Bridging Policy and Practice: Reassessing the Economic Role of Higher Education Institutions in Terengganu's Development Trajectory

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ABSTRACT

This study investigates the influence of higher education policies on regional economic development in Terengganu, Malaysia, emphasizing how universities serve as catalysts for innovation, human capital, and industry collaboration. Despite substantial investment in institutions like University Malaysia Terengganu (UMT), University Sultan Zainal Abidin (UniSZA), and University Technology MARA (UiTM) Terengganu, the region continues to experience a disconnect between academic outputs and economic impact. Employing a qualitative case study method, the research draws on interviews with policymakers, academics, and industry representatives to assess structural barriers such as limited research commercialization, skills mismatches, and underfunded innovation systems. The theoretical framing draws from Human Capital Theory and the Triple Helix Model to analyse how education, government, and industry interact within Terengganu's socio-economic context. Findings highlight the urgent need for place-based funding, curriculum-industry alignment, and intermediary institutions to bridge gaps in collaboration and implementation. The research concludes with policy recommendations for enhancing the role of universities in driving inclusive, sustainable growth in peripheral regions. This study offers transferable insights for regions facing similar developmental constraints, reinforcing the strategic importance of localized higher education reforms in national economic agendas.

Keywords: Higher Education Policy, Regional Economic Development, University-Industry Collaboration, Human Capital Theory, Innovation Ecosystem

INTRODUCTION

Higher education is widely recognized as a key driver of economic development, particularly in knowledge-based economies where innovation and skilled human capital are critical for growth (Valero & Van Reenen, 2019). In Malaysia, the government has strategically prioritized higher education as a catalyst for regional development, particularly through policies such as the Malaysia Education Blueprint (Higher Education) 2015-2025, which emphasizes research excellence, innovation, and stronger industry-academia linkages (Ministry of Higher Education [MoHE], 2015). Terengganu, a state on Malaysia's East Coast, has historically relied on traditional industries such as oil and gas, fisheries, and tourism. However, in recent years, there has been a concerted effort to diversify the economy by strengthening higher education institutions (HEIs) as engines of innovation and human capital development.

The state is home to several key universities, including University Malaysia Terengganu (UMT), which specializes in marine science and environmental studies, and University Sultan Zainal Abidin (UniSZA), which focuses on Islamic studies, medicine, and sustainability. Additionally, University Technology MARA (UiTM) Terengganu plays a crucial role in vocational and technical education, offering industry-aligned programs in fields such as engineering, business, and information technology (UiTM, 2022). These institutions have contributed to local development through research, community engagement, and workforce training. However, despite these investments, the extent to which they translate into measurable economic benefits, such as increased employment, entrepreneurship, and regional innovation, remains underexplored.

This study investigates the relationship between higher education policies and economic development in Terengganu, with a particular focus on how universities foster innovation, research commercialization, and industry collaboration. While previous studies have examined the role of HEIs in urban centres like Kuala Lumpur and Penang (Rasiah et al., 2016), fewer have explored their impact in East Coast states, where economic disparities persist. By analysing qualitative data from policymakers, university administrators, and industry leaders, this research seeks to provide actionable insights into how higher education can be optimized to support sustainable economic progress in Terengganu. The findings will contribute to ongoing policy discussions on aligning academic programs with labour market needs, enhancing research commercialization, and strengthening public-private partnerships in the region.

BACKGROUND TO THE RESEARCH

Terengganu, a coastal state in northeastern Malaysia, has long been dependent on traditional economic sectors such as oil and gas, fisheries, and tourism, which collectively contribute significantly to its GDP and employment (Department of Statistics Malaysia [DOSM], 2023). However, the volatility of global oil prices and the increasing pressure on marine resources due to climate change have exposed the vulnerabilities of this economic model (Abdullah et al., 2020). Recognizing these challenges, both state and federal governments have initiated efforts to transition toward a more diversified, knowledge-driven economy. A key strategy in this shift has been the strategic development of higher education institutions (HEIs) as hubs for innovation, skilled workforce development, and industry-relevant research.

In recent years, Terengganu has seen substantial investments in its higher education sector, with universities playing a pivotal role in shaping the state's economic trajectory. University Malaysia Terengganu (UMT), with its strong focus on marine science, aquaculture, and environmental sustainability, has positioned itself as a leader in research that directly supports the state's blue economy (UMT, 2021). Similarly, University Sultan Zainal Abidin (UniSZA) has carved a niche in Islamic finance, healthcare, and sustainable development, aligning its academic programs with Malaysia's broader aspirations to become a global Islamic finance hub (UniSZA, 2022). Meanwhile, University Technology MARA (UiTM) Terengganu, a branch of Malaysia's largest public university, contributes significantly through its emphasis on technical and vocational education, particularly in engineering, business management, and digital technologies, fields critical for modernizing local industries (UiTM Terengganu, 2023).

Despite these advancements, there remains a gap between academic research and its practical application in Terengganu's economy. While universities produce a steady stream of graduates and research outputs, the commercialization of these innovations and their integration into local industries have been inconsistent (Ismail et al., 2019). For instance, despite UMT's breakthroughs in sustainable fisheries, many local fishing communities still rely on traditional methods, highlighting a disconnect between academic research and grassroots economic practices. Similarly, while UiTM Terengganu produces highly skilled technical graduates, some industries report difficulties in finding workers with the precise competencies needed, suggesting a misalignment between education and labour market demands (MoHE, 2022).

This research seeks to explore these challenges in depth, examining how higher education policies can be refined to ensure that universities not only generate knowledge but also actively contribute to Terengganu's economic transformation. By analysing the current role of HEIs in regional development, this study aims to identify best practices and policy adjustments that could enhance the economic impact of higher education in the state.

PROBLEM STATEMENT

Despite significant investments in higher education institutions (HEIs) across Terengganu, there remains a critical disconnect between academic initiatives and tangible economic outcomes. While universities such as University Malaysia Terengganu (UMT), University Sultan Zainal Abidin (UniSZA), and University Technology MARA (UiTM) Terengganu have expanded their research capabilities and academic offerings, their contributions to the state's economic development have not been systematically measured or optimized. This gap in understanding presents several pressing challenges that hinder Terengganu's transition to a knowledge-based economy.

First, there exists a persistent research-industry gap, where valuable academic research fails to translate into commercial applications or policy solutions. Studies indicate that less than 30% of university research in Malaysia's East Coast region leads to patents, startups, or industry partnerships (Ismail et al., 2019). For instance, UMT's innovations in marine biotechnology—though academically promising—have seen limited adoption by local fisheries and aquaculture businesses due to weak technology transfer mechanisms (Hassan & Rahman, 2021). This underutilization of research represents a missed opportunity for economic diversification, particularly in sectors where Terengganu holds competitive advantages.

Second, a concerning skill mismatch persists between graduate competencies and labor market needs. While Terengganu's universities produce thousands of graduates annually, industry surveys reveal that nearly 40% of employers struggle to find candidates with job-ready technical and soft skills (Ministry of Higher Education [MoHE], 2020). This mismatch is particularly evident in growing sectors like renewable energy and digital commerce, where curricula have been slow to adapt to technological changes. The consequences are stark: graduate underemployment rates in Terengganu remain higher than the national average at 15.2% (Department of Statistics Malaysia [DOSM], 2023), suggesting that education policies require stronger alignment with evolving industry demands.

Third, funding constraints continue to limit the potential of HEIs to drive innovation. Compared to universities in Malaysia's more developed western states, Terengganu's institutions receive disproportionately lower research grants and private sector investments (Tan & Lee, 2022). This funding disparity affects infrastructure quality, faculty retention, and the ability to scale promising research—creating a cycle where under-resourced universities struggle to demonstrate their economic value, thereby receiving even fewer resources.

These interconnected challenges underscore an urgent need to reevaluate how higher education policies can better serve Terengganu's development goals. This study seeks to address these gaps by investigating: (1) structural barriers to research commercialization, (2) systemic causes of the skills mismatch, and (3) innovative funding models that could unlock universities' economic potential. By doing so, it aims to provide policymakers with evidence-based strategies to transform HEIs from degree-granting institutions into true engines of regional growth.

LITERATURE REVIEW

The Role of Higher Education in Economic Development

The relationship between higher education and economic development has been extensively studied, with a strong consensus emerging about the transformative potential of universities in driving sustainable growth. At the heart of this relationship lies the concept of human capital development, first articulated by Schultz (1961) and later expanded by Becker (1964), which posits that investments in education yield significant returns by enhancing workforce productivity. In the context of Terengganu, this theory is particularly relevant as the state transitions from resource-based industries to knowledge-intensive sectors. Studies have shown that regions with higher concentrations of university graduates experience faster productivity growth—by as much as 0.5% annually in developing economies (Bloom et al., 2014). However, the effectiveness of this human capital pipeline depends crucially on the alignment between academic programs and labor market needs, an area where Terengganu faces ongoing challenges (MoHE, 2022).

Beyond workforce development, universities serve as critical hubs for research and innovation. The Triple Helix Model (Etzkowitz & Leydesdorff, 2000) provides a compelling framework for understanding how universities interact with industry and government to stimulate knowledge-based economies. In successful cases, such as Silicon Valley and Cambridge's biotechnology cluster, university research has led to breakthrough innovations, patents, and spin-off companies that create high-value jobs (Mowery & Sampat, 2005). In Terengganu, while institutions like UMT have demonstrated strong research capabilities, particularly in marine science and renewable energy, the commercialization rate remains low. Data suggests that less than 15% of university patents in East Coast Malaysia reach market implementation, compared to 35% in the Klang Valley (Rasiah et al., 2020). This disparity highlights untapped potential for Terengganu's universities to contribute more substantially to the state's economic diversification.

Universities also play a pivotal role in regional development through their "anchor institution" function. As Chatterton and Goddard (2000) demonstrate, higher education institutions stimulate local economies not only through direct employment (accounting for 5-7% of regional employment in many cases) but also by attracting ancillary businesses, improving infrastructure, and enhancing quality of life. In Terengganu, the presence of UMT, UniSZA, and UiTM has catalysed development in surrounding areas—for example, the growth of technology parks near UMT's campus (Terengganu State Economic Planning Unit, 2021). However, these benefits have been geographically uneven, with rural districts receiving fewer spillover effects. This suggests a need for more deliberate policies to ensure that university-driven development reaches all parts of the state.

The literature thus presents both opportunities and challenges for Terengganu. While the theoretical benefits of higher education are well-established, their realization depends on addressing specific contextual barriers—particularly in research commercialization, industry collaboration, and equitable regional development. The following sections will examine how these dynamics play out in Terengganu's unique socioeconomic landscape.

Higher Education Policies in Malaysia

Malaysia's higher education policies have undergone significant transformation since the early 2000s, shaped by the nation's aspiration to become a global education hub and a knowledge-based economy. The *National Higher Education Strategic Plan 2020* and subsequent Malaysia Education Blueprint (Higher Education) 2015-2025 outline a comprehensive framework focused on three key pillars: internationalization, research excellence, and industry-academia collaboration (Ministry of Higher Education [MoHE], 2015). These policies have driven substantial reforms, including the establishment of research universities, the introduction of the Malaysian Qualifications Framework (MQF), and incentives for private sector engagement in research and development (Azman et al., 2014).

Internationalization efforts, for instance, have positioned Malaysia as one of the top destinations for global higher education, with over 170,000 international students enrolled in 2022 (MoHE, 2023). Programs such as the APEX (Accelerated Program for Excellence) University initiative have elevated institutions like Universiti Sains Malaysia (USM) to world-class status, enhancing their research output and global rankings. However, this success has been unevenly distributed. While universities in the Klang Valley, such as Universiti Malaya (UM) and Universiti Kebangsaan Malaysia (UKM), have flourished under these policies, institutions in East Coast states like Terengganu face persistent challenges in attracting international students and faculty, partly due to infrastructure limitations and fewer industry linkages (Rasiah et al., 2016).

Research commercialization remains another area of disparity. The Research University (RU) Grant Scheme, introduced in 2007, has significantly boosted patent filings and spin-off companies from leading institutions. For example, University Putra Malaysia (UPM) and University Technology Malaysia (UTM) collectively accounted for over 60% of Malaysia's university patents in 2022 (National Patent Office, 2023). In contrast, Terengganu's universities, despite their niche strengths in marine science and Islamic finance, have struggled to translate research into marketable innovations. Data indicate that only 12% of research projects at University Malaysia Terengganu (UMT) result in commercial applications, compared to 34% at UM (MoHE, 2023). This gap reflects not only funding disparities but also weaker industry networks in the East Coast region, where private sector R&D investment is significantly lower than in the Klang Valley (Economic Planning Unit [EPU], 2022).

Industry partnerships, a cornerstone of Malaysia's higher education policy, have also faced implementation

challenges outside major urban centers. The MyBrain15 and Industrial PhD programs, designed to foster collaboration between universities and corporations, have seen limited uptake in Terengganu due to the predominance of small and medium enterprises (SMEs) with limited capacity for research absorption (Ismail & Ahmad, 2020). While initiatives like the East Coast Economic Region (ECER) Development Council aim to bridge this gap by promoting technical and vocational education (TVET) through institutions like UiTM Terengganu, progress has been slow. A 2022 survey found that only 28% of Terengganu-based firms actively collaborate with local universities, compared to 52% in Selangor (Malaysian Industry-Government Group for High Technology [MIGHT], 2022).

These disparities highlight a critical tension in Malaysia's higher education policy: while the national framework is well-designed, its benefits are concentrated in developed regions, exacerbating the economic divide between states. For Terengganu, this means that despite having universities with unique specializations, the full potential of higher education as a driver of economic development remains unrealized. Addressing these gaps requires targeted interventions, such as decentralized funding models, regional innovation clusters, and incentives for industry collaboration in non-urban areas—measures that could help align national ambitions with local realities.

THEORETICAL FRAMEWORK

This study is anchored in two complementary theoretical frameworks that together provide a robust lens for analyzing the relationship between higher education and economic development in Terengganu. The first, Human Capital Theory (Becker, 1964), posits that investments in education and training enhance individual productivity, which in turn drives macroeconomic growth. Becker's foundational work demonstrated that the knowledge and skills acquired through higher education translate into greater workforce efficiency, innovation capacity, and earning potential, factors that collectively contribute to regional economic advancement (Becker, 1993). In the context of Terengganu, this theory helps explain how universities like UMT, UniSZA, and UiTM Terengganu function as engines of human capital formation. However, the theory also raises critical questions about the quality and relevance of this human capital: while Terengganu's universities produce a steady stream of graduates, persistent underemployment (DOSM, 2023) suggests that not all educational investments are yielding optimal economic returns. This disconnect underscores the need to examine how curriculum design, industry partnerships, and labor market signals can better align educational outputs with the state's developmental needs.

The second framework, the Triple Helix Model (Etzkowitz & Leydesdorff, 2000), offers a structural perspective on how universities interact with other key actors in the innovation ecosystem. This model identifies three institutional spheres, universities, industries, and government, that must dynamically intersect to foster knowledge-based development. Unlike linear models of innovation, the Triple Helix emphasizes the hybrid roles these actors play: universities become entrepreneurial by commercializing research, industries engage in knowledge production through R&D, and governments act as venture capitalists by funding high-risk innovation (Etzkowitz, 2008). Applied to Terengganu, this model helps diagnose why some higher education initiatives succeed while others falter. For example, UMT's Ocean Thermal Energy Conversion (OTEC) project, a collaboration with the state government and Petronas, demonstrates successful Triple Helix alignment, having attracted RM50 million in investment and created high-skilled jobs (Terengganu State Government, 2022). Conversely, the limited commercialization of UniSZA's Islamic finance research highlights systemic barriers in the university-industry-government interface, including weak technology transfer offices and misaligned incentive structures (Ismail et al., 2021).

Together, these theories provide a multi-dimensional understanding of higher education's economic role. Human Capital Theory illuminates the micro-level relationship between education and productivity, while the Triple Helix Model reveals the macro-level institutional arrangements necessary to convert knowledge into growth. This dual perspective is particularly valuable for Terengganu, where economic transformation requires both high-quality human capital and effective innovation systems. The frameworks also suggest policy entry points: Human Capital Theory directs attention to curriculum reforms and lifelong learning initiatives, whereas the Triple Helix Model emphasizes the need for intermediary organizations (e.g., technology parks, innovation hubs) to bridge institutional gaps. By applying these theories in tandem, this study can generate nuanced recommendations for optimizing Terengganu's higher education policies in service of inclusive, sustainable

development.

CONCEPTUAL FRAMEWORK

Building upon the theoretical foundations of Human Capital Theory and the Triple Helix Model, this study develops a conceptual framework that systematically maps the relationship between higher education inputs and economic outcomes in Terengganu. At its core, the framework identifies three key independent variables that drive university contributions to development: (1) higher education policies (e.g., governance structures, internationalization strategies, quality assurance mechanisms), (2) research funding (including government grants, industry investments, and international partnerships), and (3) industry collaboration (encompassing joint research projects, curriculum co-design, and workforce training programs). These inputs shape institutional activities, represented as mediating variables, where universities engage in research (basic /applied), teaching (degree programs/ continuing education), and innovation (patents, spin-offs, social entrepreneurship).

The dependent variables, the ultimate economic outcomes, are operationalized through measurable indicators: economic growth (GDP contribution, sectoral value-added), employment rates (graduate employability, job creation in knowledge-intensive sectors), and innovation output (patents filed, startups launched, productivity improvements in local firms). Crucially, this relationship is not linear but iterative, as economic gains can feedback into policy improvements and increased funding, a dynamic represented by bidirectional arrows in the schematic diagram below.

This framework incorporates contextual factors unique to Terengganu, such as the marine economy's dominance (which shapes research priorities at UMT) and the Islamic governance context (influencing UniSZA's curriculum design). It also accounts for moderating variables like digital infrastructure quality and English proficiency levels, which can amplify or constrain the translation of academic activities into economic impacts (World Bank, 2022). For instance, while UiTM Terengganu's engineering programs have strong industry advisory panels—a positive policy feature—limited broadband connectivity in rural areas hampers graduates' ability to contribute to Industry 4.0 initiatives (MCMC, 2023).

The framework's value lies in its diagnostic power: by tracing how specific policy interventions (e.g., increasing research commercialization grants by 20%) might propagate through university activities to affect economic indicators, it enables targeted policy experimentation. It also highlights often-overlooked feedback mechanisms—for example, how rising employment in tech sectors might subsequently increase industry demand for university partnerships, creating a virtuous cycle. This systems perspective is particularly valuable for Terengganu, where resource constraints necessitate precise targeting of higher education investments for maximum developmental impact.

RESEARCH QUESTIONS AND OBJECTIVES

This study is guided by three interrelated research questions designed to systematically investigate the nexus between higher education and economic development in Terengganu.

The first question, How do higher education policies in Terengganu influence economic development?, examines the causal mechanisms linking policy interventions to tangible outcomes, such as GDP growth and employment rates. By analyzing policies like the Terengganu Education Development Masterplan 2021-2030 (Terengganu State Government, 2021), the study seeks to identify which strategies (e.g., research grants, curriculum reforms) yield the highest socioeconomic returns.

The second question, What are the barriers to effective university-industry collaboration?, delves into persistent challenges hindering knowledge transfer between Terengganu's universities and local enterprises. Preliminary studies suggest mismatched incentives, weak commercialization support, and limited industry R&D capacity as key obstacles (Ismail et al., 2021). This investigation will prioritize voices from both academia and industry to uncover actionable solutions.

Finally, the third question, How can HEIs enhance their contribution to regional growth?, shifts focus to policy

prescriptions. Drawing on international best practices (e.g., Finland's regional innovation ecosystems) and local success cases (e.g., UMT's aquaculture partnerships), the study will propose context-specific strategies to amplify universities' economic impact (OECD, 2022).

Aligned with these questions, the research pursues three objectives:

1. Impact analysis of higher education policies using both qualitative (policy documents, stakeholder interviews) and quantitative (economic indicators) data.

2. Partnership assessment through case studies of university-industry collaborations, evaluating their outputs (e.g., patents, workforce upskilling).

3. Policy optimization via evidence-based recommendations tailored to Terengganu's unique industrial landscape and institutional capabilities.

Together, these questions and objectives bridge theoretical frameworks with practical policymaking, ensuring findings are both academically rigorous and operationally relevant for Terengganu's development planners.

JUSTIFICATION FOR THE RESEARCH

This study addresses a pressing need in both academic and policy circles by systematically examining how higher education institutions (HEIs) contribute to economic development in Terengganu, a region often overlooked in Malaysia's national development narrative. While extensive research exists on the role of universities in urban centers like Kuala Lumpur and Penang (Rasiah et al., 2020), East Coast states face unique challenges that remain understudied, including weaker industry linkages, infrastructure gaps, and distinct socioeconomic priorities tied to their marine and Islamic economies.

The research holds immediate practical value for multiple stakeholders:

- Policymakers at both state and federal levels will gain evidence to refine funding allocations, such as prioritizing research areas with high commercialization potential in Terengganu's niche sectors (e.g., halal biotechnology, sustainable fisheries).

- University leaders can utilize findings to strengthen community engagement strategies, as demonstrated by UiTM Terengganu's successful coastal entrepreneurship programs (Yusoff et al., 2022).

- Industry partners, particularly small and medium enterprises (SMEs), will benefit from clearer pathways to tap into university resources, addressing a critical need identified in the *12th Malaysia Plan* (EPU, 2021) for East Coast industrial upgrading.

Academically, the study enriches the literature on regional development by testing how global frameworks like the Triple Helix Model apply in resource-dependent, non-urban contexts. Its mixed-methods approach, combining policy analysis, economic data, and stakeholder perspectives, offers a replicable model for studying periphery regions globally. With Terengganu serving as a microcosm of challenges faced by many developing territories, the insights generated will resonate beyond Malaysia's borders.

RESEARCH METHODOLOGY

Research Design

This study adopts a qualitative case study approach, a methodological choice particularly suited for investigating complex, real-world phenomena within their natural contexts (Yin, 2018). By focusing on Terengganu as a bounded system, the research captures the nuanced interplay between higher education policies and economic development, allowing for an in-depth exploration of how stakeholders experience, interpret, and shape these dynamics. The case study design is especially appropriate given the study's emphasis on understanding "how" and "why" questions, specifically, how policy mechanisms operate on the ground and why certain outcomes emerge (Stake, 1995).

Data collection centers on semi-structured interviews with 20 strategically selected participants, ensuring representation across the Triple Helix actors (university-industry-government). Five policymakers, including officers from the Terengganu State Economic Planning Unit and Ministry of Higher Education (MoHE) representatives, provide insights into policy formulation, implementation challenges, and performance metrics. Their perspectives help trace the journey of policies from paper to practice, revealing disconnects that may explain Terengganu's lag in research commercialization compared to western states (Rasiah et al., 2020).

Ten academics from UiTM Terengganu, UMT, and UniSZA,spanning senior professors, mid-career researchers, and early-career lecturers, offer ground-level views of how policies translate into teaching and research activities. This group includes faculty from both STEM fields (e.g., marine science at UMT) and social sciences (e.g., Islamic finance at UniSZA), capturing discipline-specific variations in policy impacts. For instance, while UMT researchers might highlight successes in securing fisheries-related grants, UiTM faculty could discuss barriers in applying technical education to local SME needs, a tension noted in Malaysia's Technical and Vocational Education and Training (TVET) evaluations (MOHE, 2022).

Five industry representatives, comprising CEOs of Terengganu-based enterprises and founders of graduate-led startups, share critical demand-side perspectives. Their experiences with university collaborations, or lack thereof, shed light on practical barriers like mismatched timelines (academic research cycles versus business urgency) and intellectual property concerns (Wong et al., 2021). One interview focus explores why only 28% of Terengganu firms engage with local universities compared to 52% in Selangor (MIGHT, 2022), probing whether this stems from awareness gaps, perceived relevance, or structural obstacles.

The semi-structured format balances consistency across interviews with flexibility to pursue emergent themes. A core set of questions guides all sessions, e.g., "How do current funding mechanisms influence your research priorities?" for academics or "What would incentivize your business to invest in university R&D?" for industry participants, while allowing spontaneous follow-ups to clarify contradictions or unexpected insights. This approach surfaces rich, contextualized data that surveys might miss, such as how UiTM's apprenticeship programs successfully adapted to coastal SMEs' needs through iterative feedback (Yusoff et al., 2022).

To enhance methodological rigor, the study employs source triangulation (cross-checking interview data with policy documents and economic reports) and analyst triangulation (having multiple researchers review coding patterns). These strategies mitigate biases while preserving the depth of qualitative inquiry, ensuring findings are both credible and actionable for Terengganu's development.

Data Collection

The data collection process was designed to capture rich, nuanced insights into the complex relationship between higher education policies and economic development in Terengganu. Semi-structured interviews, each lasting approximately 45–60 minutes, were conducted with the 20 participants across policymaking, academic, and industry sectors. These interviews were carefully audio-recorded with consent and later transcribed verbatim to ensure accuracy in data representation (Kvale & Brinkmann, 2018). The semi-structured format allowed for flexibility, enabling participants to elaborate on critical points while maintaining consistency in core questions across all interviews. For example, policymakers were asked to reflect on the implementation challenges of national education policies at the state level, while industry representatives provided candid feedback on their experiences collaborating with local universities.

To enhance the reliability of the data, member checking was employed, where participants were given the opportunity to review their interview transcripts for accuracy, a process that also served to validate the emerging interpretations (Birt et al., 2016). Additionally, secondary data sources, such as policy documents from the Ministry of Higher Education (MoHE) and annual reports from University Malaysia Terengganu (UMT) and UiTM Terengganu, were analysed to triangulate findings and provide contextual depth. This multi-method approach not only strengthened the study’s credibility but also helped identify discrepancies between policy intentions and on-the-ground realities, such as the gap between state-level economic plans and actual university-industry collaboration rates (Terengganu State Economic Planning Unit, 2023).

Data Analysis

The transcribed interviews were analysed using thematic analysis (Braun & Clarke, 2006), a method well-suited for identifying patterns of meaning across qualitative datasets. The analysis followed a six-phase process: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report. NVivo software was utilized to manage and code the data systematically, ensuring transparency and rigor in the analytical process (Zamawe, 2015).

Three key themes emerged from the analysis, each shedding light on critical dimensions of higher education's role in Terengganu's economic development:

1. Policy Effectiveness: Balancing Ambition with Resource Realities

   While participants universally acknowledged that HEIs contribute to economic growth, they highlighted persistent funding challenges as a major bottleneck. Policymakers noted that budget allocations for East Coast universities often lag behind those for institutions in more developed regions, limiting their capacity to scale research initiatives. For instance, a senior MoHE official revealed that Terengganu's HEIs receive 20–30% less research funding per capita compared to counterparts in Selangor (MoHE, 2023). Academics echoed this concern, emphasizing that restricted funding stifles innovation—particularly in niche areas like marine biotechnology, where Terengganu has a competitive advantage.

2. Industry Collaboration: Bridging the Expectation Gap

   A recurring theme was the mismatch between university and industry expectations. Industry leaders expressed frustration over the slow pace of academic research, which often conflicts with the rapid problem-solving demands of businesses. A CEO of a Kuala Terengganu-based renewable energy startup remarked, *"We need solutions yesterday, but universities operate on three-year research cycles"* (Participant 18, Industry Representative). Conversely, academics cited a lack of industry engagement in joint projects, with some attributing this to SMEs' limited R&D capacity. This disconnect underscores the need for intermediary platforms, such as the proposed Terengganu Innovation Hub, to facilitate dialogue and project co-creation (Terengganu State Government, 2023).

3. Graduate Employability: Aligning Curriculum with Market Demands

   Stakeholders across all sectors emphasized the urgent need for curriculum reforms to address skill gaps. Industry participants reported that while graduates possess strong theoretical knowledge, many lack practical competencies like data analytics and project management. A UniSZA lecturer noted, *"Our Islamic finance program is rigorous, but we need more fintech modules to meet market trends"* (Participant 7, Academic). This sentiment aligns with national findings showing that 38% of Malaysian employers struggle to find graduates with job-ready skills (World Bank, 2022). Proposed solutions included expanding apprenticeship programs—such as UiTM Terengganu's successful industry-linked diploma courses—and establishing employer advisory panels to inform curriculum updates.

The thematic analysis also revealed unexpected nuances, such as the role of cultural factors in shaping collaboration dynamics. For example, several participants highlighted the importance of *personal relationships* in fostering university-industry partnerships, a finding that suggests formal policy mechanisms alone may be insufficient without trust-building initiatives.

DELIMITATIONS AND KEY ASSUMPTIONS

This study consciously narrows its focus to public universities in Terengganu, specifically University Malaysia Terengganu (UMT), University Sultan Zainal Abidin (UniSZA), and University Technology MARA (UiTM) Terengganu, to provide a targeted analysis of state-aligned higher education policies. While private institutions and vocational colleges also contribute to human capital development, their exclusion allows for deeper examination of how federal and state policies interact within public institutions, which enrols over 70% of

Terengganu's tertiary students (MOHE, 2023). Geographically, the study concentrates on mainland Terengganu, acknowledging but not investigating the unique challenges of island communities like Perhentian and Redang, where educational access differs significantly (Terengganu State Government, 2022).

The research operates under two key assumptions: first, that participants provided truthful responses despite potential sensitivities around policy criticism, a risk mitigated through anonymization and ethical review board approval. Second, that no major higher education policy shifts would occur during data collection, ensuring consistency in participants' reference points. While the 2022 change in Malaysia's federal government did introduce some uncertainty, the core policies under examination (e.g., the Malaysia Education Blueprint) remained intact, supporting this assumption's validity (Rasiah, 2023). These delimitations and assumptions clarify the study's boundaries while inviting future research to explore excluded dimensions.

DISCUSSION

The findings of this study present a nuanced picture of higher education's role in Terengganu's economic development, revealing both significant contributions and untapped potential. While HEIs undeniably serve as critical drivers of human capital formation and localized innovation, their full economic impact remains constrained by systemic barriers that demand urgent policy attention. The research corroborates earlier studies (Valero & Van Reenen, 2019) demonstrating universities' multiplier effects on regional economies, but with important Terengganu-specific qualifications.

Three key insights emerge from the data. First, the asymmetric distribution of benefits across sectors is striking. Successful cases like UiTM Terengganu's industry-linked diploma programs in aquaculture technology, where 92% of graduates secure immediate employment with local marine product firms (UMT, 2023), demonstrate the transformative potential of demand-driven education. However, such successes remain exceptions rather than norms, with most academic programs exhibiting limited labor market responsiveness. This aligns with broader Malaysian findings showing only 34% of employers consider graduates "work-ready" (World Bank, 2022), but the disparity is more acute in Terengganu's specialized economic context.

Second, the collaboration gap between universities and industry persists despite policy rhetoric. While the Triple Helix model (Etzkowitz & Leydesdorff, 2000) posits synergistic relationships, Terengganu's reality reveals fundamental mismatches. Industry participants reported academic research timelines (typically 2-3 years) as misaligned with business needs for rapid solutions (<6 months), particularly in fast-evolving sectors like halal ecotourism. This echoes Ismail et al.'s (2021) findings about "temporal disconnect" in East Coast collaborations. More troubling is the spatial dimension: 78% of industry partnerships occur within 30km of university campuses (Kuala Terengganu district), leaving rural districts like Hulu Terengganu underserved (TERENGGANU PLANMalaysia, 2023).

Third, the policy implementation gap undermines potential synergies. While federal policies like the Malaysia Education Blueprint emphasize commercialization, Terengganu's HEIs face structural disadvantages. Compared to research universities in the Klang Valley, UMT receives 60% less industry research funding per faculty member (MOHE, 2023), limiting scalability of successful initiatives. The state's heavy reliance on public funding (92% of university R&D budgets) versus private sector contributions (8%) contrasts sharply with Penang's 35% industry funding share (MIGHT, 2022), reflecting deeper ecosystem weaknesses.

The case of UiTM Terengganu's automotive technology program illustrates both promise and challenges. While its partnership with TERENGGANU Automotive Hub has placed 120 skilled workers in local firms since 2020, attempts to replicate this model in renewable energy sectors stalled due to faculty shortages and equipment gaps (UiTM, 2023). This suggests that successful models require careful contextual adaptation rather than blanket replication, a lesson for policymakers drafting Terengganu-specific solutions.

Three policy implications emerge:

1. Place-based funding mechanisms could redirect resources to Terengganu's priority sectors (marine, Islamic finance) while incentivizing industry co-investment.

2. Intermediary broker institutions (e.g., a Terengganu Knowledge Exchange Office) could bridge temporal and spatial gaps in collaboration.

3. Curriculum co-creation panels involving employers could enhance graduate employability, particularly for technical programs.

These findings challenge conventional human capital theory assumptions by revealing how institutional and geographic factors mediate education's economic returns. For Terengganu's policymakers, they underscore the need to move beyond generic higher education strategies toward targeted, context-sensitive interventions that account for the state's unique economic structure and developmental stage.

CONCLUSION AND RECOMMENDATIONS

This study has systematically examined the intricate relationship between higher education policies and economic development in Terengganu, offering a nuanced understanding of how universities contribute to, and could further catalyze, the state's socioeconomic progress. By integrating qualitative insights from policymakers, academics, and industry leaders with empirical data, the research reveals both the transformative potential of higher education institutions (HEIs) and the systemic barriers limiting their full impact. The findings underscore that while Terengganu's HEIs have laid a foundation for knowledge-driven growth, strategic refinements are essential to bridge gaps between policy intent, academic execution, and market realities.

Conclusions About Research Questions

The study's first research question explored how higher education policies influence Terengganu's economic development. The findings confirm that policies such as the *Malaysia Education Blueprint* have spurred measurable progress, particularly in human capital development and niche research areas like marine science and Islamic finance. However, the benefits are unevenly distributed, with rural districts and non-technical sectors receiving fewer spillover effects. The second question, addressing barriers to university-industry collaboration, highlighted critical mismatches in timelines, expectations, and geographic focus. Industry participants expressed frustration with the slow pace of academic research, while academics cited limited engagement from local small and medium enterprises (SMEs), echoing broader challenges identified in East Coast Malaysia (Ismail et al., 2021). The third question, on enhancing HEIs' economic contributions, revealed that curriculum relevance and targeted funding are pivotal—lessons exemplified by UiTM Terengganu's successful industry-linked programs but absent in many traditional degree offerings.

Conclusions About the Research Problem

At its core, this research identifies a tension between Terengganu's higher education ambitions and its implementation capacity. While HEIs like UMT and UniSZA have demonstrated excellence in specialized research, their economic impact is constrained by structural issues: underfunded commercialization pathways, curricula lagging behind industry trends, and weak intermediary systems to connect academia with Terengganu's predominantly SME-driven economy. These challenges are compounded by the state's unique geographic and socioeconomic context, where resource disparities between urban and rural areas further complicate policy delivery (TERENGGANU PLAN Malaysia, 2023).

Implications for Theory

The study enriches theoretical frameworks like the Triple Helix Model by demonstrating how its principles manifest in a resource-dependent, non-urban setting. Unlike innovation hubs in Kuala Lumpur or Penang, where industry and universities are tightly coupled, Terengganu's experience shows that spatial and sectoral disparities can disrupt knowledge flows. This calls for adapting theories of regional innovation to account for periphery-specific factors, such as the role of cultural capital in fostering trust-based collaborations (Yusoff et al., 2022).

Implications for Policy and Practice

For public sector policy analysts and managers, the findings advocate for place-based policies that prioritize

Terengganu's competitive advantages. This includes increasing research commercialization grants for priority sectors (e.g., blue economy, renewable energy) and establishing a *Terengganu Knowledge Exchange Office* to mediate university-industry partnerships. Such an institution could emulate successful models like Finland's regional innovation agencies, which have narrowed urban-rural innovation gaps (OECD, 2022). Additionally, curriculum reforms should be accelerated through mandatory industry advisory panels for all technical programs, ensuring skills align with emerging needs in fields like halal biotechnology and green technology.

For private sector managers, particularly in SMEs, the study underscores the untapped value of engaging with local universities. Strategies like micro-internships or joint problem-solving labs could mitigate perceived risks of collaboration while addressing immediate business challenges. The case of UiTM Terengganu's automotive program, where 85% of participating firms reported productivity gains (UiTM, 2023), demonstrates the tangible returns of such partnerships.

Further Research

Future studies should adopt longitudinal designs to track the long-term effects of policy adjustments, particularly in measuring how curriculum reforms influence graduate employability over five- to ten-year horizons. Comparative research with other East Coast states (Kelantan, Pahang) could identify transferable solutions for peripheral regions. Additionally, deeper exploration of cultural factors, such as how *kampung*-based kinship networks influence knowledge diffusion, could yield novel insights for decentralized innovation policies.

FINAL RECOMMENDATIONS

To fully harness higher education's economic potential, Terengganu must address three priority areas: First, rebalance funding allocations to incentivize industry co-investment in applied research, perhaps through tax breaks for firms supporting university R&D. Second, embed industry practitioners in curriculum design, ensuring programs like UniSZA's Islamic finance degrees incorporate fintech and ESG (environmental, social, and governance) competencies demanded by employers. Third, scale successful pilot partnerships, such as UMT's community-based coastal tourism projects, through state-funded replication grants. These steps, while tailored to Terengganu's context, offer lessons for regional development globally, proving that when policies align with local realities, universities can indeed transform from degree factories into engines of inclusive growth.

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