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RESEARCH ARTICLE

Enhancing talent competitiveness in ASEAN: Insights from input-output efficiency analysis

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ABSTRACT - This research explores talent competitiveness among the Association of Southeast Asia Nations (ASEAN) using the Global Talent Competitiveness Index (GTCI) framework data in the 2023 report. The study delves beyond the pillar rankings to analyze the GTCI Sub-Indices and the concept of Efficiency Score, which reveals how effectively countries transform talent inputs (education, skills) into outputs (innovation productivity). At the same time, Singapore emerges as the regional leader with optimal efficiency, while Indonesia, Thailand, Vietnam, and the Philippines all have room for improvement. Despite lower rankings, the Philippines' case, with a high-efficiency score, necessitates further investigation. Data Envelopment Analysis (DEA) is introduced as a potential tool for policymakers to identify efficient performers and areas for improvement, highlighting the importance of the Efficiency Score as a valuable metric for understanding talent utilization. The research emphasizes the need for ASEAN to invest in education, skills development, and innovation. Recommendations include promoting lifelong learning, improving regulations, and promoting collaboration. Policymakers can cultivate a thriving talent ecosystem for sustained economic growth by leveraging the GTCI framework Efficiency score and DEA.

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1. INTRODUCTION

There are several reasons for preparing human resources in the Association of Southeast Asian Countries (ASEAN) for global competition. It is the skilled human resources that drive economic growth and enhance the competitiveness of nations. Investing in human capital, including education and skills development, significantly contributes to the GDP growth. For instance, a 1% increase in human capital led to a 0.37% increase in GDP per capita in ASEAN (Camps, 2016). ASEAN countries are integrated into the global economy through ever-increasing globalization and trade. Skilled human resources are vital for capitalizing on opportunities in international markets. ASEAN's total trade with the world reached $2.8 trillion in 2019 (Secretariat ASEAN, 2019), highlighting the importance of having a skilled workforce capable of competing globally. Naturally, innovation is a crucial driver of competitiveness in an era of rapid technological change. Skilled human resources are crucial for adopting and leveraging new technologies effectively. According to the Global Innovation Index (GII) report, innovation is closely linked to economic growth and competitiveness (World Intellectual Property Organization, 2023). ASEAN countries need skilled talent to drive innovation and technological advancement, promoting competitiveness (Key Messages, n.d.).

Globalization and technological advancements have reshaped labor market demands, favoring skills such as digital literacy, critical thinking, and adaptability. The International Labor Organization (ILO) reported that the future of work requires workers with diverse skills to thrive in evolving job markets (Skills, Knowledge and Employability, 2021). In ASEAN, preparing human resources for global competition means they have the skills to succeed in the labor market. For instance, the ASEAN Economic Community (AEC) intends to create a single market and production base, facilitating the movement of goods, services, and skilled labor within the region, considering seriously skilled human resources in realizing the benefits of regional integration by contributing to productivity gains and advancing cross-border cooperation (ASEAN, 2020). It is vital to invest in education, skills development, and creating attractive opportunities for career advancement to retain talent and prevent brain drain. Asian Development Bank revealed that investing in education and skills development mitigates the negative effect of brain drain by creating opportunities for skilled workers to contribute to their country's development (Guido, 2021).

The Global Talent Competitiveness Index (GTCI), published annually by INSEAD, provides a comprehensive benchmarking report that assesses how countries and cities grow, attract, and retain talent. Specifically, it evaluates their ability to prepare human resources for global competitiveness (Global Talent Competitiveness Index, n.d.). The 2023 report covers 134 countries across all income groups. Critical data and figures from the GTCI include ranking based on talent competitiveness, focusing on disparities among ASEAN nations. These rankings offer insights for decision-makers to understand the talent landscape and devise strategies to enhance their economies (GTCI, 2023, n.d.). The GTCI gauges talent competitiveness based on the four key pillars. Enabling examines the environment that enables talent development, including education, policy, regulatory framework, and technical readiness, with strong enabling conditions that nurture

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talent (Cunicica, 2019). Attractiveness is the pillar that is critical to retaining talent, examining a country's ability to attract talent domestically and internationally with consideration to include quality of life, immigration policy, and job opportunities. Talent development and growth are key to competitiveness (Chaiyapuck, 2021). The Grow pillar examines education programs, lifelong learning, and professional development. Countries that consistently invest in skills development perform well in this area. Retaining talent is critical to sustainable economic growth and focuses on career growth, work-life balance, and social security (Evans et al., 2021). Countries that create an environment where talent can grow and stay contribute to long-term success.

The Vocational and Technical (VT) Skills focuses on skills acquired through vocational or professional training and practical experience. VT skills encompass technical expertise, hands-on abilities, and specialized knowledge relevant to specific industries or professions. These are the two outputs used to evaluate the GTCI. Countries with strong VT skills effectively address workforce demands and contribute to economic growth (Chaiyapuck, 2021). Global Knowledge (GK) Skills refer to broader knowledge, innovation, and adaptability competencies. These skills include critical thinking, creativity, digital literacy, and collaborating across borders. Countries that nurture GK skills foster an environment conducive to research, development, and global collaboration, enhancing their overall talent competitiveness (Buracas & Navickas, 2017). The GCTI does not rely on a specific theory. It is a composite index considering different factors in a country's talent ecosystem. However, understanding the underlying theoretical concept provides insights into the factors contributing to the ASEAN-6 talent competitiveness in the globalized economy (Evans et al., 2021.)

Several theories serve as the basis for developing a country's talent, a significant input in attaining economic output. The Human Capital Theory is one of the bases for developing Human Capital, which Theodore Schultz popularized in 1961 in his book "Investment in Human Capital," arguing that education and skills development are investments that result in economic returns, like investment in physical capital. In 1964, Gary Becker supported this claim in "Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education," a book further developing the concept of human capital, analyzing the economic impacts of investments in education, OJT, and health (Becker, 2009). The Knowledge-Based View (KBV) supported the Human Capital Theory, starting with the work of Michael Polanyi, the Science, and Foresight in 1962, emphasizing the importance of tacit knowledge and its role in innovation (Coombs & Hull,1998). Similarly, the Theory of Managerial Capitalism (1964) by Robin Marris explores the concept of a firm's competitive advantage stemming from its knowledge assets and capabilities. From the point of view of Economic Development Theories, Robert Luca, Jr., in his seminal paper On the Mechanics of Economic Development (1988), explores the role of human capital and technological progress in long-run economic growth (Luca & Cariman, 2021). The work of Paul Romer, The Origins of Endogenous Growth (1994), argues that investments in knowledge and innovation lead to sustained economic growth. The latest theory to support talent development is Henry Chesbrough's research, Open Innovation: The New Imperative for Creating and Profiting from Technology (2003), which introduces the concept of open innovation, where companies leverage internal and external sources of knowledge to drive innovation.

The United Nations Sustainable Development Goal (SDG) 8: Decent Work and Economic Growth relates to the above insight on ASEAN nations' talent competitiveness regarding its input-output efficiency, as exhibited in the GCTI. SDG 8 targets promotable, inclusive, sustainable economic growth, full and productive employment, and decent work. Regarding talent competitiveness by countries, they can create more employment opportunities, facilitate an increase in productivity, and, in turn, foster economic growth, supporting job creation, entrepreneurship, and business growth through activities such as improving technical skills and efficient utilization of resources. SDG 8 calls for closing training gaps using strategies that encourage entrepreneurship that leads to job creation. Identifying deficiencies and drawing upon strengths revealed in the GTCI assist in attaining SDG 8's vision to uphold a more prosperous society that is fairer across the entire ASEAN region.

The general objective of this study is to measure the relative efficiency of ASEAN countries in utilizing inputs to produce outputs related to talent competitiveness using the Data Envelopment Analysis (DEA) methodology applied to the GTCI data. By measuring the efficiency of ASEAN-6 countries across various dimensions such as Enable, Attract, Grow, Retain, the inputs and the Vocational and Technical (VT) Skills, and Global Knowledge (GK) Skills, this research aims to identify best practices and areas for improvement in talent development strategies within the region. The first objective is to understand the nuanced factors influencing efficiency and identify specific areas for improvement, which is possible through detailed input-output variables. Further, the second objective is to provide a high-level overview or comparative analysis of efficiency across ASEAN-6, computing with aggregated indices, which is suitable. The study seeks to provide valuable insights for policymakers, business leaders, and stakeholders by focusing on the factors contributing to high efficiency in talent competitiveness and offering recommendations for enhancing the overall competitiveness of ASEAN countries in the global talent landscape. Finally, the findings of this study aim to inform evidence-based decision-making and facilitate the development of targeted interventions to promote sustainable economic growth and prosperity in the ASEAN region.

2. METHODOLOGY

The Data Envelopment Analysis (DEA) is a valuable tool for measuring the output and efficiency of the Association of Southeast Asian Nations' six members (Singapore, Indonesia, Thailand, Malaysia, Vietnam, and Philippines) ASEAN-6, in terms of 2023 INSEAD report on Global Talent Competitiveness Index (GCTI) DEA considers countries as

"decision-making units" (DMU) and their talent inputs (Enable, Attract, Grow and Retain) to identify the best performers by comparing them with their outputs (VK Skills and GK Skills) reflecting countries that use their resources efficiently to achieve positive development (Chang & Chang, 2023). By analyzing these top-performing countries, others can identify areas for improvement in their talent development strategies. However, the DEA did not furnish the specifics of the scores; instead, it provided a framework for comparing efficiency across countries.

Given the data provided by the inputs and the outputs, the DEA was used to measure efficiency, allowing for the simultaneous consideration of multiple inputs and outputs to evaluate the relative efficiency of DMU (Hadi-Vencheh & Foroughi, 2006). The DEA was applied to the GCTI data, initially formulating the DEA model, standardizing the inputs and outputs to ensure comparability across countries by using min-max normalization, transforming all variables to a scale between 0 and 1 (Al-Refaie et al., 2019). The Input-oriented DEA model maximized efficiency while minimizing the inputs relative to outputs (Cook & Bala, 2007). The DEA model calculated efficiency scores for each country. An efficiency score of 1 depicts operating on the efficiency frontier, and a score of less than 1 conveys potential areas for improvement. The best practices and strategies were identified. Inefficient countries were benchmarked against efficient ones to identify opportunities for improvement and areas where resources are underutilized.

The statistical formula for DEA in an input-oriented context involves calculating the efficiency score of decision-making units (DMUs) based on their inputs and outputs. The formula for the DEA efficiency score is shown below as

$$Efficiency\ Score\ (Es) = \frac{\sum_{j=1}^{n} \lambda_j x_{0j}}{\sum_{j=1}^{n} \lambda_j x_{ij}}$$

where:

ES is the efficiency score of the DMU.

λj, represents the weight assigned to each input.

*x*0*j*, denotes the amount of input *j* for the DMU under evaluation.

xij, represent the amount if input *j* for the *i*th DMU in the dataset.

n, is the total number of inputs.

This formula calculates the efficiency of a DMU by comparing its weighted sum of inputs to the weighted sum of inputs of the best-performing DMU in the dataset. A DEA efficiency score of 1 indicates that the DMU is efficient, while a score less than 1 signifies inefficiency.

The GCTI uses a two-step process involving the GTCI Input Sub-Index and GTCI Output Sub-Index to calculate the Efficiency Score, furnishing significant insights into the country's ability to translate its talent resources into economic benefits. The GCTI Input Sub-Index likely captures factors contributing to building a strong talent pool, such as educational investments, skills development, and supportive regulations for businesses and innovation. On the other hand, the GTCI Output Sub-Index focuses on outcomes like a skilled workforce, innovation levels, and overall economic productivity. The Efficiency Score, calculated by comparing these two subindices, indicated how effectively a country utilized its talent inputs to achieve talent output. A score closer to 1 signified that a country was maximizing its potential and efficiently converting its resources into a competitive talent pool that drives economic growth. Conversely, a lower score depicts room for improvement in using its talent base, even if the country has a large workforce or a well-developed education system. In this case, the Efficiency Score goes beyond just measuring a country's raw talent resources, revealing how well these resources are translated into a dynamic and productive talent ecosystem that sustains innovation and economic success.

$$\text{GTCI\_Input\_Sub\_Index} = \frac{\sum_{i=1}^{n} (w_i \text{ x } x_i)}{n}$$

$$\text{GTCI\_Output\_Sub\_Index} = \frac{\sum_{i=1}^{n} (w_j \ x \ x_j)}{n}$$

$$Efficiency\ Score = \frac{GTCI\_Output\_Sub_{Index\ of\ Country}}{GTCI\_Input\_Sub_{Index\ of\ Country}}$$

Notable, there were two Data Envelopment Analyses (DEA) reflecting various efficiency aspects. In terms of the Input and Outputs, the first DEA equation includes specific input and output variables for each country, such as "Enable," "Attract," "Grow," "Retain," "VT Skills," and "GK Skills." (APPENDIX D: DATA ENVELOPMENT ANALYSIS (DEA), n.d.) Conversely, the second equation aggregates these inputs and outputs into GTC input and output sub-indices. The first equation provides a more detailed breakdown of the factors contributing to efficiency, while the second equation simplifies the analysis by considering broad indices. Moreover, in terms of efficiency scores, both equations calculate efficiency scores using the DEA methodology. However, the efficiency scores in the first equation are calculated based on the specific input-output variables for each country. The efficiency scores in the second equation are calculated based on the aggregated GTCI input and output sub-indices.

The first equation allows for a more granular efficiency analysis, considering individual input and output variables. The second equation provides a more generalized assessment of efficiency using aggregated indices, which are suitable

for high-level comparison but overlook nuances in efficiency drivers. The second DEA model that aggregates input and outputs in indices is commonly referred to as the Variable Returns to Scale (VRS) DEA model, considering the aggregation of inputs and outputs in indices allows for a more comprehensive evaluation of efficiency level (Zarrin & Brunner, 2023).

3. RESULT AND DISCUSSIONS

Malaysia, Thailand, Vietnam, and the Philippines are compared to other countries globally based on the most recent 2023 data. Singapore stands out as the regional leader in ASEAN in attracting and retaining talent, ranking second globally, which indicates a highly developed ecosystem for nurturing talent and a strong pull for internationally skilled professionals. Malaysia followed behind at 45th globally, reflecting a moderately developed talent pool and a somewhat competitive environment for attracting and retaining talent. Falling in the mid-range with Thailand at 75th and Vietnam at 74th suggests room for improvement in areas such as education, skills development, and fostering an attractive work environment. Currently facing the most significant challenges in talent competitiveness, Indonesia, ranking 82nd, and the Philippines 80th, convey a need for substantial investment in human capital development and creating a more competitive job market. Compared to other regions globally, these rankings depict North America and Europe dominating the top spots, with several countries boasting a strong talent ecosystem. While Singapore leads the pack in ASEAN, other East Asian economies like Japan and South Korea also rank highly. South Asia and Africa generally score lower on the GTCI, focusing on the global disparity in talent development.

Figure 1. ASEAN-6, Global Talent Competitiveness Index (GTCI)

Overall, the GTCI ranking paints a picture of Southeast Asia as a region with potential growth in talent competitiveness. While Singapore stands out as a frontrunner, other countries in the region need to invest in human capital development, improve education systems, and create a more competitive environment to retain and attract skilled workers crucial for them to compete effectively in the globalized job market and achieve sustainable economic growth. Singapore sets the bar high with a strong talent ecosystem across most pillars. Indonesia and the Philippines face significant challenges but have a large and young workforce. Thailand, Malaysia, and Vietnam show potential improvement, particularly in education, skills development, and fostering innovation. All countries should focus on STEM education and digital skills training to prepare their workforce for the future. The government can create policies that encourage lifelong learning and skills development. Investment in infrastructure can improve talent mobility and business competitiveness. Fostering a culture of innovation and entrepreneurship is crucial for attracting and retaining talent.

Figure 2 on Global Talent Competitiveness Index (GTCI) rankings and the individual pillars: Enable, Attract, Grow, Retan, Vocational, and Technical (VT) Skills, and Global Knowledge (GK) Skills. Based on overall rankings, Singapore stands out as the top performer in the ASEAN region, ranking 2nd overall globally, depicting its strong performance across multiple pillars. The city-state excels in the Enable, Grow, and GK Skills, conveying a conducive environment for talent development, continuous learning, and knowledge creation. Malaysia secures a relatively high position compared to other ASEAN countries, indicating a moderate level of talent competitiveness. It performs well in the Enable and GK Skills, claiming a solid education and knowledge creation foundation. Thailand ranked 79th, Vietnam is 75th, the Philippines at 84th, and Indonesia at 80th are positioned lower in the overall ranking, implying room for improvement in talent competitiveness.

Table 1. Human resources readiness for global competition in Southeast Asia: Insights from the GTCI

	Rank	Strengths	Weaknesses
Singapore	2	**Enabling Environment**: Strong legal and regulatory frameworks, investment in research and development (R&D) Research, Innovation, and Enterprise (RIE) 2025 Plan;1.92% to GDP; S$25 billion for R&D **Skills:** Emphasis on lifelong learning, strong vocational training programs **Labor market:** High labor mobility, efficient talent attraction strategies (Lim et al., 2024).	**Education:** Focus on rote learning might hinder creativity and innovation. **Cost of living:** High living expense ay hinder some international talent (Tremblay et al., 2019).
Indonesia	82	**Labor Market**: Large and young workforce, relatively low labor cost. **Enabling Environment**: Growing focus on innovation and entrepreneurship (*Significant number of start-ups valued at over $1 billion*.) (City-Level Tech Startup Ecosystems, 2022)	**Education**: Uneven quality across the education system, limited access to higher education. (50 million students, three million teachers, and 300,000 schools; The 20% of the national budget is allocated to education, emphasizing both compulsory and higher education) (Rosser, 2018). **Skills:** Skills mismatch between graduates and industry needs. (Average monthly wages reached IDR 3,204,880 in Q3 2023) (Indonesia Economic Update, 2023) **Infrastructure**: Deficiencies in transportation and communication Infrastructure can hinder talent mobility (Antaranews.com, 2024).
Thailand	75	**Cultural Appeal:** Strong cultural heritage and tourist industry can attract talent. (In June 2022, income of 26 billion Thai baht; in 2017, over four million people working in tourism; 11.15 million international tourists) (Thailand on Track to Meet Tourism Target, n.d.) **Cost of living:** Relatively low compared to other Southeast Asian Nations. (*Family of four, $1,981.20 cost of living*) (*Cost of Living in Thailand*, n.d.)	**Education:** Focus on memorization over critical thinking and problem-solving skills. (*Average schooling is nine years) (World Economics, 2023)* **Labor market**: limited labor mobility due to rigid regulations. (Labor force is the sixth largest in Pacific region, 67% of population participate in labor force) (Aging & Labor market, n.d.) **Innovation**: Lower level of R&D investment compared to regional leaders. (In 2020, THB 208.009 billion on R&D, equivalent to 1.33% of GDP; Private investment accounts for 77% of R&D spending in Thailand) (Saowaruj Rattanakhamfu, 2023)

Table 1. (cont.)

	Rank	Strengths	Weaknesses
Malaysia	45	**Education**: Established an education system with a good mix of public and private institutions. (In 2024, the government allocated RM58.7 billion for education; Approximately 43.5% to almost 40% of tertiary students in Malaysia graduate in STEM fields) (World Economic Forum on LinkedIn, n.d.) **Infrastructure**: Developed infrastructure network facilities talent mobility (In 2023 infrastructure development budget of US$20.43 billion covers more than 7,615 development projects) (Budget 2023: 7,615 Development Projects, n.d.)	**Skills:** There is a need for more emphasis on STEM education and digital skills. (46% of Malaysian workers reported having some digital skills; more than 240,000 digital talents in Malaysia) (Talent: Digital Job Vacancies, n.d.) **Brain Drain**: Loss of skilled professionals in other countries. **Enabling Environment**: Bureaucracy hinders business growth and talent attraction (Povera, 2024).
Vietnam	74	**Young and Growing Workforce**: Demographics dividend with a large pool of potential talent. (*51.6 million people of working age, with 58% of them being under 35 years old*) (Thanh, 2022). **Cost of Living**: Competitive labor costs compared to regional players. (*Family of four, cost of living, $1,641.30*) (*Vietnam Living Cost per Month*, n.d.)	**Education**: Focus on theoretical knowledge over practical skills development. (*In 2022, the Vietnamese government allocated 4.9% of GDP for education.*) (VnExpress, n.d.) **Labor Market**: Inefficiencies in matching job seekers with available positions **Language skills**: Limited proficiency in English can hinder global competitiveness. (*Việt Nam "Moderately" Proficient in English*, n.d.)
Philippines	80	**Strong English Language Skills**: High English proficiency due to historical ties with the US. **Cultural Affinity**: The large Filipino diaspora abroad can serve as a network for attracting talent (from *April to September 2022, there were approximately 1.96 million OFWs*.) (*Why the OFW Is in Demand*, n.d.)	**Infrastructure**: Deficient infrastructure creates challenges for business development and talent mobility (In 2024 National Expenditure Program (NEP) allocates an unprecedented P924.7 billion for the education sector.) (DBM: Education Gets P924.7 billion, n.d.) **Education**: Underinvestment in education leads to skills gaps (Department of Education P758.6 billion, Commission on Higher Education gets P31.0 billion. Technical Education and Skills Development Authority receives P15.2 billion, and State Universities and Colleges (SUCs) receive P105.6 billion) (DBM Ensures Free Tertiary Education, 2023) **Labor Market**: High informality and underemployment rates. (*In January 2024, the underemployment rate was 13.9%*) (Lo, 2024)

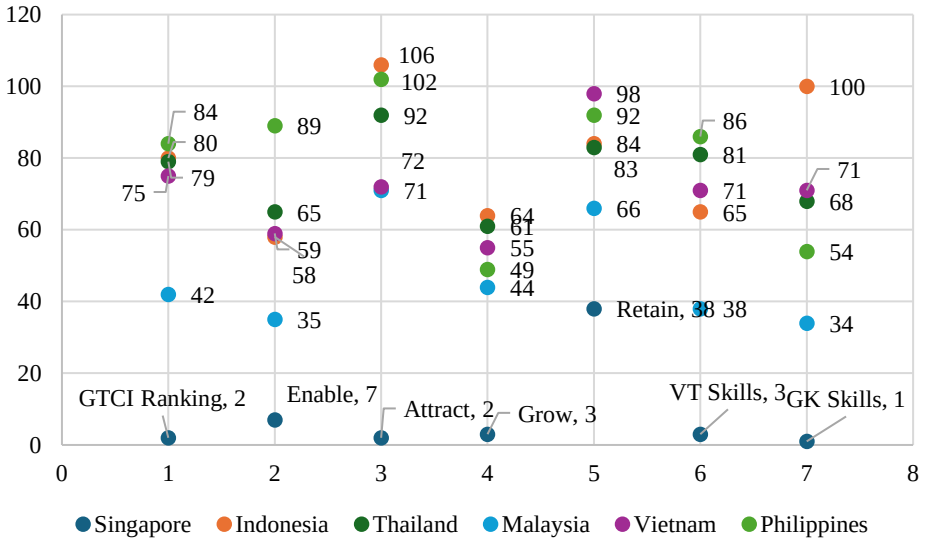

Figure 2. Ranking of ASEAN-6 in the GTCI overall and by pillar

Regarding the pillar analysis, Enable, Attract, Grow, and Retain, Singapore ranked 7th, 2nd, 3rd, and 38th, presenting a strong enabling, attracting, career advancement, and retaining environment for talent competitiveness. Malaysia also performed well in this pillar, ranked 35th, 71st, 44th, 66th. Thailand, Vietnam, Indonesia, and the Philippines have lower rankings, presenting challenges in providing a conducive environment for talent development. They struggle to attract talent compared to global leaders. Also, they find it hard to provide for talent growth and development. Thus, indicating difficulties in retaining talent within their borders. For the outputs, the Vocational and Technical (VT) Skills and Global Knowledge skills show that Singapore ranked 3rd, strongly emphasizing VT skills development, and ranked 1st in GK skills, conveying excellence in promoting global knowledge skills. Malaysia ranked 38th and 34th respectively. Meanwhile, Thailand, Vietnam, the Philippines, and Indonesia exhibit varying performance levels in VK and GK skills, with room for improvement and challenges in developing global talent pools.

Figure 1 above provides the future global competitiveness of ASEAN countries. Analyzing ASEAN countries' current rankings and performance provides a snapshot of their competitiveness. However, considering the future trends and projections to measure their trajectory for a country showing improvement in certain pillars or having strategic initiatives to address weaknesses indicates a positive disposition for future competitiveness. In the same way, countries with higher rankings in pillars like “Enable,” “Grow,” and “VT Skills” present a commitment to investing in human capital development. Governments and private sectors in ASEAN countries must continue investing in education, training, and skill development to secure a steady supply of skilled workers capable of competing globally. Figures related to government expenditures on education, enrollment rates in vocational and technical programs, and R&D investments provide insights into the level of commitment to human capital development.

Talent attraction and retention are crucial for sustaining competitiveness. Countries with higher rankings in the Attract and Retain pillars have advantages in attracting and retaining skilled workers. ASEAN countries must develop strategies to attract and retain talent, such as improving quality of life, offering competitive salaries and benefits, and creating a favorable work environment. Categorized as outputs, the “Global Knowledge (GK) Skills” convey a country’s ability to promote innovation and adapt to global trends. This pillar will likely be more competitive in sectors driven by innovation and technology for countries with higher rankings. For ASEAN countries promoting a culture of innovation, an observed increase in patent applications, research publications, and technology exports.

Table 2 offers a different perspective on the talent competitiveness of ASEAN-6 based on the GTCI framework, which presents a conversion of pillar rankings into weights or scores. A value closer to 1 indicates a strong performance in that specific pillar for that country, and a value closer to 0 indicates a weaker performance. Singapore holds high in Retain (1.00) and Enable (1.00), claiming a strong work environment and supportive regulations. Along with its score in Attract (1.00), it strongly focuses on retaining existing talent and attracting a large pool of new talent. Indonesia exhibits a very low value in Attract (0), Grow (0), and GK Skills (0.1764), which are attributed to the large workforce that did not translate directly to high-skilled talent. Except with Singapore, Indonesia depicts its strength in VT Skills (0.8848), besting all other ASEAN countries. The overall Efficiency Score confirmed this, with a value of 0.4309, suggesting room for improvement in using its talent base.

Indonesia’s strong performance in VT Skills, as indicated by its score in the GTCI, is attributed to several factors. Indonesia is focusing on vocational education reforms and skill development initiatives to address the demands of its rapidly evolving economy. With assistance from the Asian Development Bank (ADB) through the Vocational Education Strengthening Project (INVEST) with $80 million in funding in 2008, which expanded the capacity of the country’s vocational schools, matching courses with industry needs (Bank, 2012). Also, the Indonesian government established the

Kartu Prakerja (pre-employment card) program in 2019, benefiting 16.4 million people by providing cash rebates for training and assisting in job matching. The program successfully bridges the gap between education and industry requirements for 16.5 million individuals, especially those previously receiving vocational training. Around 51% of the beneficiaries were women, and participants' monthly income rose by an average of $8.50 (Brown, 2023). Further, the Public-Private Partnership (PPPs) is crucial in addressing the skills gap. This collaboration in Indonesia's technical and vocational education and training (TVET) institutions equipped graduates with vital competencies for employment (USAID PADU: Enhancing, 2024). For instance, the SMK Negeri Penerbangan 29 is one of the 300 vocational schools supported by the ADB INVEST project to convey success in enhancing skills and employment prospects for the youth (Bank, 2012). Indonesia's success in VT Skills underscores its commitment to addressing the skills gap and promoting a workforce equipped with practical and in-demand skills for the 21st-century global economy.

Table 2. ASEA-6 conversion of pillar rankings into efficiency scores

Country	Enable	Attract	Grow	Retain	VT Skills	GK Skills	Efficiency Score
Singapore	1	1	1	1	1	1	1
Indonesia	0.5293	0	0	0.3248	0.8848	0.1764	0.4309
Thailand	0.3851	0.0511	0	0.3447	0.0485	0.3721	0.4827
Malaysia	0.6895	0.2106	0.2043	0.6565	0.6445	0.6843	0.9607
Vietnam	0.4322	0.1756	0.0636	0	0.1961	0.3515	0.4614
Philippines	0.2464	0.0094	0.2831	0.1081	0.5109	0.4965	0.4869

Thailand, like Indonesia, has very low values in Grow (0) and GK Skills (0.3721), with a score of 0.3851 in Enable (Regulations), suggesting relative strength in this area. The Efficiency Score (0.4827) displays some progress in using talent resources. Thailand faced challenges. However, there were several initiatives to improve their standing. Starting with the Talent Advancement Program (Accenture) offers a tailored progression program for graduates focusing on continuous learning, structuring personal growth, and multidisciplinary teamwork. Graduates work on diverse projects, including data-driven solutions for banking and unique shopper experience (Talent Advancement Program, Accenture Thailand, n.d.). Moreover, the Leadership Training Program (Change Works) is a customized learning and development program for organizational leaders. It aims to develop talented candidates into leaders by enhancing their skills and competencies (CHANGE WORKS LTD., 2020). The Thailand Talent Summit 2023 brought together talent and HR heads to elevate strategies for attracting, engaging, developing, and retaining top talent in Thailand (Transform Talent Thailand, 2023). Unlike Singapore, Thailand faces difficulties attracting professionals who want to move abroad, which is critical for Thailand's talent landscape (Languepin, 2022).

Scores in Malaysia show a more balanced distribution across pillars, with none reaching extremes. The Efficiency Score (0.9607) conveys that Malaysia uses its talent resources reasonably well. Malaysia made commendable initiatives in talent development and investment. Even during the pandemic, Malaysia's Foreign Direct Investment (FDI) shows resilience. In 2021, the country exceeded its pre-pandemic performance at RM48.1 billion, driven primarily by net inflows in equities and investment fund shares (MIDA, 2022). Large-scale investment in semiconductor projects notably contributed to the positive trend, playing a necessary role in technology transfer, promoting healthy competition, and supporting human capital development (MIDA, 2023). Globally, Malaysia ranks 42nd in talent competitiveness and is recognized as among the best-performing upper-middle-income countries. Brunei and China are closely behind in rankings (Malaysia Ranked 42nd, n.d.). In the GTCI 2023 report, Malaysia secured 34th position in Global Knowledge Skills, 8th in Digital Skills, 3rd in High-Value Exports, and 9th in Brain Retention. More significant challenges are attractiveness and internal openness related to tolerance towards immigrants and gender equality, placing Malaysia at 71st and 98th, respectively (MIDA, 2023).

For its successful talent program, TalentCorp Malaysia actively shapes the youth talent pool through initiatives like the Young Employable Students (YES) program, creating awareness by providing insights on industry trends and establishing the employability of Malaysian youth with industry needs (Newsroom, 2023). Common among industries in Malaysia is its Employee Retention Program, which consists of matured Improved Learning and Development, which is actively implemented to retain employees for skill enhancement and career growth. Similarly, the Increased Well-Being Initiatives contribute to retention and the Hybrid Work Policy adapting to changing needs by offering flexible work arrangements (BusinessToday, 2023). Malaysia successfully sustained its strategies for attracting and retaining talent. Most industries offer competitive compensation packages beyond salary and comprehensive benefits, conveying care for employees' needs. Career Development Opportunities provide growth prospects within the organization and, coupled with fostering a positive work environment and prioritizing employee health, contribute to its competitiveness on the global stage (Malaysia, 2023).

Generally, Vietnam's scores are higher than Indonesia's. However, weakness in VT Skills (0.1961) and Retain (0) with a score of 0.3851 in Enable (regulations) suggests similar challenges to Thailand, and the Efficiency Score (0.4614) presents some progress in using talent. Regarding Vocational Technical (VT) Skills, Vietnam is trying to enhance its talent competitiveness. The country ranked 59th globally in Global Knowledge Skills, improving 10 places from 2019.

However, the country's performance in Attract fell to the 105th spot compared to 91st last year and stood at the 117th pace in VT Skills (VietnamPlus, 2020). The gap between Vietnam and high-income countries, particularly in digital skills, remains significant (Việt Nam Ranks 96th, 2020). There are challenges and opportunities, such as Supply-Side mismatches between skills and knowledge gained through education and those required in modern work. Several firms reported facing obstacles due to a lack of educated applicants. In like manner, rapid technological advancements demand skills beyond traditional education. Complex problem-solving, decision-making, creativity, and strong interpersonal communication are vital for high-skilled roles (Connecting Vietnam's Youth, 2024). Vietnam started a successful VT Skills Talent Program called Innovating Vietnam's TVET System for Sustainable Growth (VIETSKILL), which is coordinated by Professor Ari Kokko from Copenhagen Business School aiming to enhance Vietnam's Technical Vocational Education System (TVET) system for sustainable development and growth (Viet Skill - Innovating Vietnam's TVET System, n.d.). Simultaneously initiated was the Future Talent Program (Sidel), an immersive 16-month development program involving job rotations across various business areas worldwide. Participants gain accelerated knowledge and practical experience (Future Talent Program, n.d.). Vietnam's journey toward talent competitiveness required addressing skills gaps, fostering innovation, and preparing its future workforce for high-value roles.

Finally, the Philippines presented the lowest score in Attract (0.0094), attributed to massive brain drain and Enable (0.2464). However, their score in Grow (0.2831) conveys strength. The Efficiency Score (0.4869) confers moderate use of talent resources. Brain Drain is a significant challenge for the Philippines, impacting its economic complexity and productive capabilities. Senator Juan Edgardo Angara underlined brain drain as a significant hurdle in achieving economic complexity, which measures a country's productive capabilities based on knowledge and diversity, with skilled workers seeking better opportunities abroad due to limited job prospects or inadequate compensation at home. Approximately 10 million Filipinos work abroad. Despite this, the country can prosper by leveraging its human and material resources. Notably, it transformed from an agricultural exporter to a producer of more complex products, especially in the electronics sector. The Philippines ranked 35th in the Economic Complexity Index (ECI), which measures a country's productive capabilities based on its exports (Yap, 2021). The Philippines Society for Talent Development (PSTD) focuses on Training Need Analysis (TNA), designing workplace training programs aligned with organizational needs, and emphasizing developing innate talents and gifts (Home, n.d.). It describes stages of employee development and the required capabilities for success (Roy, 2023). Implementing an effective HR program is crucial for continuous learning and growth. These programs equip employees with the necessary skills and promote a culture of improvement (Guzman, 2023).

Table 3 showcases additional data points related to the GTCI framework based on the 2023 report and displays the scores for each GTCI pillar (Enable, Attract, Grow, Retain, VT Skills, and GK Skills). Along with sub-indices, the GTCI Input Sub-Index represents a weighted average of the pillar scores, reflecting the country's resources in talent development, with higher scores indicating relative ranking. Similarly, the GTCI Output Sub-Index presents a measure of talent outcome, potentially based on factors such as innovation output or skilled labor force participation. The last column is the Efficiency Score (DEA), representing a score derived from the Data Envelopment Analysis (DEA) method used to assess the relative efficiency of a set of decision-making units (DMU), in this case, countries. The DEA method creates a virtual frontier of best practices by analyzing the input and output data for all countries with an Efficiency Score of 1, indicating that the country is considered efficient on the DEA frontier. Compared to other countries, it uses its resources (input sub-index) to achieve the best possible talent outcomes (output sub-index). An Efficiency Score Below 1 conveys that a country is not operating on the frontier and potentially improving efficiency. Table 3 provides insights into the talent efficiency of ASEAN-6 based on the GTCI framework, which focuses on the Efficiency Score and its relation to the sub-indices and pillar rankings. Singapore maintains a high ranking in most pillars, with an Efficiency Score (0.9435) suggesting it optimally uses its talent resources. Singapore performs exceptionally well in enabling, attracting, growing, and retaining talent, implying that it effectively converts inputs such as education, infrastructure, and skills into talent-related outputs. Singapore's talent ecosystem is robust, and it efficiently utilizes its resources to foster talent development and retention.

Table 3. ASEAN-6 relative efficiency score based on the GTCI framework

Country	Enable	Attract	Grow	Retain	VT Skills	GK Skills	GTCI Input Sub-Index	GTCI Output Sub-Index	Efficiency Score
Singapore	0.80	84.26	77.84	71.17	73.66	74.92	78.7675	74.290	0.9435
Indonesia	47.99	38.78	39.41	49.98	48.74	16.62	44.7900	32.680	0.7299
Thailand	43.79	44.37	40.19	50.09	41.03	25.16	44.3600	33.095	0.7469
Malaysia	55.56	49.62	45.98	58.77	59.16	39.02	52.4825	49.090	0.9355
Vietnam	46.78	49.58	41.45	42.21	44.55	24.40	44.7550	34.475	0.7707
Philippines	37.72	40.04	42.77	44.86	39.78	30.22	41.0975	35.000	0.8518

Indonesia (0.7299) presents a decent efficiency score, conveying that it is progressing in converting talent inputs into outputs. However, its high ranking Attract (106th) and GK skills (100th) might be due to factors that do not directly

translate into talent benefits (e.g., large workforce, technical proficiency). Indonesia faces efficiency challenges, particularly in enabling and retaining talent. Highlighting policies that enhance talent development and retention can positively impact Indonesia's talent landscape. Thailand (0.7469) has a higher Efficiency Score than Indonesia, suggesting it might be more effective in utilizing its talent pool. Contrarily, a closer look at pillar rankings (Enable:65th, Attarct:92nd) reveals areas for improvement in regulations and attracting top talent. Thailand's efficiency score is lower, conveying challenges in converting inputs into talent-related outcomes. Addressing talent development and attraction gaps can enhance Thailand's overall talent competitiveness. Despite a decent ranking in some pillars (Grow: 44th, Retain: 66th), Malaysia (0.9355) has the second highest Efficiency Score; translating these inputs into talent benefits seems efficient. Malaysia also demonstrates strong talent competitiveness, specifically in attracting and growing talent. Its efficiency score indicates the effective utilization of inputs. Malaysia's talent development and attraction efforts are paying off, contributing to its competitiveness.

Vietnam (0.7707) demonstrates a good Efficiency Score, suggesting it effectively utilizes its talent resources. Also, its pilar ranking (Grow:55th, VT Skills: 71st) implies potential for improvement in education and skills development. Vietnam has the potential for improvement in all dimensions, especially in attracting and growing talent. Strategic investment in education, infrastructure, and talent attraction can elevate Vietnam's competitiveness. The Philippines (0.8518) has the third-highest efficiency score, suggesting excellent value for talent inputs. The Philippines performs mediocre in retaining talent. However, there is room for improvement in other dimensions. Enhancing talent attraction and growth strategies further boosts the country's competitiveness. However, a deeper analysis is needed to understand the reasons behind this score. Low ranking in Attract (102nd) and Retain (92nd) are due to a large OFW and diaspora largely attributed to brain drain. The Efficiency Score provides a valuable metric beyond pillar rankings, presenting how well ASEAN countries use their base talents. Singapore stands out for optimal talent utilization, while others have room for improvement. A high ranking in a pillar (Attract, GK Skills) does not necessarily translate to high efficiency if not coupled with effective utilization—the Philippines' high-efficiency Score warrants further investigation.

4. CONCLUSION AND IMPLICATIONS

This study explored the Talent Competitiveness of Southeast Asian Nations (ASEAN-6) using the GTCI framework based on the released 2023 report. The pillar ranking was examined as GTCI Sub-Indices, and the concept of Efficiency Score was to gain a comprehensive understanding. Singapore stands out, emerging as a regional leader, excelling in attracting, retaining, and developing talent. Its High-Efficiency Score suggests optimal utilization of resources. Indonesia, Thailand, Vietnam, and the Philippines have areas for improvement in various aspects of talent development, as reflected in their pillar rankings and Efficiency Scores ranging from 0.7 to 0.9. Malaysia displayed a more balanced approach across most pillars, presenting the potential for further improvement but a solid foundation for talent development. Despite a lower pillar ranking than others, the Philippines' high-efficiency score needs further investigation. Cultural factors or a significant workforce might contribute to this score.

The Efficiency Score appears as a valuable metric beyond just pillar rankings, revealing how effectively countries translate talent inputs (education, skills) into outputs (innovation, productivity). On the other side, the Data Envelopment Analysis (DEA) was introduced as a potential tool for further analysis, using the GTCI pillars as inputs and the sub-indices as outputs in a DEA model, identifying Singapore as the most efficient country in talent utilization. This analysis relied on hypothetical data and reflected the actual findings of the GTCI 2023 report. For ASEAN-6 policymakers, investing in talent development is crucial for sustained economic growth, which can unlock their full potential and help them thrive in the competitive global landscape. For all ASEAN-6 countries, investing in education and skills development starts by focusing on a program that equips the workforce with the skills needed for evolving the job market, including STEM education, digital literacy, and critical thinking skills. Fostering innovation and entrepreneurship arises from an environment that provides funding for startups, simplifies business regulations, and promotes research and development (R&D). Streamline regulations and reduce bureaucratic hurdles in attracting and retaining talent, simplifying work visa processes and creating a more business-friendly environment. Encouraging a culture of lifelong learning establishes a workforce that can adapt to changing skills demands, offering upskilling and reskilling programs for workers of all ages.

Indonesia, Thailand, and Vietnam should prioritize improving their performance in pillars like "Grow" (Education, Skills Development) and "Enable" (Regulations). Also, promoting a strong focus on "VT Skills" (Vocational & Technical Skills) is beneficial. While showing a more balanced approach, Malaysia can focus on further strengthening areas like "Attract" (Talent Attractiveness) and "GK Skills" (Global Knowledge Skills) to gain a competitive edge. Examine the factors contributing to the Philippines' Efficiency Score. Analyze the role of cultural factors, a large workforce, or specific skill sets that attract talent. Encourage regional collaboration and knowledge sharing among ASEAN, sharing best practices, co-developing talent development programs, and learning from each other's successes and challenges. Explore how technology can improve talent development and management through online learning platforms, AI-powered skills assessments, and data analytics tools for tracking workforce trends. Regularly monitor and evaluate talent development programs to secure their effectiveness, meet objectives, set goals, track progress, and make necessary adjustments.

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