
Postgraduate Education at Papua New Guinea University of Technology: A Distinctive Journey of Achievements and National Development

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Abstract: In celebration of 50 years of Papua New Guinea's independence, Papua New Guinea University of Technology (PNGUoT) reflects on its pioneering role in spearheading national development through postgraduate education. PNGUoT has shaped experts and researchers in key Science, Technology, Engineering, and Mathematics (STEM) fields pivotal to the socio-economic development of the country. The purpose of this article is to evaluate PNGUoT's accomplishments in teaching and research excellence, and to explore future developments that will establish it as a knowledge hub. The university has made significant progress, but it remains constrained by ongoing funding limitations, gaps in physical infrastructure, equipment, and laboratory facilities, and inadequate scholarship coverage. This constrains the drastic expansion of postgraduate training necessary for industrialization, innovation, and a knowledge-based economy. Between 1976 and 2025, PNGUoT graduated 28 Doctor of Philosophy, 451 Master's, and 210 Postgraduate Diploma and Postgraduate Certificate students. Between 1976 and 2000, the number of graduates was 75, whereas in the subsequent 25 years, from 2001 to 2025, it significantly increased to 614. In recent years, the University has graduated approximately 40-50 postgraduate students annually, with enrolments reaching 214 in 2025 across the faculty. Despite this progress, access to postgraduate education remains limited to a small segment of the population. A significant gap exists that must be addressed to expand access and bring postgraduate programs closer to the levels seen in developed nations, involving ongoing investment in research infrastructure, academic staff capacity-building, strengthened partnership-building, and a balanced scholarship scheme. As PNG charts its next 50 years of development, the revitalization of postgraduate education in PNGUoT and other higher education institutions offers a transformative path to unlocking human capital, enhancing research quality, and fostering technological leadership to propel educational, economic, and scientific contributions to sustainable national development for all.

Keywords: higher degree research, innovations, national development, research skills

1. INTRODUCTION

In today's era of rapid technological advancement and intense global competition, postgraduate study is not a luxury—it is a necessity. Postgraduate education and research are among the most critical pathways to remain at the forefront of knowledge and technological innovation. A country's ability to adopt, disseminate, and capitalize on rapid technological progress depends heavily on the strength of its tertiary education system. Accessible, well-functioning higher education institutions and effective national innovation systems can significantly accelerate a developing country's path toward sustainable development and long-term success. A country cannot achieve sustainable economic growth and development without the use of science and technology.

Postgraduate programs (Master's and PhD) offered at universities train subject specialists, researchers, and creative pathfinder leaders who are needed to initiate the sustainable development of a country's economy and society. Qualified professionals, trained in higher degree courses, possess the potential to drive developments in fields such as agriculture, engineering, technology, social sciences, and healthcare. Postgraduates are instrumental in creating new knowledge and innovations. Their research can serve as the foundation for new products and technologies, as well as solutions to national issues such as environmental threats, climate change, and food security, thereby enhancing productivity and efficiency.

Universities, through their postgraduate programs, can influence communities through their innovative solutions and change the lives of millions. A well-known case of an environmental problem would be in Bangladesh rural communities, where millions of people were exposed to arsenic-laced groundwater, which poses severe health issues, including skin diseases and cancer. The problem is complex, as it involves both geological and social elements. A group of researchers, comprising postgraduate students from the Bangladesh University of Engineering and Technology and Dhaka University, collaborated with international partners to conduct intensive studies on the hydrogeology of arsenic contamination. They encouraged the installation of safer tube wells in low-arsenic zones, as well as advancements in low-cost filtering systems that they developed and mass-produced for public use in partnership with multilateral agencies (Rahman et al., 2010; Jannat et al., 2022).

In this era, research in science and technology is more than just tools in any economy—they are drivers of economic prosperity, social progress, and national resilience. For conducting research, trained human resources are necessary. Nations that invest in higher education, research, innovation, and technology build strong foundations for sustainable growth and improved quality of life for their citizens (Acharya & Pathak, 2019; Li et al., 2024). PhD/Master's students develop cutting-edge innovations ready for industrial application. Postgraduates in science and technology can potentially fuel R&D efforts within industry clusters and science parks. Postgraduates often become lecturers and researchers in universities and training institutions. They are required to maintain quality teaching, develop future researchers, and build academic and institutional capabilities. The benefits of vital postgraduate education also affect the primary and secondary education systems. For example, in Finland, a Master's degree is the minimum qualification for a permanent teaching position, even in primary schools. Primary teachers undergo a five-year integrated Master's program that includes a major in teaching education and the completion of a thesis on the same academic standard as other university subjects (Sahlberg, 2013). In contrast, Papua New Guinea has been described by the World Bank as being in a “human capital crisis”. Such a situation, precipitated by poorly trained teachers impacting classroom learning, could be overcome by providing structured lesson plans (Needham, 2024).

A highly educated workforce attracts investment, promotes entrepreneurship, and enhances the country's global competitiveness. Postgraduate training develops expertise in areas such as public health, environmental studies, economics, and governance, enabling the design of better policies and the provision of higher-quality services. Higher degree training develops critical thinkers with problem-solving abilities and innovators, effectively creating a strong pipeline for entrepreneurship and research and development (R&D). This, in turn, makes the nation an attractive destination for investors, helping industries evolve and flourish in the rapidly changing global economic landscape (Abramo et al., 2019). This study is undertaken with the following objectives: i) To evaluate the impact of PNGUoT's postgraduate education in STEM fields on national development between 1976 and 2025; and ii) To identify and promote key strategies for addressing the challenges and gaps that constrain the expansion of postgraduate training within the broader postgraduate education ecosystem in Papua New Guinea.

2. METHODOLOGY

This study deploys a mixed-methods design, combining quantitative and qualitative approaches, grounded in secondary data analysis to evaluate the contributions, status, and challenges of postgraduate studies at the Papua New Guinea University of Technology (PNGUoT) during the period 1976-2025.

2.1 Data Sources

Institutional Records and Reports: Postgraduate enrollment and graduation statistics were obtained from official academic records, annual reports, and strategic papers of PNGUoT to account for trends and performance during the research period. National Government policy documents, including the Medium-Term Development Plan IV and Vision 2050, were studied to position the role of postgraduate education in national development agendas. Information on funding levels, scholarship programs, and infrastructural capacities was collected from newspapers and Government budget documents. Published literature and comparative international education data, i.e., Organization for Economic Cooperation and Development (OECD) postgraduate benchmarks, were reviewed to contrast the postgraduate education situation in PNGUoT with global standards.

2.2 Data Analysis and Synthesis

Quantitative enrollment and graduation data were scrutinized to establish trends in growth, capacity thresholds, and the efficiency of output from postgraduate programs. Qualitative content analysis of policy documents revealed strategic imperatives and challenges pertinent to the expansion of postgraduate education. The study integrated these data to identify gaps, limitations, and opportunities, particularly in funding, infrastructure, and scholarship coverage. Projections and recommendations were made by integrating institutional data with national strategic goals and international standards to advise paths to rejuvenate postgraduate education at PNGUoT.

2.3 Limitations and Ethical Considerations

The study relies on secondary data, which may have discrepancies and gaps, and the projections assume continuation of current policies and funding levels, which may vary. All data sources are publicly available or presented in institutional reports; therefore, the study is compliant with the ethical criteria of confidentiality and data standards of use.

3. STATUS OF HIGHER DEGREE TRAINING IN PNG

Overall, there is a lack of openly available information on the number of postgraduate students enrolled in Papua New Guinea. The major public universities—namely the University of Papua New Guinea, PNG University of Technology, and the University of Goroka—have established postgraduate schools or faculties. Newer universities such as IBS University, Sonoma Adventist College, and PNG University of Natural Resources and Environment (PNGUNRE), along with private institutions like Divine Word University and Pacific Adventist University, may enrol only a handful of postgraduate students.

Since independence, Papua New Guinea has largely overlooked the importance of capacity building and higher degree training of local researchers, despite its direct relevance to the realization of the country's national goals and directive principles (Baje & Itaki, 2022). It has been argued that the current capacity is insufficient even to meet the academic staffing needs of the country's expanding higher education sector. The present output of doctoral graduates from both national institutions and aid-supported programs remains inadequate to meet future demand (Baje & Itaki, 2022). A recent estimate suggests that 22 PhDs and 504 Master's degrees were awarded through domestic postgraduate training within Papua New Guinea institutions between 2012 and 2016 (Kaupa et al., 2024). The study highlights that, despite growing investment in human and financial resources for research and development (R&D), the current levels remain meagre and insufficient. Furthermore, the training of young researchers at the Master's and PhD levels—and retaining them across various research fields—is seen as a crucial first step in ensuring that PNG develops an adequate pool of qualified R&D personnel at the national level (Kaupa et al., 2024).

4. HISTORICAL PERSPECTIVES OF POSTGRADUATE PROGRAMS AT PNGUOT

The Papua New Guinea University of Technology (PNGUoT), since its inception in 1973, has taken a strategic decision not merely as a higher teaching institution, but has also decided to integrate teaching and research. The critical element for such a decision was not only to become a higher learning institution of excellence in teaching and research, but also to meet the professional and developmental needs of the young nation by building local human capacity. The reflection of such a decision was the graduation of its first PhD in Civil Engineering and one MCOM student from the Department of Accountancy and Business Studies in 1976. This trend continues into the later years. However, most of the postgraduate students were initially overseas academics at the university. The program was unable to attract any national staff/students into the postgraduate program until 1981, when three of them enrolled for the postgraduate diploma. Between 1976 and 2000, the total number of PhDs awarded was 9, the number of Master's was 21, and PGD/PCert was 45 (Figure 1a).

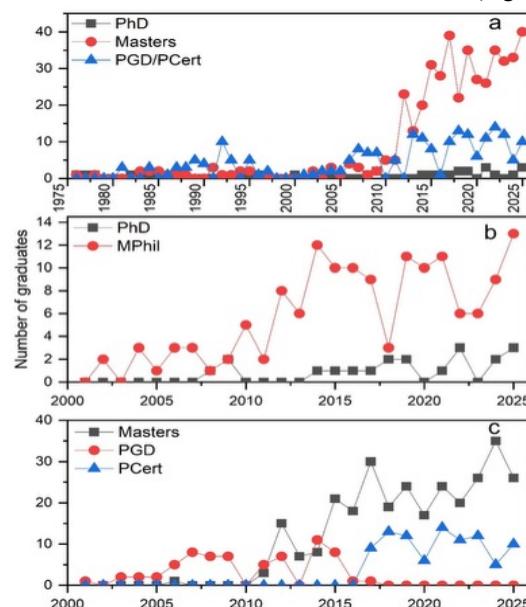


Figure 1. Growth of postgraduate programs at PNGUoT: a) Graduation trend from 1976-2025. b) Graduation trend in Research only programs from 2001-2025 (PhD, MPhil). c) Graduation trend in course-based programs from 2001-2025 (Masters-Master of Science/Engineering/Technology/Communication Studies/Business Administration, etc., PGD, and PCert programs).

The momentum of postgraduate studies did not continue for long. PNGUoT could not take advantage of the generous funding for a sustainable postgraduate program and research through institutionalizing the postgraduate programs, foreseeing the importance from the standpoint of human capacity building and succession planning. The postgraduate programs were mostly in hibernation during the 90s to early 2000s. This was primarily due to the mass exodus of experienced staff with postgraduate supervision capability, resulting from the floating and depreciation of the PNG Kina. PNGUoT reached a crisis point in terms of recruiting and retaining qualified staff. This prompted PNGUoT to reconsider the strengthening of in-house postgraduate studies and research. With the change of time, technological development, and experience, the university embarked on “UNITECH 2030”, Papua New Guinea University of Technology’s Pathway to the Future, to align its focus and direction with the Government policies, like Vision 2050, DSP 2030 with the strategic development goal of promotion of scholarships, externalization of academic programs, and entrepreneurial quality development.

From the mid-2000s, postgraduate programs underwent rejuvenation through a refocusing on research and scholarship character development, as well as the reintroduction of the Graduate Assistantship Program (GAP) in place of the Assistant Lectureship Scheme in 2001 to promote scholarship character and strengthen the in-house program targeting the first-degree holder with excellent academic records to pursue Master’s and PhD (Figure 2b and 2c). The GAP became a cornerstone of PNGUoT’s efforts to build a robust research culture, particularly by integrating research training with academic staffing needs.

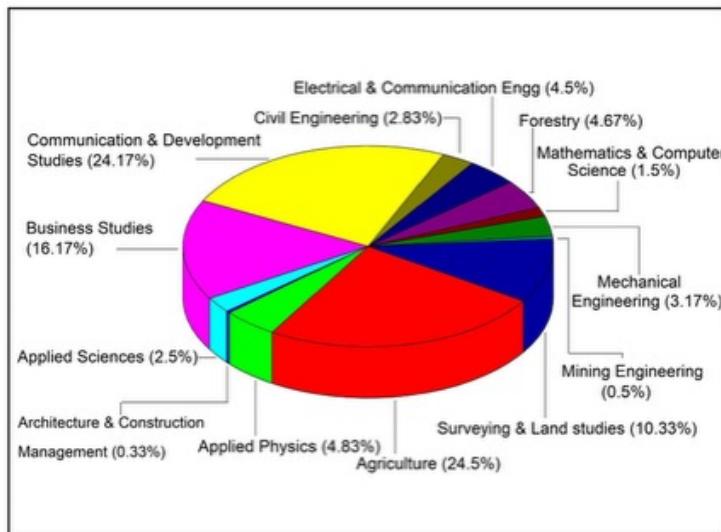


Figure 2. Contribution of PNGUoT academic schools to the postgraduate program outputs (2001-2025)

A major catalytic shift in the in-house program occurred through the Australian Centre for International Agricultural Research (ACIAR)’s postgraduate scholarship scheme, coordinated by the University of Queensland (UQ), which was allocated to the Department of Agriculture between 2005 and 2011. ACIAR supported postgraduate students pursuing Postgraduate Diplomas in Agriculture and Forestry to research topics aligned with in-country ACIAR projects. The ACIAR Scholarship Scheme aimed at strengthening capacity building and training the supervisors was highly successful by graduating five Master’s and 35 postgraduate diploma students.

This initiative demonstrated the value and impact of collaboration between International academic institutions and the National Agricultural Research and Extension system. In addition, Academic Departments such as Agriculture, Surveying and Land Studies pioneered collaboration with industries to fund postgraduate student research. Trukai Industries Ltd – Rice Research Scholarships, which have been funded since 2012, have supported over 13 postgraduate students from the School of Agriculture at PNGUoT (Trukai Industries Ltd., 2024). Additionally, the Agriculture Department partnered with several key organizations, including the National Agricultural Research Institute, Ramu Agri Industries Ltd, the Oil Palm Research Institute, the New Zealand Government-supported Scholarship Program “Women in Agriculture (WAG)”, and the Morobe Provincial Government Scholarships, to support staff and students in their postgraduate studies. The Agriculture Department took full advantage of these available scholarships (Figure 2). It was at the forefront in terms of postgraduate studies and research, thanks to sustained leadership, effective teamwork, and the recruitment and retention of qualified staff from the home-grown postgraduate program. The Department quickly became the role model for other academic departments to

reinvigorate their postgraduate programs and attract students.

4.1 Postgraduate School

At the initial stages, postgraduate programs were delivered through individual academic departments, often with limited centralized coordination. The Postgraduate/Higer Degree Committee of the Academic Board was mandated to administer the postgraduate program through the Registrar's office. By the early 2000s, it became increasingly evident that a more integrated and coordinated approach was needed. During this period, postgraduate education was also recognized as essential for addressing staffing needs within the university and other national institutions. The increasing number of students across the academic departments necessitates the need for a centralized coordinating body to maintain quality and steer postgraduate studies and research programs to achieve their intended objectives. PNGUoT approved the creation of the Postgraduate School in 2006, headed by a Dean.

The appointment of the Dean materialized only in 2013 with the objectives to:

- i. Promote, administer, and oversee the implementation of the postgraduate policy and activities throughout the university.
- ii. Formulate and oversee the implementation of the comprehensive research policy and guidelines to facilitate a vibrant research culture and capacity building to foster research outcomes that would benefit the nation of Papua New Guinea and humanity as a whole.
- iii. Publicize and market the Postgraduate programs and the research strength of PNGUoT to the broader community
- iv. Establish linkages and develop partnership programs within and outside of PNG.

In 2023, the Postgraduate School was renamed as the Faculty of Postgraduate Studies, Research and Innovation, and aligned with the Strategic Plan 2025-2029 for academic excellence and conducting state-of-the-art research leading to innovation and product development. To underscore its importance, Research, Development, and Innovation was designated as one of the four strategic pillars of the 2025–2029 Strategic Plan. In addition, a high-level committee—the Research, Innovation, and Development Team (RIDT)—was established in 2025 under the Postgraduate Studies, Research, and Innovation Committee to spearhead innovation efforts.

4.2 Internationalization

With recent progress in postgraduate programs, PNGUoT started working towards internationalization of her programs to integrate an international, intercultural, or global dimension into the purpose, functions or delivery for global competition for talents, recruitment of international students, students, staff and scholars exchange programs, internationalization of the curriculum, and research and education partnership between institutions regionally and internationally. This, in turn, will provide a competitive advantage in terms of innovation, maintaining a high level of quality, being committed to corporate and social responsibility, and continuing to strive to provide the best education while adapting to different countries and cultures. Through student and staff exchanges, partner universities will benefit from each other's experiences, best practices, and innovative approaches, ultimately building partnerships for collaborative research and supporting partnerships that enhance interpersonal skills and job prospects.

As part of its internationalization efforts, PNGUoT initiated a partnership in 2012 with the Caribbean and Pacific Island Mobility Scheme (CARPIMS), Building University Links for Action (BULA), and the Associate Partners with DREAM-ACP and KITE projects, all funded by the European Union under ERASMUS Mundus. About 29 PNGUoT students and staff benefited under the EU-funded projects, while PNGUoT also hosted 19 staff and students from various Pacific Islands, Caribbean, and African countries. PNGUoT is also a member of the Association of the Commonwealth Universities (ACU) and every year hosts one student under the Queen Elizabeth Commonwealth Scholarship Scheme (QECS). PNGUoT is also the signatory of the Magna Charta Universitatum, and a member of the Pacific Islands Regional Network (PIURN). The university also has ERSAMUS-Plus partnerships with universities in Portugal, Spain, Hungary, and Romania. PNGUoT has bilateral agreements with universities in Australia, New Zealand, India, China, the USA, Fiji, and Tonga. The university has now created the Office of Strategic Internationalization to coordinate and gauge strategic partnerships.

4.3 Postgraduate Student Research Seminar

To showcase the achievements of postgraduate studies and research, the postgraduate student research seminar was introduced in 2011. It has since become an annual event that highlights the postgraduate studies and research capabilities, communication, and presentation skills of the postgraduate students. The seminar aims to promote the development of a research culture at PNGUoT and PNG. Every year, on average, more than 50 postgraduate students present their research on a wide range of vital areas that contribute positively to PNG's society and economic development. University academics, students, staff, and other

stakeholders from the related organizations/institutions attend this annual event. It has become a hallmark event for PNGUoT. Participants and attendees have included representatives from National Agricultural Research Institute, Department of Agriculture and Livestock, University of Natural Resources and Environment, Australian Centre for International Agricultural Research, Department of Foreign Affairs and Trade (Australia), Institute of Medical Research (Papua New Guinea Institute of Medical Research), Fresh Produce Development Agency, PNG Forest Research Institute, and PNG Research, Science and Technology Secretariat, among others.

Figure 2 illustrates a summary of postgraduate graduation trends by school for the years 2001 to 2025, as well as the proportional contribution of each academic unit to the total output of 600 graduates over the period. The School of Agriculture and the School of Communication and Development Studies were the leading performers, with each contributing approximately 25% of the overall postgraduate completions. This reflects their stable enrollment and program offerings over the years. The School of Business Studies contributes 16.2%, and the School of Surveying and Land Studies contributes 10.3%. A closer examination reveals that in the School of Communication and Development Studies, the majority of the graduates (92 out of 150) earned a Postgraduate Certificate in Student Centred Teaching. Only 36 students earned higher degrees, such as the Master of Communication Studies or the Master of Arts in Organizational Leadership. This indicates that shorter skill-based certification programs tremendously pad the number of graduates for that school. The remaining schools, although diverse in their academic disciplines, contributed less than 5% to the overall postgraduate output. These figures reveal a concentration of postgraduate activity within a small group of schools, with others making a minor contribution to postgraduate education during the period under review.

Variation in postgraduate training performance across university departments/schools is well-documented in the literature, particularly in the developing world. Strong academic leadership and institutional infrastructure are crucial for facilitating prompt progress and the completion of postgraduate studies (Lee, 2008). The availability of aptly qualified and research-active supervisors bears a direct correlation with student achievement, as inadequate supervision is a well-documented barrier to the completion of postgraduate studies (McCallin & Nayar, 2012). Research culture of organizing regular seminars, publications, and inter-institutional collaboration generates a lively climate for intellectual debate among researchers and students' motivation (Manathunga, 2005). Fostering adequate infrastructure and providing laboratory equipment, as well as financing, are also required to develop research work, especially in science and engineering domains (Altbach et al., 2009). Programs and research integrated with national development priorities and industry needs attract higher enrolments and external partnerships, resulting in sustainable learning environments (Teferra & Altbach, 2004). Student support structures—namely, well-delineated timelines, progress tracking, and administrative efficiency—are shown to reduce attrition and increase completion rates (Wisker, 2003). Without these conducive conditions, postgraduate training is usually characterized by delays, low enrolments, and extensive dropouts.

5. CURRENT STATUS OF POSTGRADUATE PROGRAMS AT PNGUOT

The Papua New Guinea University of Technology (PNGUoT) boasts a diverse and rich portfolio of postgraduate courses, comprising course-based, research-based, and professional development programs, offered through regular and flexible delivery modes. The Faculty of Postgraduate Studies, Research & Innovation manages approximately 64 programs, including 22 PhDs, 40 Master's degrees, and a couple of postgraduate certificate programs. Some Master's degrees, such as those in Remote Sensing and GIS, are offered via distance learning mode. Research-only options include MPhil and PhD degrees across various fields (e.g., sciences, engineering, humanities, and the built environment). Course-based and executive programmes (e.g., MBA, EMBA) cater to the professional and practical needs of individuals. This mix ensures access, flexibility, and a range of disciplines.

The enrolment statistics for Semester 1 of 2025 are presented in Table 1. The postgraduate student enrollments stood at 214 students, comprising 139 male students (65%) and 75 female students (35%). Among the 192 Master's-level postgraduate students, approximately 128 students (67%) have opted for course-based Master's programs, while the remaining 33% have opted for research-only programs (MPhil). These data exclude enrolments for Semester 2, 2025, online Master's programs, and admissions through nominations. This observation aligns with the findings of Vieno et al. (2022).

Table 1. Enrolment data for Semester 1 of the academic year 2025

Schools	Female			Male			Total
	Course-based programs	MPhil	PhD	Course-based programs	MPhil	PhD	
Agriculture	8	4	2	7	7	5	33
Applied Physics	1		3	4	2		10
Applied Sciences	2	1	1	1	2	1	8
Architecture & Construction Management	9	1		2	2		14
Business Studies	20	3		40	5	2	70
Civil Engineering		3	1	8	2		14
Communication and Development Studies	2			2			4
Electrical and Communication Engineering		2	1		11	3	17
Mathematics and Computer Sciences	8			8	4	3	23
Mechanical Engineering				6			6
Mining Engineering		1			3		4
Surveying and Land Studies		2			9		11
Total	50	17	8	78	47	14	214

Course-based postgraduate programs are more popular than research-based programs due to their structured syllabus, shorter duration, and profession-oriented nature. They impart practical knowledge in coordination with industry standards, making them popular among professionals who do not want to advance without conducting research in academia. They have more structured schedules, broader accessibility, and relatively lower costs, making them appealing to students from diverse backgrounds. On the other hand, research-only degrees require strong research skills, self-motivation, and a higher level of commitment, which may not be suitable for all students. With the heightened global need for job-ready graduates, course-based degrees offer immediate employability and flexibility, making them the preferred choice in most professional and academic settings.

The statistics on postgraduate studies completion in 2025 are presented in Figure 3. A total of 53 students graduated with postgraduate degrees. Of them, 26 students received course-based degrees (49%), thesis-based Master's students comprised 14 students (26.4%), and 10 students (18.9%) obtained postgraduate certificates in Student Centred Teaching. Three students completed their PhD degrees.

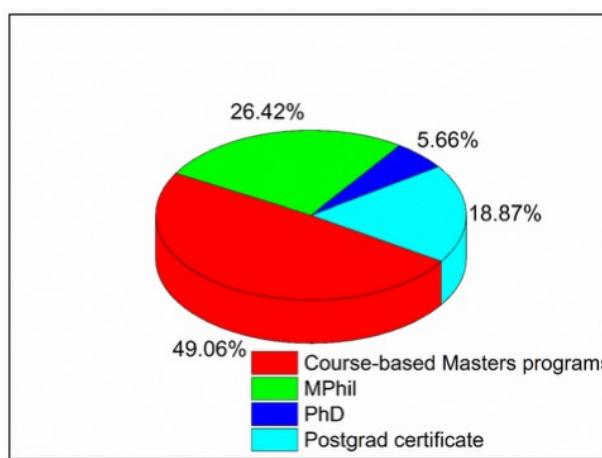


Figure 3. The composition of the postgraduate cohort graduated in 2025.

6. CONTRIBUTIONS TO THE NATIONAL DEVELOPMENT OF PNG

Overall, the PNGUoT postgraduate programs have contributed 28 PhDs, 451 Master's, and 210 Postgraduate Diploma/Postgraduate Certificate graduates between 1976 and 2025. Between 1976 and 2000, only 9 PhD, 21 Master's, and

45 PG Diploma/PG Certificate students graduated. However, during the following 25-year period from 2001 to 2025, the number increased significantly to 19 PhD, 430 Master's degrees, and 165 PGD/PG Certificates. In developed countries such as the USA, important social indicators like individual and household income have been significantly influenced by educational attainment (Wang, 2023). PNGUoT postgraduates and their studies served as a successful conduit for technology transfer to local industries. We conceptualize that their contribution towards national development goals is multifaceted, and they serve as a direct link to industries (Figure 4).

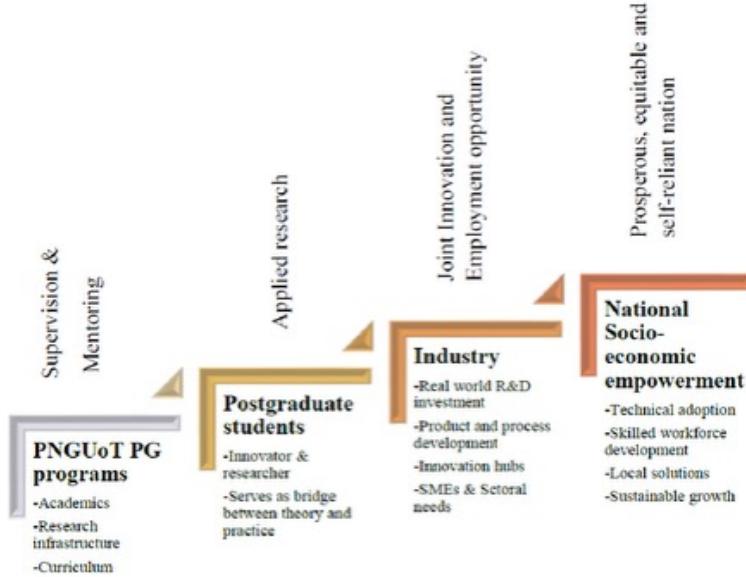


Figure 4. Conceptual framework illustrating contributions of expanding postgraduate programs to national development

During the learning process, students will design innovative prototypes, processes, or systems tailored to the local context. Engineering students can design and develop low-cost, locally accepted machinery suitable for small and medium-sized enterprises (SMEs). In contrast, ICT students may develop custom data systems for logistics firms, agribusinesses, or Government agencies. Environmental science postgraduates might improve renewable energy proposals in rural areas. Such research findings are directly accessible to local industries and funding agencies, reducing dependence on expensive overseas technologies, promoting local innovation, and enhancing efficiency in key economic sectors, including agriculture, manufacturing, logistics, and mining. The scant data available on domestic postgraduate training status within PNG suggest that the total number of postgraduates (Masters and PhDs) trained through research between 2012 and 2016 stands at approximately 526 (Paula et al., 2024). The postgraduate output between 2012 and 2016 from PNGUoT alone was 118, accounting for 22.4% of the nation's postgraduate output.

One of the key strengths of postgraduate research is that it focuses on solving local problems. If students conduct studies that are rooted in the realities of their context, they can gain valuable insights. In that case, the solutions proposed are also likely to be more practical and culturally appropriate than those derived from overseas models. Applied Sciences students can devise solutions to address sanitation or malnourishment in rural communities, agricultural researchers can develop pest-resistant or climate-resilient crops, and social scientists can design models of participatory governance. Such research enhances service delivery, fosters public trust in academia and science, and promotes community resilience. Postgraduates play a crucial role in developing skilled human capital. Beyond their research output, they become lecturers, advisors, policymakers, and innovators in their respective fields. Their presence in universities, government agencies, NGOs, and R&D institutions adds intellectual depth to the nation. With their specialization in critical thinking and orderly approach to problem-solving, they guide policy directions and enhance the quality of national research and development priorities.

Lastly, postgraduate research fosters the inclusive and sustainable development of PNG. Addressing local challenges, creating new economic opportunities, and reinvigorating public and private institutions enables development benefits to extend to marginalized and rural communities. Research on gender inclusion, indigenous knowledge, and community-based programs aligns scholarship with national agendas and the UN Sustainable Development Goals (SDGs), thereby fostering an inclusive and sustainable approach to economic growth.

7. FUTURE OUTLOOK

At PNGUoT, the success of the postgraduate program is directly attributable to three mutually dependent drivers: the Graduate Assistance Program (GAP) scholarship, effective academic and administrative management, and quality supervision (Akanda

et al., 2013). The GAP scholarship is a critical variable in making access feasible and ensuring student retention by funding tuition fees and living allowances. This aid reduces dropout levels, allowing students, particularly those who are disadvantaged, to focus solely on their studies. Of similar importance is the role played by proper program and administrative management. Those schools with clearly established postgraduate policies, timely approval procedures, and integrated progress-monitoring systems are more apt to provide smoother student progression and completion. The third pillar of success is academic supervision. Regular interaction, encouraging feedback, and shared research interests between supervisors and students are critical to academic progress and timely completion. Experienced, research-active supervisors create a successful research environment, and unsatisfactory supervision has consistently been linked to attrition. These findings are consistent with more universal postgraduate success criteria, which focus on scholarship (Altbach et al., 2009), institutional support (Wisker, 2005), and supervisor quality (Lee, 2008; McCallin & Nayar, 2012) as key drivers of postgraduate performance. The Higher Education Loan Program (HELP) introduced by the PNG Government in 2022 is also a step in the right direction to encourage postgraduate studies and ease the financial burden on self-sponsored students.

Further support and promotion of postgraduate education are required within the country. Expanding access to higher education aligns with UNESCO's aim of developing inclusive and equitable quality education to achieve the fourth Sustainable Development Goal of the UN (Li et al., 2024). Promoting postgraduate education plays a crucial role in shaping a country's human resource development, as well as driving scientific and technological innovation—both key to economic growth. In developed countries such as the USA, important social indicators like individual and household income have been significantly influenced by educational attainment (Wang, 2023). Popularization has the potential to attract students from neighbouring countries through various government exchange programs and existing networks. Such transnational popularization and branding will enhance regional stability in all possible spheres—social, financial, trade, and resource sharing.

Table 2 provides an example of the postgraduate enrolments required for Papua New Guinea, benchmarked against OECD standards.

Table 2. Estimates of postgraduates required to match the benchmarks of OECD countries

	Target percentage of the 25-34 age group	OECD benchmark enrolments/y	Modest national targets (10% of benchmark)
Masters	10-15%	175,000–262,500	17,500–26,250
PhD	0.5-1.0%	8,750–17,500	875–1,750
Total	-	183,750–280,000	18,375–28,000

Papua New Guinea's target population for postgraduate education is approximately 1.75 million people, representing the 25–34 age group within a total estimated population of 11 million (United Nations, Department of Economic and Social Affairs, Population Division, 2023). According to OECD benchmark standards, 10–15% of this age group should be enrolled in Master's programs, and 0.5–1% in PhD programs. This translates to approximately 175,000–262,500 Master's enrolments and 8,750–17,500 PhD enrolments annually. Even assuming a more modest target of 10% for Master's and PhD studies, given PNG's current funding constraints, at least 17,500–26,250 Master's and 875–1,750 PhD annual enrolments are required. These figures highlight a significant gap between current enrolments and the scale of postgraduate education capability needed to meet the industrial and developmental aspirations of a modern PNG.

The need for horizontal and vertical expansion of postgraduate programs poses significant challenges to Higher Education Institutions, including PNGUoT. Much of the government's emphasis is on increasing the limited space available at undergraduate programs, and efforts are directed at increasing the number of students. These increases will put additional stress on existing manpower eligible to mentor and advise postgraduate students. Currently, the annual cost of training a STEM Master's student (MSc, MTech, or MEngg) at PNGUoT is PGK 44,150, while the cost for a PhD student on a full scholarship is approximately PGK 54,667. To enrol and train 500 Master's and 50 PhD students in the first year, and gradually scale up to 1,000 Master's students by the second year and 150 PhD students by the third year, PNGUoT would require a total funding outlay of PGK 24.81 million in Year 1, PGK 49.62 million in Year 2, and PGK 52.35 million in Year 3. This level of funding must be sustained in the future.

Research infrastructure and laboratory facilities are central components of quality postgraduate education, particularly for Master's by research and PhD qualifications. They are the foundation for practical training, quality data generation, and innovation, enabling students to conduct proper research and produce original theses. Effective labs influence the quality of supervision, academic honesty, and research productivity, all of which are central to program accreditation and

global competitiveness. In addition, equipped laboratories draw research grants, facilitate industry collaborations, and enable inter-school cooperation. The establishment cost for research labs varies across disciplines, ranging from PGK 500,000 to 1.5 million for mid-level research laboratories and PGK 5 million or more for advanced research facilities. For a university like PNGUoT, anticipating the growth of postgraduate training in at least 5–6 priority disciplines, an initial capital outlay of PGK 13–15 million would be necessary to establish common core laboratories, discipline-specific research facilities, and an ICT/data analytics centre. Planning should also allow for sustainable inputs, such as maintenance, personnel, and security/safety systems.

Scholarships are essential to developing postgraduate programs by enabling equitable access, attracting high-quality candidates, and allowing full-time dedication to study and research. In a context like Papua New Guinea, where many potential postgraduate students are financially disadvantaged, scholarships are necessary if a strong national research capacity is to be developed and skills shortages in key areas are to be addressed (Altbach et al., 2009; Salmi, 2017). Scholarship provision reduces student attrition, increases completion rates, and helps universities recruit talented graduates into academic and research careers. To maintain a thriving scholarship ecosystem, financing can be achieved through a combination of government appropriations, competitive research grants, development partners (such as the Asian Development Bank, Department of Foreign Affairs and Trade (Australia), and the European Union), and institutional programs (World Bank, 2010). The universities also establish endowments or cost-sharing arrangements with industry and public sector organizations needing research-informed solutions. A structured national postgraduate fellowship program, supported by partnerships and aligned with national development priorities, can significantly enhance the capacity and quality of postgraduate education (UNESCO, 2015).

8. CONCLUSIONS

As Papua New Guinea marks 50 years of independence, the Papua New Guinea University of Technology (PNGUoT) stands as a national icon of technical and scientific advancement. Over the decades, PNGUoT's postgraduate programs have significantly contributed to the development of human capital in key sectors such as engineering, agriculture, environmental science, and information technology—critical to realizing the nation's development aspirations.

Despite these achievements, postgraduate education at PNGUoT and other higher education institutions faces persistent challenges, including inadequate funding, limited laboratory facilities, and the absence of a systematic scholarship support framework. Nevertheless, the vision and goals outlined in the Medium-Term Development Plan IV and Vision 2050 call for a substantial scale-up in the training of Master's and PhD graduates to meet the demands of a modern economy, climate resilience, digitalization, and industrialization.

Looking ahead, PNGUoT must position its postgraduate programs as engines of innovation and policy influence, underpinned by strategic investment, robust academic partnerships, and alignment with national development priorities. Bridging the current capacity gap will require a coordinated effort by the government, development partners, industry, and the university to build a sustainable and effective postgraduate training ecosystem—one capable of shaping the next 50 years of nation-building in Papua New Guinea.

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