

Merging for Progress in Higher Education: The Case of NKUST from Taiwan

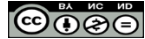
ABSTRACT

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Since the 1960s, mergers in higher education have become increasingly common globally, driven by goals such as enhancing efficiency, improving educational quality, and reducing public expenditure. Australia, the United States, and several European nations have witnessed numerous mergers in the higher education sector. In Taiwan, a significant merger occurred in February 2018 when the National Kaohsiung University of Science and Technology (NKUST) was formed by merging three national universities in Kaohsiung. This merger, initiated by the Ministry of Education under Article 7 of the University Law and approved by the Executive Yuan, marks Taiwan's first case of an involuntary university merger. This study aims to conduct a case analysis of the NKUST merger, with a primary focus on the outcomes for undergraduate education. We first review the merger process, followed by an examination and comparison of institutional data before and after the merger, with a focus on undergraduate student data from 2017 to 2022. The results indicate that, due to the geographical proximity of the three universities, there is a similarity in the student demographics regarding their residential locations and the distribution of their workplaces within five years after graduation. In terms of research capacity and industry-academia collaboration, the integration of the long-term research strengths and resources of the three original institutions introduces heterogeneity, breaking previous similarities and gradually enhancing the research capabilities of the merged university. There has also been a positive growth trend in the number and funding of industry-academia collaboration projects. Overall, this study utilizes historical data to evaluate the potential benefits of the merger for talent development. However, given that NKUST is still in the early stages of its merger, longitudinal research is necessary to gain a more comprehensive understanding of the outcomes of higher education mergers.

Keywords: Mergers, Higher Education, Institutional Research, Enrollment, Admission.

1. Introduction

Over the past four decades, Taiwan's higher education landscape has shown transformative changes, evolving from rapid expansion to confronting new challenges and adapting through significant reforms. This journey began in the 1980s, marked by a substantial increase in the number of higher education institutions, which was highlighted by the establishment of numerous universities and the upgrade of technical colleges into universities of science and technology. Such expansion, driven by the amendment and implementation of the University Law in January 1994, not only enhanced diversity and autonomy within the sector but also led to a considerable rise in the gross enrollment rate, indicating a shift from elite to mass and then to universal education systems (Trow, 1970, 2000). In 1988, the gross enrollment rate surpassed 15%, signifying a shift to a mass education system as classified by Trow (Trow, 1970, 2000). By 1997, the gross enrollment rate had exceeded 50%. Of the 1,601,471 individuals aged 18-21, 807,567 were enrolled in higher education institutions, indicating Taiwan's transition to a stage of universal education.

The peak of this expansion occurred in 2007, when the number of higher education institutions reached a record high of 164. However, this phase of expansion soon encountered demographic and competitive pressures, especially due to Taiwan's declining fertility rate, which has significantly impacted higher education, resulting in the termination of certain departments or even entire universities. Also, the increased international competition in various fields highlighted the need to address issues of resource allocation and the quality of higher education. In response, the Taiwanese government has prioritized quality enhancement in higher education. To support this goal, policies have been introduced to encourage national universities to collaborate and share resources. These initiatives include forming alliances, establishing research centers, and integrating resources through mergers or regional cooperation.

Taiwan's situation described above echoes the global trends, that higher education mergers and alliances have been a common strategy since the 1960s to attain economic advantages and enhance research productivity (Patterson, 2001; Ahmed et al., 2015; Lu et al., 2022). There have been numerous mergers in higher education in Australia, the USA, and several European countries, aimed at achieving greater efficiency, higher quality, and reducing public budgets (Skodvin, 1999). Mergers in higher education play a significant role in reshaping institutional landscapes and have implications for system diversity, academic excellence, and societal relevance (Cai & Yang, 2016; Frølich & Stensaker, 2021). They are seen as strategic tools to enhance efficiency, quality, and relevance within the higher education sector. Mergers can lead to the creation of more academically solid and societally relevant institutions, as well as contribute to organizational redesign and the integration of different institutional cultures. Taiwan also experienced a wave of mergers and reforms in the 2000s. The pivotal moment fell on January 10, 2011, when the Legislative Yuan passed the amendment on Article 7 of the University Law. It stipulated that the Ministry of Education (MOE) might lead and propose merger plans between public universities, and the merger plan approved by the Executive Yuan shall be implemented by such relevant national universities. The amendment would then influence higher education reform in Taiwan. Furthermore, in 2015, the MOE project proposed to the Legislative Yuan that public universities would be prioritized for merger based on two criteria: having fewer than 10,000 students and being located in a municipality with more than two public universities.

This paper focuses on a landmark case in this evolving scenario: the February 2018 merger that formed the National Kaohsiung University of Science and Technology (NKUST) from three national universities. This incident is not only the first case in Taiwan's higher education being initiated involuntarily by the Ministry of Education, but also marks a significant turn in policy and practice. According to Harman (2000), proposed mergers in Australia are often viewed as a threat to the country's unique institutional strengths and traditions. On the other hand, the potential benefits include a larger and more diverse institution, stronger academic programs, increased efficiency and cost savings, as well as improved student services

and infrastructure. Major organizational upheavals and reorganization efforts may occur following the merger. This paper examines the dynamics of higher education institutions (HEIs) mergers using the NKUST merger as a case study. This study aims to explore the broader implications of such transformative moves within Taiwan's distinctive educational landscape, taking into account both the potential benefits and the organizational challenges observed in similar global instances.

This study aims to evaluate the primary functions of universities, which include teaching, research, and service (Slade et al., 2022), through the lens of these three fundamental institutional functions, which serve as key criteria for assessing the success of mergers (Boyer, 2015; Olo et al., 2021). It examines the impact of institutional mergers on these functions, highlighting both the disruptions and the potential positive outcomes, such as the enhancement of academic programs and research capacities (Harman and Harman, 2003, 2008). To address the aim of evaluating the impact of the NKUST university merger on its core undergraduate functions, this study is guided by the following research objectives:

1. To review the context and process of the NKUST merger, with a focus on how the integration of three institutions influenced undergraduate-level governance and strategy.
2. To evaluate changes in teaching performance, using indicators such as enrollment patterns, freshman retention, and graduate employment rates.
3. To assess the evolution of research capacity, particularly in terms of research output, international collaboration, and citation performance.
4. To analyze service-oriented outcomes, including trends in industry-academia collaboration projects and applied research funding.
5. To synthesize the findings across these domains to determine how the merger has supported or challenged NKUST's ability to fulfill its undergraduate education mission.

These objectives are sequenced to build a comprehensive understanding of the merger's impact, starting from institutional transformation to functional outcomes. Given the scope and data availability, this study focuses specifically on the undergraduate level of NKUST. The three pre-merger institutions all had comparable structures and data systems at the undergraduate level, allowing for consistent longitudinal analysis. While NKUST comprises graduate and doctoral programs, the present study does not aim to generalize findings to those levels. Instead, it offers insights into how institutional mergers may impact undergraduate education, which is a critical dimension of university performance and policy in Taiwan. The subsequent sections will delve into the specifics of the NKUST merger, analyzing key metrics and drawing comparisons to understand the broader implications of such organizational changes in the realm of higher education.

2. Research Background and Literature Review

2.1 The Merger Process of NKUST

NKUST is established and merged from three public technical universities in Kaohsiung: the National Kaohsiung University of Applied Sciences (KUAS), the National Kaohsiung First University of Science and Technology (NKFUST), and the National Kaohsiung Marine University (NKMU). The merger plan dated back to 2013, when two universities, NKFUST and NKMU, initiated a merger plan, and KUAS proposed joining in. However, different stakeholders at these universities had varying opinions about the merger. Therefore, in June 2015, the university assembly vetoed joining the merger. After NKFUST and NKMU presented their merger plan to the Executive Yuan for approval in May 2017, KUAS agreed to merge with the other two universities following extensive discussion and consideration. The Executive Yuan supported the merger of the three universities, and two months later, the MOE took an active role in the merger process, in accordance with the University Law, Article 7, section 2. A Merger Initiative

Committee was established, and NKUST was founded in February 2018, with a total of five campuses across Kaohsiung City. It became the largest university of science and technology in Taiwan.

Although the newly established university has been introduced to the public, it still takes time for the academic departments and administrative units from the previous three universities to amalgamate. In June 2018, the General Education Committee and Educational Centers were merged and integrated. The new organizational regulations of NKUST were approved in February 2019, and subsequently, the administrative units were reorganized. As for academic departments, it has transitioned from 10 colleges and 49 departments in 2017 to 11 colleges and 51 departments in 2023. The student population has increased from 27,320 to 28,069 during this period.

2.2 Challenges for HEI mergers

The merger of two or more universities presents significant challenges for all stakeholders, including students, faculty members, administrative staff, alumni, parents, and partner institutions. Although such mergers are often pursued with the intention of enhancing research productivity and institutional effectiveness, they can also result in considerable challenges and unintended consequences, necessitating meticulous management and strategic planning. Extensive studies on university mergers across various countries indicate that the outcomes are not only influenced by the characteristics of the institutions prior to the merger but are also closely tied to broader social, cultural, and educational systems. For instance, Slade et al. (2022) observed that a merger between two disparate institutions can have a significant sociocultural impact on faculty research productivity, with a notable decline, particularly in the fifth year following the merger. The establishment of a unified academic culture following a merger remains a primary challenge for higher education institutions (HEIs) (Ripoll-Soler et al., 2013).

An analysis of both the immediate and long-term effects of HEI mergers on institutional performance offers valuable insights into the challenges faced by merged institutions. Ripoll-Soler et al. (2013) referenced various HEI mergers involving universities and specialized institutions across Europe, revealing variability in institutional effectiveness post-merger. These findings highlight the complexity of factors influencing merger success, including institutional context and post-merger strategies. However, an examination of comparative performance in international academic rankings at different time points generally supports the view that mergers often result in improved standings for world-class universities. Conversely, Frølich and Stensaker (2021) note that mergers can reshape institutional missions and the dynamics of the higher education system. In Norway, for example, universities often merge to enhance social relevance rather than academic excellence, reflecting the country's emphasis on equality and social responsibility. Such mergers present the challenge of balancing academic excellence with societal relevance, as institutions often need to adjust their missions and strategies in response to the merger.

In the context of Asia, Cai and Yang (2016) examined mergers of Chinese higher education institutions, focusing on indices such as economies of scale, academic capacity, and performance enhancement, as well as organizational integration and staff integration. Despite China's unique political culture, the factors affecting merger outcomes are generally consistent with those in other countries, including the composition of the original universities, governance policies, cultural differences, academic goals, and financial issues. This study is particularly insightful as it outlines complex criteria for classifying mergers, which resonate with the situation of NKUST and the three pre-merger universities. For instance, the merger of NKUST, which was conducted under the jurisdiction of Taiwan's Ministry of Education, encountered significant challenges in proposing mutual goals and benefits for members from the three pre-merger schools.

Prior studies collectively highlight that institutional mergers often face challenges, including cultural integration, administrative restructuring, and identity realignment. In the context of NKUST, we focus specifically on how these challenges manifest in undergraduate education through enrollment patterns, student demographics, and academic restructuring, all of which are influenced by pre-merger similarities

in institutional missions and student populations (Cai & Yang, 2016; Slade et al., 2022). One notable example is the challenge of institutional identity: the naming of the post-merger university posed symbolic and practical difficulties, as NKUST adopted an entirely new name rather than building on the legacy of its predecessors (Cai & Yang, 2016). Given that the pursuit of higher academic performance did not drive NKUST's merger, this research provides an opportunity to reconsider the concept of social relevance within the local context and how the existing characteristics of the pre-merger universities have influenced the policies, missions, and identity of the newly merged institution. It also echoes the call for adopting a long-term perspective to gain a comprehensive understanding of institutional trajectories (Fumasoli, Pinheiro & Stensaker, 2015).

2.3 HEI merger success

University mergers are a global trend driven by competitiveness and government policies (Harman, 2000; Cai & Yang, 2016). Though often challenging, mergers can result in larger institutions that excel internationally (Harman, 2000). Success hinges on historical context, economics, power dynamics, and human relations (Eastman & Lang, 2001). However, the impact on curricula is frequently neglected (Jansen, 2003). To better understand mergers, it is essential to consider environmental factors, evaluation criteria, and organizational influences (Cai & Yang, 2016). These insights can guide future merger strategies and research in higher education. While mergers are often seen as a strategy for institutional expansion and efficiency, their long-term success depends on how well they enhance universities' ability to fulfill their core functions.

University mergers are complex processes driven by multiple motives, including increased efficiency and competitiveness (Savović, 2020; Umbach & Mathies, 2023). Success factors include effective leadership, cultural integration, and communication (Savović, 2020; Leslie et al., 2018). However, mergers often face challenges such as employee resistance and cultural conservatism (Savović, 2020). While mergers may not always lead to financial or staffing efficiencies, they can have a positive impact on university rankings (Umbach & Mathies, 2023). The outcomes of mergers can be evaluated through various dimensions, including teaching, research, and service (Leslie et al., 2018; Eastman & Lang, 2001). Successful mergers are more likely to occur between institutions of different sizes or those with complementary strengths (Savović, 2020). To avoid pitfalls, institutions should prioritize the proper integration of systems and cultures, ensuring effective leadership throughout the process (Leslie et al., 2018). Overall, merger success depends on careful planning and execution, taking into account both organizational and human factors. Ultimately, mergers are not just administrative or financial decisions; they redefine universities' roles, making it crucial to evaluate their outcomes through the lens of academic and societal contributions.

The core functions of universities, teaching, research, and service, form the foundation of higher education institutions' missions and contribute to their long-term sustainability (Boyer, 1990; Olo, Correia, & Rego, 2021; Slade et al., 2022). These functions are interconnected, although service remains less clearly defined compared to teaching and research, despite its growing importance in universities' strategic plans (Abukari, 2009). Emerging trends, including global education services, international research collaboration, economic activities, regional development, and leadership training, are reshaping the role of universities (Jacob & Meek, 2013; Qian et al., 2016; De Wit & Altbach, 2021). With the rapid introduction of new technologies and evolving employment landscapes, it has been suggested that universities should shift their focus from merely teaching practical skills (*savoir-faire*) to fostering a way of life (*savoir-vivre*) that prepares students for changing work patterns while also prompting critical reflection on traditional assumptions about employability and the value of a degree (Moscardini et al., 2022). Since mergers fundamentally reshape universities' structures and operations, their success should ultimately be assessed through their influence on these core academic functions.

Synthesizing prior research, the key benefits of successful mergers include enhanced research productivity, expanded academic offerings, and stronger university-industry partnerships (Harman & Harman, 2003; Leslie et al., 2018). In this study, we operationalize these outcomes through indicators such as publication output, collaboration funding, and graduate employment rates, particularly at the undergraduate level, to examine whether these benefits are materializing post-merger at NKUST.

2.4 Constructs for Merger Evaluation

To evaluate the success and impact of university mergers, this study adopts three fundamental institutional functions, teaching, research, and services, as its core evaluative constructs. These functions reflect the traditional missions of higher education institutions and serve as widely accepted benchmarks for institutional performance and development (Boyer, 1990; Olo et al., 2021). Teaching focuses on student enrollment, retention, and post-graduation employability, capturing how well the university meets the educational needs of its students (Tinto, 1993; Hénard & Roseveare, 2012; Slade et al., 2022). Research performance is assessed through outputs such as publications, citations, and international collaborations, reflecting the institution's capacity to generate knowledge and contribute to academic advancement (Altbach & Salmi, 2011). Service, though often less clearly defined, encompasses industry-academia collaboration and societal engagement, highlighting the university's role in applying knowledge to address real-world challenges (Abukari, 2009; Ankrah & AL-Tabbaa, 2015). By grounding the evaluation of the NKUST merger in these three constructs, the study aligns with established frameworks and provides a holistic understanding of institutional transformation.

3. Methodology

This study adopts a single-case study design, focusing on the NKUST as a representative case of an involuntary university merger in Taiwan. A case study approach is suitable for this research due to the complexity, uniqueness, and early-stage nature of the NKUST merger, which allows for an in-depth examination of institutional change over time (Stake, 1995; Yin, 2017). While mergers often lead to organizational disruptions, such as administrative restructuring and cultural integration issues, they can also yield significant benefits, including the consolidation of academic programs, enhanced research capacities, and improved resource allocation (Harman & Harman, 2003; Harman & Harman, 2008; Pinheiro et al., 2016). This study utilizes data from the institutional research database of the case study university, focusing on trends and changes over six years from 2017 to 2022, encompassing teaching, research, and service activities. By adopting a longitudinal approach, it seeks to uncover patterns of adaptation and growth in the aftermath of a merger, providing insights into how universities can strategically align their missions with evolving societal and academic demands (Tight, 2020).

3.1 Research Design

This study aims to evaluate the core functions of universities, which include teaching, research, and service (Boyer, 1990; Slade et al., 2022). It examines the impact of institutional mergers on these functions, highlighting both the disruptions and the potential positive outcomes, such as the enhancement of academic programs and research capacities (Harman and Harman, 2003, 2008). This study draws on secondary data collected at the undergraduate level from NKUST's Institutional Research Office and relevant administrative units. The data cover the period from 2017 to 2022, except for industry-academia collaboration data, which is available starting from 2018. The university administration granted access to these records. All datasets were verified for consistency and completeness before analysis.

The analysis employed descriptive statistics (e.g., mean comparisons, growth rates) and trend analysis to examine changes in key performance indicators before and after the merger. Data were compiled and visualized using Microsoft Excel and IBM SPSS to detect patterns across the six years. Research output

was evaluated using bibliometric indicators, including publication volume, field-weighted citation impact (FWCI), and international co-authorship rates, as obtained from Scopus.

3.1.1 Teaching Performance

To evaluate the performance of teaching functions, this study collects data on three key metrics: the number of new students, freshman retention rates, and the employment status of graduates. These indicators provide valuable insights into a university's effectiveness in attracting, retaining, and preparing students for successful careers.

Enrollment Rate

The enrollment rate is a critical measure of a university's attractiveness and competitiveness. High enrollment rates indicate the institution's ability to meet the diverse needs and expectations of students, including academic programs, campus facilities, and career prospects. According to the OECD (2020), increased enrollment rates often correlate with enhanced institutional reputation and the perceived ability to prepare students for successful futures. Furthermore, robust enrollment figures provide a sustainable revenue stream through tuition, supporting institutional growth and the development of academic and infrastructural resources.

Freshmen Retention Rate

The retention rate, which measures the percentage of students who continue their studies beyond their first year, serves as a vital indicator of student satisfaction, institutional support, and the overall quality of the educational experience. Tinto (1993) emphasizes that strong retention rates reflect the effectiveness of student engagement strategies, such as academic advising, extracurricular activities, and support services. High retention rates also contribute to improved graduation rates, further boosting the university's reputation and standing in global rankings.

Student Employability

The employment rate of graduates is a pivotal indicator of a university's success in preparing students for the workforce. Institutions with high graduate employment rates are more attractive to prospective students and key stakeholders. According to the QS Graduate Employability Rankings (2022), universities that actively facilitate employment opportunities through internships, industry partnerships, and career counseling demonstrate a strong commitment to long-term student success. Additionally, high employment rates enhance a university's reputation on both national and international stages, reinforcing its appeal to future applicants and collaborators.

3.1.2 Research Performance

The performance of research functions is assessed through indicators that measure academic research capability. The performance of research functions is a vital indicator of a university's academic strength, innovation capacity, and global impact. A strong research capacity significantly enhances a university's academic reputation. As noted by Altbach and Salmi (2011), research output and citations are crucial factors in global university rankings, such as the QS World University Rankings and Times Higher Education (THE) rankings. Universities with robust research programs are better positioned to attract top-tier faculty and high-achieving students, further solidifying their status as academic leaders. Assessing this performance involves several key metrics, each of which provides valuable insights into different aspects of research capability and quality.

Number of Publications

The total number of publications reflects the volume of research activity within an institution. A high publication count indicates active engagement in knowledge creation and dissemination across various academic fields. It serves as a foundational metric for evaluating the university's overall research productivity.

Field-Weighted Citation Impact (FWCI)

The FWCI measures the influence and quality of a university's research by comparing its citation rates to global averages within specific disciplines. A high FWCI indicates that the institution's research is frequently cited and influential in advancing knowledge, often exceeding global standards in terms of quality and relevance.

Proportion of Highly Cited Papers

The percentage of highly cited papers is a critical indicator of research excellence. These papers, which represent the top 1% or 10% of most-cited articles globally, demonstrate the university's ability to produce groundbreaking and impactful research that resonates within the academic community.

Proportion of Articles Published in Top-Tier Journals

Publishing in top-tier journals is a hallmark of research quality and prestige. These journals are often highly selective and peer-reviewed, ensuring that only the most rigorous and innovative studies are accepted for publication. A high proportion of publications in such journals reflects the university's commitment to excellence in research.

Proportion of Internationally Co-Authored Papers

The percentage of papers co-authored with international collaborators underscores the institution's global reach and its capacity to establish networks across borders. This metric underscores the importance of interdisciplinary and cross-cultural collaboration in addressing complex global challenges, enhancing both the visibility and impact of the university's research.

These metrics provide a comprehensive evaluation of a university's research performance. They not only quantify productivity and quality but also highlight the institution's global influence, reputation, and capacity to drive innovation. By excelling in these indicators, universities can strengthen their position as leaders in knowledge creation and societal advancement.

3.1.3 Service Performance

The performance of service functions in universities is assessed through the capability of industry-academia collaboration, which is measured by two key indicators: the amount of funding for industry-academic cooperation and the number of industry-academic cooperation projects. These collaborations play a pivotal role in translating cutting-edge academic research into practical innovations and technological advancements within the industry.

Academic Cooperation Funding

The amount of academic cooperation funding is a critical indicator of the financial support and resources dedicated to industry-academia collaborations. This funding enables universities to invest in research

initiatives, infrastructure, and technology transfer processes that directly benefit both academic and industrial sectors. Strong financial backing enhances universities' capacity to conduct high-quality, cutting-edge research and implement innovative projects in collaboration with industry partners. Additionally, it facilitates the commercialization of academic research, enabling universities to translate theoretical knowledge into practical applications that have a tangible impact in the real world. Furthermore, significant funding for cooperation strengthens the university's ability to attract top-tier researchers, foster innovation, and expand its research capabilities.

Number of Industry-Academic Cooperation Projects

The number of industry-academic cooperation projects is another vital indicator of the strength and extent of collaborations between universities and industries. A high number of such projects demonstrates the university's active role in fostering partnerships that bridge the gap between academic knowledge and industrial practice. These projects often involve applied research, internships, co-op programs, and joint ventures that provide students with valuable real-world experience and skills aligned with industry needs. Such collaborations enhance the employability of graduates and improve the university's reputation as a career-oriented institution. Moreover, a high volume of cooperation projects indicates a strong network of industry partners and reflects the university's ability to address global challenges.

University-industry collaborations also enable institutions to address pressing societal issues through applied research. For example, partnerships in fields such as renewable energy, healthcare, and digital transformation contribute to solving global challenges, reinforcing the university's role as a leader in societal progress (Ankrah & AL-Tabbaa, 2015).

4. Results

This study aims to evaluate the fundamental functions of universities—teaching, research, and service (Slade et al., 2022). This section examines how institutional mergers impact these functions, exploring both the challenges they pose and the potential benefits, such as the strengthening of academic programs and the expansion of research capabilities (Harman & Harman, 2003, 2008).

4.1 Teaching Performance

To address research objective 2, which explores how the merger has impacted NKUST's core functions of teaching, we analyzed data to capture shifts in enrollment, retention, and employment outcomes, central to evaluating academic continuity and student success.

4.1.1 Enrollment by Home Location

The analysis of student enrollment by home location at NKUST over the past five years is shown in Figure 1. It reveals distinct geographical patterns, with the majority of students originating from the southern region of Taiwan, particularly Kaohsiung City. This aligns with findings in the literature, which indicate that proximity and regional familiarity significantly influence students' choices of higher education institutions (Chen & Zimitat, 2006). The university's location likely plays a pivotal role in attracting students from nearby areas due to logistical convenience, affordability, and familiarity with the local context.

The steady increase in students from the central region suggests that NKUST is gradually broadening its appeal beyond its immediate geographical area. This trend may be attributed to enhanced marketing strategies, academic reputation, or specific program offerings that resonate with students from central Taiwan. Studies have shown that universities can expand their geographical reach by promoting unique

program features and emphasizing career prospects associated with their academic offerings (Hemsley-Brown & Oplatka, 2015). NKUST's growing appeal to students from the central region could indicate the effectiveness of such strategies.

The decline in enrollment from outlying islands, however, warrants attention. Geographic and socioeconomic challenges, including travel costs and limited access to resources, may contribute to this decline, as highlighted by Deil-Amen & Turley (2007). Addressing these challenges through targeted initiatives, such as transportation subsidies, scholarships, or distance learning opportunities, could help mitigate the barriers faced by students from outlying islands.

Additionally, NKUST's reliance on students from the southern region raises concerns about the diversification of its student body. A more geographically diverse student population can foster cross-regional exchange and enhance the university's academic environment, as suggested by Choudaha (2017). To attract students from northern Taiwan and other regions, NKUST may need to adopt strategic initiatives, such as collaboration with high schools in northern Taiwan, the establishment of satellite campuses, or the offering of programs tailored to the interests of students from those areas.

While NKUST has established a strong regional presence in the southern region, efforts to diversify its student base geographically could enhance its institutional profile and long-term sustainability. Addressing the decline in students from outlying islands and implementing targeted recruitment strategies in northern and central regions could support this goal.

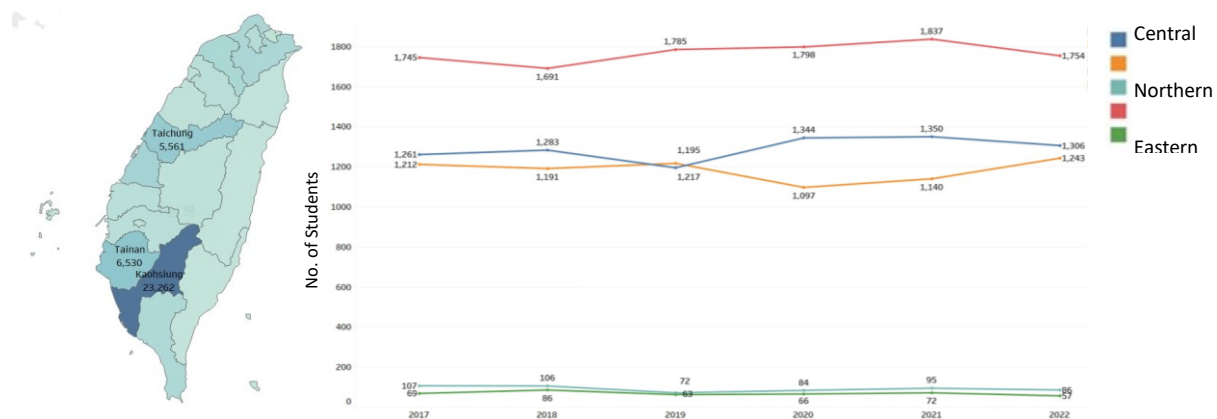


Figure 1. Student Enrollment by Geographical Location in Taiwan

4.1.2 Freshman Retention Rates

The retention rate has become an important indicator for universities over the past five years (Aljahani, 2016; Nieuwoudt & Pedler, 2023). This data not only serves as a key factor in university rankings but also influences high school students' considerations when choosing schools. In the Taiwanese context of higher education, with universities being widely established, almost all high school graduates have access to tertiary education. Consequently, university education has become more accessible to the general population. However, declining birth rates have led many universities to face enrollment challenges.

Table 1. Freshman Retention Rate by Campus

	School Year	2017	2018	2019	2020	2021	2022
Programs	5-Year Junior College	97.06	▲ 99.01	▼ 95.15	▲ 96.72	▼ 96.62	▲ 100.00
	2-Year Technical Program	90.87	▲ 95.48	▼ 91.58	▲ 96.51	▼ 91.67	▼ 80.98
	4-Year Technical Program	96.72	▲ 97.19	▲ 98.47	▼ 97.90	▲ 99.45	▼ 98.56
	Master Program	88.77	▲ 89.89	▲ 90.75	▲ 92.04	▼ 90.00	▼ 84.97
	PhD program	100.00	▼ 93.07	▼ 91.67	▲ 100.00	▼ 94.59	▼ 70.37

Note: Retention rates compared to the previous school year: ▲ incline ■ equal to ▼ decline

The freshmen retention rates at NKUST, as highlighted in Table 1, demonstrate a strong overall average of 93.54%, suggesting a high level of student satisfaction and institutional effectiveness in meeting students' needs. Retention rates serve as an essential metric for evaluating institutional performance, as they reflect not only the quality of academic offerings but also the adequacy of support services provided to students (Tinto, 2012). The higher retention rates observed in 5-year junior colleges and 4-year technical programs suggest that these programs are particularly well-aligned with student expectations and needs, possibly due to targeted academic support and industry-relevant curricula.

However, the decline in retention rates for the other three programs in 2022 warrants further investigation. Studies have shown that retention rates are influenced by a combination of factors, including student engagement, the availability of academic advising, and campus resources (Reason, 2009). A drop in retention rates may signal challenges in these areas or external factors, such as changes in student demographics or economic conditions, that affect their ability to continue their education. Institutions with high retention rates often excel in providing comprehensive support systems, including mentoring, career counseling, and financial aid, which contribute to students' persistence (Kuh et al., 2005).

Retention is also tied to the balance between academic rigor and support. While academic rigor is necessary to maintain program quality and standards, overly stringent requirements without adequate support can lead to higher dropout rates (Astin, 1999). Suppose the decline in retention rates for specific programs at NKUST is linked to academic challenges. In that case, it may be beneficial to review and potentially enhance academic support measures, such as tutoring services, peer mentorship programs, or study skills workshops, to support students better.

Furthermore, tuition fees and the perceived value of education play a critical role in student retention. As noted by Hossler et al. (2009), students are more likely to remain enrolled if they perceive their educational investment to be worthwhile in terms of academic experience, career readiness, and future opportunities. If retention rates are dropping due to concerns about the return on investment, NKUST could consider implementing strategies to increase transparency regarding career outcomes and the value of its programs.

4.1.3 Student Employability

Student employability data were obtained from the student survey after graduation. Alumni are invited to answer the survey 1 year after they graduate. Respondents were asked to report the length of time it took them to find their first job after graduation. Over the past 5 years, up to 95% of alumni reported finding their first job within six months after graduation.

Table 2. Time of Finding the First Job After Graduation

School Year	2017	2018	2019	2020	2021	2022
Found a job before graduation	30.17%	26.29%	34.49%	34.46%	37.05%	33.27%
within 1 month	26.75%	34.80%	26.14%	28.97%	27.93%	23.85%
1-2 months	16.21%	14.47%	16.27%	15.32%	15.56%	16.27%
2-3 months	9.94%	10.09%	8.47%	7.11%	7.76%	10.80%
3-4 months	5.41%	4.18%	3.43%	3.41%	3.03%	4.48%
4-6 months	4.81%	5.98%	4.50%	7.11%	6.00%	6.87%
6 months above	6.74%	4.20%	6.66%	3.60%	5.96%	4.45%
Survey Return Rate	75.98%	93.46%	80.74%	80.80%	61.70%	75.80%

The findings from the alumni survey are presented in Table 2. Notably, 95% of respondents secured their first job within six months of graduation, which is consistent with broader trends observed in graduate employability research. Various studies have shown that the time it takes graduates to find employment is a crucial indicator of the effectiveness of academic programs and their alignment with labor market needs. According to Harvey (2001), early employment outcomes are often linked to the relevance and quality of the education provided, as well as the employability skills imparted to students.

Additionally, the finding aligns with the concept of 'employability capital' (Yorke, 2006), which emphasizes the importance of personal, academic, and professional development throughout a student's academic journey in securing employment in a timely manner. The high percentage of alumni reporting early job acquisition may be reflective of the institution's effective career services and strong industry connections developed during and after the students' studies. It is also important to consider external factors, such as economic conditions, that may influence employment rates for recent graduates.

Moreover, the data from the 1-year post-graduation survey provides insight into the impact of early career experiences on long-term employability. As noted by Tomlinson (2017), the first job is often critical in shaping career trajectories and earning potential. The quick transition into the workforce observed in this study may be indicative of the strong employability preparation within the university's curricula and support systems, which should be further explored through longitudinal studies to understand long-term career development patterns.

4.2 Research Performance - Academic research capability of NKUST

This section addresses research objective 3 by evaluating NKUST's academic research capability through an analysis of its research publications from 2017 to 2022. In particular, the post-merger trends in publication output, citation impact, and international collaboration offer valuable insights into the institution's research performance and the effects of structural changes following the 2018 merger. The results, as presented in Table 3, highlight an initial decline in research performance indicators following the merger, a phenomenon commonly observed during institutional transitions. This decline can be explained by the "institutional shock" theory, which posits that mergers or reorganizations often lead to temporary disruptions in productivity as institutions adjust to new structures and systems (Bower & Doz, 2018).

Interestingly, while there was a drop in most research metrics in 2018, key indicators such as the Field-Weighted Citation Impact and the proportion of international collaboration papers showed resilience. This suggests that the quality of research, especially in terms of global impact and cross-border cooperation, remained strong even during the transition period. According to Aksnes and Sivertsen (2019), international collaborations are a significant driver of high-impact research, and this trend may have helped NKUST maintain visibility and influence in the global academic community despite the merger-induced setbacks.

Furthermore, the steady growth observed in research performance indicators post-merger, particularly the rebound in publication numbers by 2021, is an encouraging sign of recovery and adaptation. This aligns with research on institutional mergers, which often show a period of adaptation followed by eventual growth in output once faculty and resources are fully integrated (Fang, 2014). The continued increase in publications into 2022, despite the slower pace, indicates that NKUST has regained its research momentum, potentially benefiting from the synergies of the merger, such as pooling resources and expertise.

The slight decline in performance within the Top 10% Journal Percentiles by CiteScore in 2022 could be indicative of a longer-term trend where initial improvements in publication quantity eventually require more focused efforts on quality. This could be attributed to shifts in academic priorities or challenges in sustaining the earlier momentum, as noted in studies on post-merger performance (Mårtensson et al., 2014).

NKUST's ongoing revision of "Teacher Research Publication Incentives" reflects a proactive strategy to address this challenge. As suggested by Morrow et al. (2020), faculty incentives play a critical role in driving the quality of academic output, particularly in high-impact journals. By continuously adapting these incentives, NKUST can better align faculty motivations with institutional research goals, ensuring sustained progress in both the quantity and quality of publications.

Table 3. Academic research capability of NKUST

School Year	2017	2018	2019	2020	2021	2022
Numbers of Papers	872	▼ 725	▲ 799	▲ 847	▲ 977	▲ 1034
Field-Weighted Citation Impact	0.71	▲ 0.73	▲ 0.87	▲ 0.96	▲ 1.09	▲ 1.25
Output in Top 10% Citation Percentiles (%)	7.7	▼ 6.3	▲ 8.3	▲ 11.2	▲ 12.6	▲ 13.2
Publications in Top 10% Journal Percentiles by CiteScore percentile (%)	26.6	▼ 21.3	▲ 23.0	▲ 26.7	▲ 28.7	▼ 28.6
International collaboration (%)	18.9	▲ 23.6	▲ 25.5	▲ 30.7	▲ 31.9	▲ 36.5

4.3 Service Performance - Industry-Academia Collaboration capability of NKUST

This section addresses research objective 4 by assessing NKUST's service performance, specifically its industry-academia collaboration capability, through an analysis of trends in collaborative project numbers and funding levels following the merger. Since the merger, NKUST has established the Industry-Academia Operations Office as the primary unit responsible for promoting sustainable development through university-industry collaboration. This office oversees initiatives such as industry-academia cooperation, intellectual property management, industrial incubation, and other related matters.

Additionally, NKUST has created a platform for industry-academia matching and technical cooperation exchange services, maintaining a comprehensive database of faculty expertise and technical research. This resource allows companies to quickly understand NKUST's capabilities and faculty research fields, facilitating product technology upgrades and development. Consequently, it enhances the university's industry-academia research projects, patent transfers, and overall cooperation capacity. This platform also helps match faculty research achievements with industry needs, facilitating commercialization, fostering startups, and forming strategic, sustainable alliances to establish a seamless service chain from research to industry collaboration.





















The data presented in Table 4 on industry-academia collaboration at NKUST from 2018 to 2022 underscores a significant positive trend in both the quantity and funding of collaboration projects. This growth, particularly the 68.5% increase in total collaboration funds from 2018 to 2022, suggests a successful expansion of ties between the university and its industry partners. Several studies on industry-academia collaboration provide context to this trend, highlighting the growing recognition of the mutual benefits such collaborations offer.

According to Perkmann et al. (2013), collaboration between universities and industries has become a critical strategy for fostering innovation and enhancing knowledge transfer. The increase in collaboration cases and funds at NKUST is consistent with the broader global shift toward closer academic-industrial partnerships, which are often seen as a mechanism for translating academic research into real-world applications. The financial growth observed may be reflective of the university's growing reputation and capacity to secure funding for collaborative projects, which aligns with studies showing a positive correlation between university research output and industry partnerships (Crespi et al., 2015).

The increasing number of participating teachers and the higher average collaboration amounts per teacher further reinforce the institutional commitment to fostering research with practical industrial relevance. The growing involvement of faculty members in these collaborations is likely a result of institutional policies and incentives designed to encourage academic-industry engagement. As suggested by Sykes et al. (2015), faculty participation in industry-academia partnerships is crucial to the success of these collaborations, often leading to enhanced academic productivity and innovation outcomes.

The integration of industry-academia resources post-merger also highlights the importance of organizational restructuring in enhancing research partnerships. Mergers in higher education institutions are often associated with the pooling of resources and expertise, which can lead to greater capacity for securing industry funding and expanding the scope of collaborations (Harrison & Wicks, 2019). The significant increase in collaboration funds post-merger at NKUST could, therefore, be seen as an outcome of the strategic advantages gained through the merger, such as increased research visibility and a broader network of industry contacts.

Table 4. Industry-Academia Collaboration Capability of NKUST

Year	2018	2019	2020	2021	2022
Industry-Academia Collaboration Projects	633 	623 	701 	714 	672
Industry-Academia Collaboration Amount (NTD)	726,667,430 	826,006,282 	955,600,559 	1,393,928,926 	1,185,033,006
Number of Teachers Involved in Industry-Academia Collaboration	266 	251 	263 	252 	232
Average Number of Projects per Teacher	2.4 	2.5 	2.7 	2.8 	2.9
Average Amount per Teacher (NTD)	2,731,832 	3,290,862 	3,633,462 	5,531,464 	5,107,901

5. Discussion

This study evaluated the impact of Taiwan's first involuntary university merger by analyzing primarily undergraduate-level trends in teaching, research, and service at the NKUST. The results reveal that while the merger preserved continuity in student demographics—largely concentrated in southern Taiwan—it also introduced new challenges in enrollment strategies, academic restructuring, and long-term institutional positioning.

Skodvin (1999) emphasizes that geographical proximity is a critical factor in the success of university mergers, as demonstrated by international case studies. Consistent with this observation, NKUST's campuses continue to attract a majority of students from southern Taiwan, maintaining a similar demographic composition. However, this overlap in student sources has created challenges in admissions and recruitment strategies.

In 2018, the first full academic year following the merger, no significant changes were made to the colleges or academic departments, and student demographics remained stable. By 2019, restructuring efforts within colleges and departments led to a noticeable decline in the minimum required entrance exam scores for referral admissions. This trend could potentially impact the university's ranking and reputation, emphasizing the need for strategic planning in academic and enrollment policies.

Institutional mergers often promise long-term benefits, such as increased resources and competitiveness, but they require time for stabilization. Harman, Beswick, and Schofield (1985) found that Australian university mergers typically take between one and five years to integrate fully. Similarly, NKUST's merger is still in its early stages, making it premature to assess its ultimate success. The current study provides only a preliminary comparison of student enrollment data before and shortly after the merger, necessitating further longitudinal analysis to provide a more comprehensive understanding.

In response to Research Objective 5, which explores the implications of the merger for future policy and practice, the findings suggest that while initial disruptions are inevitable, a phased approach to integration supported by stable governance, inclusive faculty engagement, and continuous monitoring is crucial for long-term merger success. The case of NKUST offers insights into both the risks and opportunities that accompany large-scale institutional consolidation in higher education, particularly when such initiatives are driven by government policy rather than voluntary cooperation.

The literature suggests that voluntary mergers tend to yield better outcomes compared to those imposed from above (Skodvin, 1999). While the merger discussions among the three Taiwanese universities involved some level of deliberation, the final decision was imposed top-down by the Ministry of Education (MOE). This marks Taiwan's first involuntary university merger, further complicated by a short preparation period. This unique context presents additional challenges in achieving smooth integration and long-term success.

Internationalization in higher education is inherently complex, shaped by a combination of political, economic, socio-cultural, and academic factors. Although this article does not deeply explore the relationship between university rankings and internationalization, it highlights the critical role of faculty in advancing this agenda. Faculty are particularly important in implementing English-Medium Instruction (EMI) policies, which have a direct impact on educational outcomes (Macaro et al., 2018).

Countries such as Japan and South Korea have expanded EMI offerings and actively attracted international students, shifting from unidirectional student outflows to bidirectional mobility (Csizmazia, 2019; Yonezawa, 2020). In contrast, Taiwan faces challenges including a shortage of EMI-qualified faculty and high turnover rates, which add strain to administrative systems (Galloway et al., 2020). Key issues include insufficient support for faculty teaching EMI courses and instability in faculty composition, leading to limited progress in this area.

5.1 Limitations and recommendations for future research

Several limitations must be acknowledged. First, the study relies primarily on secondary data from internal databases, which may not fully capture qualitative aspects such as staff morale, cultural integration, or inter-campus collaboration. Second, the absence of a control institution limits external comparison. Third, the time frame (2017–2022) provides only short- to medium-term insights, making it premature to conclude long-term outcomes. Furthermore, the study focuses primarily on undergraduate-level data, which may not represent the full spectrum of institutional change affecting graduate education, continuing education, or internationalization efforts.

Given that NKUST is in the early stages of its merger, more comprehensive data collection is essential to evaluate its impact across academic, administrative, and student-related dimensions. A longitudinal study tracking the merger's progress over an extended period would provide valuable insights into the key factors influencing the success or failure of higher education mergers. Such an approach would contribute to a deeper understanding of merger dynamics and offer lessons for similar initiatives in the future.

To build on this preliminary analysis, future studies should incorporate longitudinal data beyond 2022 and include multi-level qualitative assessments involving faculty, staff, and students. Mixed-method approaches would be particularly valuable in capturing the lived experiences and organizational culture shifts post-

merger. Further research should also explore the effects of top-down policy design on institutional autonomy and innovation in merged universities. Lastly, comparative studies across regions or systems with different governance models (e.g., voluntary vs. mandated mergers) would offer broader insights into the conditions for successful integration.

5.2 Conclusion

From a teaching perspective, early indicators show a temporary decline in admissions thresholds and enrollment competitiveness following departmental restructuring in 2019. This highlights the importance of proactive academic planning and quality assurance during transition periods. On the research front, the merger has led to a gradual increase in publication output and international collaboration, indicating a consolidation of research capacity. Following the merger, NKUST established the Industry-Academia Operations Office, laying a structural foundation for strengthening external engagement and sustainability through industry partnerships. This case illustrates that institutional mergers in higher education must strike a balance between structural efficiency, academic integrity, and regional relevance. Strategic communication, faculty development (especially in EMI readiness), and student support are essential components of a successful transition. Additionally, merger outcomes should be evaluated not solely by output metrics, but also by institutional identity, cohesion, and stakeholder alignment.

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