oil Search Limited (funded PNG Biomass Project in Morobe Province)
4. Ok Tedi Mining Limited (environmental research to analyze the impact of mining waste along the Fly River on its research vessel Fly River Hope)
5. Ramu Nickel Mine Limited (environmental research to analyze the impact of mining waste along the Basamuk area in Madang Province)

6. Challenges and enablers for Papua New Guinea

6.1.Challenges of a Knowledge-Based Economy

While the knowledge-based economy offers economic growth and sustainability, there are critical issues that are particularly accentuated in PNG and require further consideration.

Institutional Challenges: Each research institution is independent and autonomous. They are guided by individual Acts of Parliament and have different funding structures, and implement various sector plans (Papoutsaki & Rooney, 2006). A report by Walton & Kabuni (2025) noted that government institutions are protective of their mandates and operate in silos.

Policy Challenges: There is a lack of governance policies to realign research institutions (Omuru & Kingwell, 2000) and to protect the intellectual property and patents (UNIDO, 2016).

Social and Cultural Challenges: A knowledge-based economy requires an educated workforce and reliable ICT infrastructure (Kefela, 2010). With low internet access and a high illiteracy rate, majority of the population will be marginalized and not benefit from the new economy.

6.2.Enabling environment

This section provides a brief overview of the key enablers, strategic actions, and selected references to ensure an effective transition to a knowledge-based economy.

Policy Realignment: Streamlining or realigning the research priorities of all research agencies will address the current fragmentation among research agencies caused by various legislations.

Key Action:	Realign research institutions' programs with the National Research Agenda and STI Policy Framework.
References:	PAS (2026); Forsyth (2015).

Funding: Investment is crucial to realize the potential of science and innovation in contributing to a knowledgeable society that uses information to maximize economic growth.

Key Action:	Establish an Endowment Fund with an annual appropriation to support research, science, and innovation programs.
References:	PAS (2026); Forsyth (2015).

University-Industry Collaboration: Forge useful collaborative alliances between universities, research institutions and industry to upscale and commercialize research and knowledge.

Key Strengthen collaboration between research institutions and industry.
Action:
References: Mulung et al., (2025).

Regional Partnerships: Regional partnerships offer access to global expertise, resources, and networks needed to drive science and innovation.

Key Collaborate with regional and international development partners.
Action:
References: UNESCO (2024); Mulung et al., (2025).

Infrastructure: Maintain research laboratories and obtain specialised testing equipment to respond to the development needs of the country.

Key Undertake regular maintenance and accreditation of research laboratories to
Action: meet international standards.
References: PNGSTCS (2016); PAS (2026).

Science Communication: Facilitate effective communication and dissemination of research findings and science information for policy and decision-making.

Key Expand to digital and social media platforms to reach the population.
Action:
References: PAS (2026); OECD (1996).

7. Policy recommendations

Transitioning to a knowledge-based economy presents challenges that requires a holistic approach to ensure that benefits are equitable and inclusive of all segments of society. This study identifies several key actions that must be addressed to form the basis of a knowledge-driven economy.

Universities and research institutions require consistent annual budget appropriation for research, science, and innovation programs. Strengthening the capacity of research institutions is a foundational step toward effective transition. The Government must provide attractive remuneration packages for scientists and researchers in public universities and research institutes. Apart from human resources, it is important to modernise and equip research laboratories with state-of-the-art equipment to support scientific research work. Collaboration and communication among research institutions, industry, government, civil society organizations, and development partners is necessary to facilitate the translation, uptake and application of research and knowledge into public policy, government decisions, product development, and industrial applications with resultant economic development and job creation.

8. Conclusion

It is strongly evident from this study that national development growth strategy based on principle of knowledge-based economy is robust, sustainable, and resilient. However, as observed in this study, many economic structures are reliant on the extraction of natural resources such as minerals, crude oil, forestry, agriculture, fisheries and gas as they are readily available. The study observes that while the extractive industry is a key driver for national growth and ensured economic stability in many developing countries, limited diversification and innovation hinder options for robust, resilient and sustainable economic growth. There are studies on higher education, research and human capital development, with limited and disparate literature connecting science policy and knowledge-based economy models. The study concludes that for Papua New Guinea to transition toward a knowledge-based economy, it needs a radical shift in policy landscape, and need to address infrastructural, and socio-cultural challenges it is currently

faced. Conversely, realigning research institutions, investment in research infrastructure, and collaboration are key enablers. The paper concludes that investment in research, science and innovation is crucial for a knowledge-driven economy.

References

- Acharya, K. P., & Pathak, S. 2019. Applied research in low-income countries: why and how? *Frontiers in Research Metrics and Analytics*. 4: 3
- ACIAR. 2018. *Growing research capacity in PNG*. Retrieved from <https://www.aciar.gov.au/media-search/blogs/growing-research-capacity-png>
- Adams, L. 2021. What is research? *Global Scientific Journals*, 9(12): 387 – 407.
- Anis, T. 2025. Factors influencing research and innovation in Papua New Guinea: A study of cultural, educational, economic, and institutional dimensions. *IBSUniversity Journal of Business and Research*, 2(2): 61 – 73.
- Asian Development Bank. 2019. *Pacific Finance Sector Briefs – Papua New Guinea*. Asian Development Bank. Sydney, 2000, Australia.
- Baje, L. & Itaki, L.R. 2022. Strengthening capacity building of local researchers in Papua New Guinea. *Contemporary PNG Studies: DWU Research Journal*, 37: 12 – 18.
- Barak, J. 2022. Enhancing financial inclusion of informal economy through mobile money in Papua New Guinea. PNG National Research Institute Spotlight, 16(2).
- Cai, Y. & Etzkowitz, H. 2021. Theorizing the Triple Helix model: Past, present, and future. *Science Direct*, 7(2–3):189-226.
- Cámara-Leret, R., Frodin, D.G., Adema, F., et al. 2020. New Guinea has the world's richest island flora. *Nature*. 584: 579–583.
- Carayannis, E. & Campbell, D. 2012. Triple Helix, Quadruple Helix and Quintuple Helix and How Do Knowledge, Innovation and the Environment Relate To Each Other? *International Journal of Social Ecology and Sustainable Development*, 1 (1): 41-69.
- Carr, P., & Filer, C. 2012. *Plans to close the Ok Tedi Mine in Papua New Guinea*. Open Research Repository. Australian National University.
- Chen, D.H.C. & Dahlmén, C.J. 2006. *The Knowledge Economy, the KAM Methodology and World Bank Operations*. World Bank Institute, Washington, D.C. 20433, U.S.A.
- Czarniewski, S. 2016. International Technology and Knowledge Transfer as a tool for building a Modern Economy. *International Journal in Management and Social Science*, 4(4): 292 – 303.
- Dadashzade, M. 2025. The Place of Innovations in the Modern Concept of Economic Development. Herald UNU. *International Economic Relations and World Economy*. 2025-55-1.

Department of National Planning and Monitoring. 2014. *National Strategy for Responsible Sustainable Development for Papua New Guinea*. Port Moresby, Papua New Guinea.

Department of National Planning and Monitoring. 2023. *Medium term development Plan IV 2023 – 2027*. Port Moresby, Papua New Guinea.

Edoun, E.I., Poee, S., & Fotso, G.B. 2020. The Impact of Knowledge-Based Economy on Growth Performance: Evidence from South Africa. *Journal of Reviews on Global Economics*. 9: 387 – 402.

Fabiano, M.T & Ricardo, G.R. 2023. Triple helix in the management of innovation in public policies: a study of two countries. *GeSec: Revista de Gestao e Secretariado*, 14(8): 14516.

Fromhold-Eisebith, M. 2007. Bridging Scales in Innovation Policies: How to Link Regional, National and International Innovation Systems. *European Planning Studies*. 15(2): 217-233.

Frosyth, M. 2015. Papua New Guinea's National Research Agenda. State, Society & Governance in Melanesia (SSGM) In brief 2025/24. Australian National University.

Gavin, M.M., Charles, R., Stephen, A.N., Simon, M.J. & Gama, G. 2020. Mining in Papua New Guinea: A complex story of trends, impacts and governance. *Elsevier – Science of The Total Environment*. 741, 140375.

Hualupmomi, F. 2013. The role of state in economy through Human Capital Development in Research, Science and Technology. *Huon Seminar 2013 Proceedings*, PNG University of Technology: 207 – 217.

Independent Consumer and Competition Commission. 2026. *Press Statement: Adjusted Indicative Retail Fuel Prices – April 2026*. Port Moresby, Papua New Guinea.

Kaupa, P., Mulung, K. & Matainaho, T. 2024. Baseline Survey of Research Capacity in Papua New Guinea's Research Institutions and Universities. *7th PNG Conference on Science and Technology*, PNG University of Technology.

Kefala, G.T. 2010. Knowledge-based economy and society has become a vital commodity to countries. *International NGO Journal*, 5(7): 160-166.

Kennedy, D. 1996. Ok Tedi all over again: Placer and the Porgera gold mine. *Multinational Monitor*, 17 (3): 22.

Logan, S. & Suwamaru, J. 2017. Land of the Disconnected - A History of the Internet in Papua New Guinea. *The Routledge Companion to Global Internet Histories*: 12 – 18.

Mulung, K., Dean, J., & Litau, L. 2025 *From Knowledge to Action: Enhancing Decision - Making through Science - Policy Integration for Papua New Guinea*. Special Issue of the IJPNGUoT, 2 (2): 24 – 36.

Narakobi, B. 1980. *The Melanesian Way*. Institute of PNG Studies. Port Moresby, PNG.

Neal, A. H., Smith, L. T., & McCormick, B. J. 2008. *Beyond Sputnik: US Science Policy in the 21st Century*. Michigan: Michigan University Press.

NSO. 2026. *Papua New Guinea National Accounts 2019 to 2024 - Gross Domestic Product*. National Statistical Office, Port Moresby, PNG.

OECD. 1996. *The Knowledge-Based Economy*. Organisation for Economic Co-operation and Development, Paris, Cedex 16, France.

OECD. 1996. *The knowledge-based economy*. Paris: OECD.

Office of Legislative Counsel. 1992. *Papua New Guinea Science and Technology Council Act, 1992*. Office of Legislative Counsel, Port Moresby, PNG.

Okoye, K., Nganji, J. T., Escamilla, J., Fung, J.M, & Hosseini, S. 2022. Impact of global government investment on education and research development: A comparative analysis and demystifying the science, technology, innovation, and education conundrum. *Global Transitions*, 4: 11-27.

Omuru, E., & Kingwell, R. 2020. *Research Priority-Setting In Papua New Guinea: Policies, Methods and Practicalities*. Presented at 4th Annual Conference of the Australian Agricultural and Resource Economics Society. University of Sydney, Australia.

Pacific Academy of Sciences. 2026. *Strengthening Pacific Research and Development: A baseline assessment of investment and capacity in Pacific states*. Pacific Academy of Sciences. Apia, Samoa.

Papoutsaki, E., & Rooney, D. 2006. Colonial legacies and neo-colonial practices in Papua New Guinean higher education. *Higher Education Research & Development*, 25(4): 421–433.

PNGSTCS. 2016. *Research Capacity Evaluation Report*. Papua New Guinea Science and Technology Council Secretariat. Port Moresby, PNG.

Powell, W.W. & Snellman, K. 2004. The Knowledge Economy. *Annual Review of Sociology*, 30 (1): 199 – 220.

Rena, R. 2009. Papua New Guinea — An Emerging Economy in the South Pacific: Challenges and Prospects. *Handbook of Business Practices and Growth in Emerging Markets*. October 2009: 517-529

Rhode, C. 2017. An Economy Transitioning from Brown to Green. *CESifo DICE Rep*, 15 (3): 51 – 55.

Robertson, S. L. 2008. *Producing Knowledge Economies: The World Bank, the KAM, Education and Development*. Centre for Globalisation, Education and Societies, University of Bristol, U.K

Schütz, F., Heidingsfelder, M.L., & Schraudner, M. 2019. Co-shaping the Future in Quadruple Helix Innovation Systems: Uncovering Public Preferences toward Participatory Research and Innovation. *She Ji: The Journal of Design, Economics, and Innovation*, 5 (2): 128-146.

Setiawan, D., Fadillah, E.N., & Ridwan, T. 2024. Synergy of Green Economy, Blue Economy and Brown Economy as a Prerequisite for SDG's Success. *Financial Engineering*. 2: 257 – 261.

Shaikh, V. 2020. *The Irreplaceable Technologies of Brown Economy*. Paper presented at Innovation Summit Conference, Pakistan. Retrieved from https://www.researchgate.net/publication/339817177_The_Irreplaceable_Technologies_of_Brown_Economy

UNIDO. 2016. *Innovation in the Pacific: An Assessment*. United Nations Industrial Development Organization (UNIDO). Vienna, Austria.

United Nations Economic and Social Council. 2024. *Global cooperation in science, technology and innovation for development*. Commission on Science and Technology for Development. Retrieved from https://unctad.org/system/files/official-document/ecn162024d3_en.pdf

Vlasov, M., Polbitsyn, S. N., Olumekor, M., & Oke, A. 2022. The Influence of Socio-Cultural Factors on Knowledge-Based Innovation and the Digital Economy. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(4): 194.

Walton, G.W., & Kabuni, M. 2025. *Anti-corruption reform and political will in Papua New Guinea*. United Nations Office on Drugs and Crime (UNODC) Report.

World Bank. 1998. *World Development Report: Knowledge for Development*. New York: Oxford University Press.

World Bank. 2003. *The World Bank Annual Report - 2003*. Washington, DC 20433 USA.