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COMPETENCY MAPPING OF VOCATIONAL EDUCATION GRADUATES OF SOUTH SUMATRA PROVINCE BASED ON LEADING INDUSTRIES USING INPUT-OUTPUT ANALYSIS

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ABSTRACT

The alignment between educational and industrial needs is an important factor in driving economic growth and workforce readiness. In South Sumatra Province, vocational high schools and polytechnics play a crucial role in equipping students with the technical and practical skills necessary for employment in key sectors such as plantations, feed, oil and gas, and coal-based industries. However, there is a gap between the competencies offered by educational institutions and the demands of the growing industry, especially in emerging areas such as digital transformation and sustainability. This study aims to map the competence of vocational schools and polytechnics to leading industries in South Sumatra using Geographic Information Systems (GIS) and input-output analysis. GIS is used to analyze the spatial distribution of educational institutions and their proximity to industrial centers, while input-output analysis assesses competency flows into industry-specific needs. Data on educational programs, graduate output, and industry requirements are compiled and analyzed to identify gaps and areas for improvement. The results reveal strong alignment in traditional industries such as rubber, palm oil, and mining, while significant gaps are observed in emerging areas such as green energy and digital technologies. Urban areas such as Palembang were found to have a higher concentration of educational institutions and diverse programs, while rural areas faced limited access to specialized training. The study emphasizes the importance of modernizing curriculum, investing in infrastructure, and encouraging industry-education collaboration to address these gaps.

Keyword: *Industry-Education Alignment, Vocational Education, Geographic Information Systems (GIS), Input-Output Analysis, Workforce Competency Mapping*

INTRODUCTION

Human resource development is the foundation of economic growth and industrial progress in any region. In South Sumatra Province, an area rich in natural resources and industrial potential, the need for a skilled and adaptable workforce is becoming clearer (Mulyadi et al., 2019; Saputra & Mujiyono, 2022; Supraptono et al., 2018). Along with technological advances and globalization, aligning the competencies of vocational and polytechnic graduates with the needs of leading industries is essential. This alignment not only ensures that graduates can be employed but also increases the productivity and competitiveness of the industry in the region (Chu et al., 2022; Jafar et al., 2020; Zhou et al., 2023)

South Sumatra is characterized by its diverse economic base, covering sectors such as agriculture, manufacturing, mining, and energy. These industries form the backbone of the regional economy and present unique demands on specialized skills and technical expertise (Bohlouli et al., 2020; Yasmin et al., 2020). For example, the region's advantages in palm oil production, coal mining, and the energy sector require a workforce that is proficient in engineering, environmental management, and industrial operations. Similarly, the growth of the service and manufacturing sectors requires competencies in logistics, information technology, and business management (Q. Li & Wu, 2021; Prastowo et al., 2023).

The global shift towards Industry 4.0 further underscores the importance of equipping graduates with digital literacy, analytical skills, and a mindset for continuous learning. As automation, artificial intelligence, and digital technologies reshape the industry, traditional skills must be complemented by

new competencies. Vocational institutions and polytechnics, with their focus on practical training, are uniquely positioned to meet this demand, provided they keep pace with technological advances (Araújo et al., 2023; Montemayor & Chanda, 2023; Sihombing, 2023)

In South Sumatra, the strategic importance of aligning educational outcomes with industrial needs cannot be overstated. The province is poised for economic transformation, driven by infrastructure development and the establishment of industrial zones. To maximize the potential of these developments, there is an urgent need to produce graduates who can contribute effectively to the growth of the industry. This requires a comprehensive understanding of the specific skills and competencies that are in demand in various sectors (Farell et al., 2022; Wibisono & Kartowagiran, 2019).

The alignment of educational outcomes with industrial needs is a critical issue that directly impacts regional development, workforce employability, and industrial competitiveness (Garousi et al., 2018; Heriyanto et al., 2019). In South Sumatra, the presence of diverse vocational high schools and polytechnics highlights the significant potential to meet the demands of leading industries. However, gaps often occur between the competencies taught in these institutions and the evolving skills needs of the industry, especially with the rapid advancements brought about by Industry 4.0. This research seeks to address this gap by identifying and mapping the competencies of vocational and polytechnic graduates with the needs of leading industries in South Sumatra. By understanding these dynamics, this research aims to contribute to more effective educational planning, the improvement of graduate employability, and increased synergy between education and industry for sustainable economic growth in the region (Lee & Hong, 2025).

METHOD

In this study, the Geographic Information System (GIS) is used as the main tool to analyze and visualize the alignment between the competencies of vocational and polytechnic graduates with the demands of the industry in South Sumatra. GIS provides a spatial perspective that allows researchers to identify geographic patterns, trends, and gaps in educational institution distribution, graduate competencies, and industry requirements. This method is particularly effective in regions such as South Sumatra, where the economic landscape is geographically diverse, including urban centers, rural areas, and industrial areas. By integrating spatial data with industry-specific information, GIS helps identify areas where there are competency gaps, offering actionable insights for stakeholders in education and industry (Alrwais, 2024; Sultan et al., 2017)

The input-output analysis method, as referred to in the research title, was also chosen to complement the GIS by providing a quantitative framework for assessing the flow of competencies from educational institutions to industry. This method evaluates the relationships between sectors, identifying how outputs from vocational and polytechnic education (graduates with specific skills) fit into the needs of various industries. Together, GIS and input-output analysis provide a comprehensive approach to competency alignment mapping, ensuring that the study provides reliable, valid, and actionable results to enhance synergy between education and industry in South Sumatra (N. Li et al., 2022; Liu et al., 2022).

RESULTS AND DISCUSSION

Competency Mapping of Vocational High Schools (SMK)

The mapping of vocational school competencies in South Sumatra reveals a variety of skills that are tailored to meet regional economic demands. Schools such as SMKN 2 Sekayu and SMKN 1 Lahat offer technical programs in the fields of automotive light vehicle engineering, construction and property, and industrial electronics. These programs are aligned with South Sumatra's leading industries, especially in manufacturing, mining, and energy. However, gaps are identified in emerging sectors such as digital technologies and renewable energy, where competencies such as software engineering and green energy management remain underrepresented.

The results of the study also highlight the gap in specialization between schools in urban and rural areas. Urban schools tend to offer a broader range of programs, including cutting-edge areas such as visual communication design and computer networking. In contrast, rural schools focus more on traditional skills, such as agriculture and automotive engineering. This gap underscores the need for a more equitable allocation of resources and curriculum development to ensure that students in all regions are equally prepared for the demands of the industry of the future.

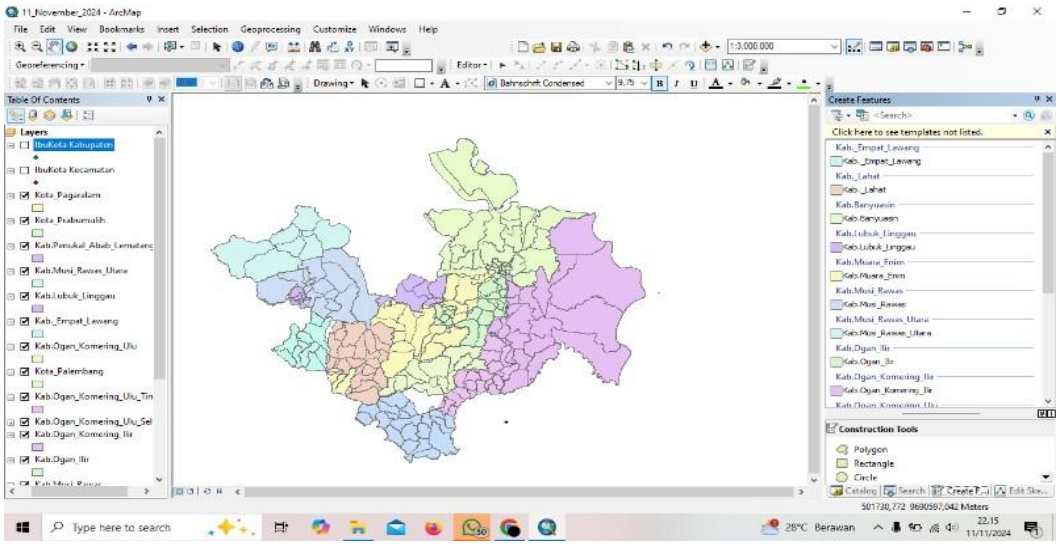

Figure 1. GIS geographical map of South Sumatra Province

Figure 1 shows a geographical map of South Sumatra Province, which was created using the Geographic Information System (GIS). The map displays administrative divisions, including districts (districts) and municipalities (cities), which are clearly distinguished by different colors. This division is critical to identifying the distribution of vocational high schools (SMKs) and their competencies across the region. GIS mapping provides insight into the spatial arrangement of educational institutions and their proximity to industrial centers. By analyzing this map, the gap in vocational school availability between urban and rural becomes clear. Urban areas such as Palembang, which serve as economic and industrial centers, show a higher concentration of institutions offering a diverse range of technical programs. In contrast, rural areas have fewer schools, often with a narrower range of specializations that focus on traditional industries such as agriculture and automotive engineering.

Polytechnic Competency Mapping

Polytechnics in South Sumatra show significant potential to supply skilled graduates in key industrial sectors. Institutions such as the Sriwijaya State Polytechnic and the Akamigas Polytechnic of Palembang specialize in chemical engineering, oil and gas processing, and mechanical engineering—fields that are important to the region's economy. In addition, Palembang Darusalam Polytechnic has diversified its programs with an applied bachelor's degree in international business administration and multimedia engineering technology, reflecting a shift towards integrating global business trends and advanced technologies into education.

Despite these strengths, certain areas require further attention. For example, while some polytechnics offer strong programs in engineering and energy-related fields, there is a lack of focus on environmental management and sustainability areas that are increasingly important to regional and global industries. In addition, the participation of programs such as data science and artificial intelligence is still limited, indicating the need to modernize the curriculum to prepare graduates to face the challenges of Industry 4.0.

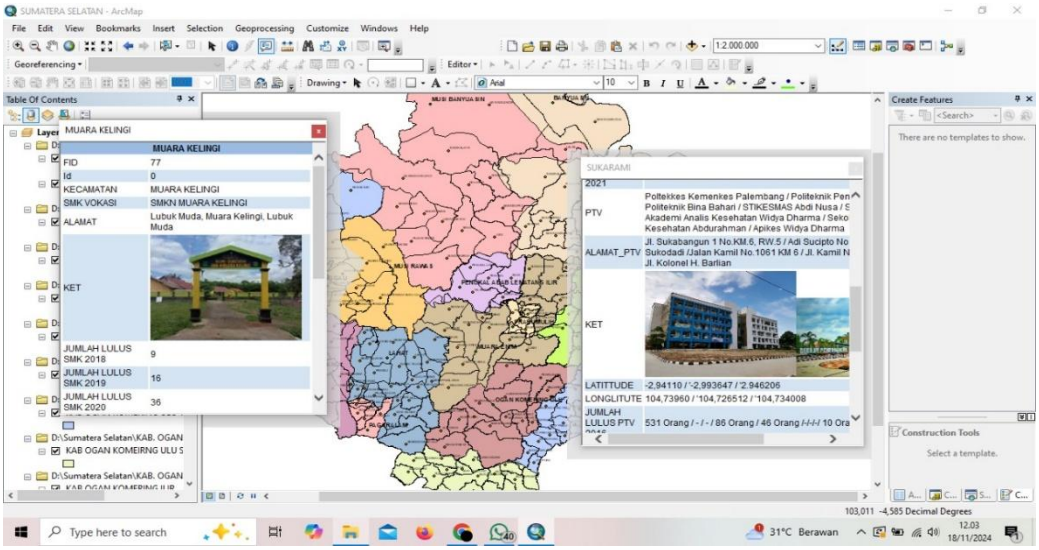

Figure 2. GIS vocational high schools (SMK) and polytechnics throughout South Sumatra Province

Figure 2 illustrates the geographical distribution of vocational high schools (SMK) and polytechnics throughout South Sumatra Province, using GIS as the main tool for visualization. The map highlights the province's administrative area, with markers and pop-up details for specific institutions, including locations, addresses, and important information about students' graduation numbers.

Spatial Analysis Using GIS

Geographic Information System (GIS) integration provides valuable insights into the spatial distribution of competencies and industrial needs throughout South Sumatra. GIS mapping reveals clusters of educational institutions in urban centers such as Palembang and Lahat, where most vocational schools and polytechnics are concentrated. These areas benefit from proximity to industrial zones, allowing for closer collaboration between education and industry. However, rural areas such as Ogan Komering Ulu Timur face challenges due to the limited availability of vocational schools and polytechnics, which limits access to specialized training for students in these areas. The GIS analysis also highlights mismatches in the supply and demand of competencies. For example, while the industry in Musi Banyuasin requires skills in the field of refrigeration and air conditioning engineering, these competencies are only offered by a few institutions, such as Sekayu Polytechnic. This discrepancy demonstrates the need for targeted initiatives to expand educational programs in specific fields and regions to better align with industry demands.

Table 1. List of Polytechnics and Institutions in South Sumatra Province by Location

Number	Polytechnics	Adress	Latitude	Longitude
1	Politeknik Penerbangan	Adi Sucipto No. 001, Sukodadi, Kecamatan Soekarami, Palembang, Sumatera Selatan 30961	-2.993647	104.726512
2	Politeknik AKAMIGAS	Area Diklat Plaju, Jl. Kb. Jahe, Komperta, Plaju District, Palembang, South Sumatra 30268, Indonesia	-2.999980	104.820530
3	Politeknik Pariwisata	Jalan Sapta Pesona No. 10, Silabranti District, Jakabaring Sport City Complex	-3.013787	104.785135
4	Politeknik Trans SDP	Jl. Sabar Jaya No. 116, Mariana, Banyuasin I District, Banyuasin Regency, South Sumatra 30962	-2.952348	104.885630
5	Politeknik Negeri Sriwijaya	Jl. Srijaya Negara, Bukit Besar, Palembang	-2.983128	104.732983
6	Politeknik Bina Bahari	Jalan Kamil No. 1061, Sukarame District KM 6, Palembang	-2.946206	104.734008

Number	Polytechnics	Adress	Latitude	Longitude
7	ASMI	Jl. Kol. H. Burlian, Lr. Peristiwa No. 259, RT 05 RW 02 KM 5, Palembang, South Sumatra 30153	-2.955163	104.731530
8	Politeknik Darussalam	Jalan Basuki Rahmat No. 1608 E-F, Palembang	-2.959873	104.739769
9	STIKES Hesti Wira;	Benteng Kuto Besak, Jl. Sultan Mahmud Badaruddin II No. 1, 19 Ilir, Bukit Kecil District, Palembang, South Sumatra 30113	-2.990860	104.759060
10	AKIPBA	Jalan Raya Bukit Asam, Muara Enim	-3.762030	103.789950
11	Poltekkes Palembang	Jalan Jenderal Sudirman KM 3.5 No. 1365, Next to Masjid Ash-Shofa, RS Moh. Hoesin Complex, Palembang, 30114	-2.941100	104.739600

Source: Primery Data, 2024

Table 3 provides a detailed list of polytechnics and related educational institutions throughout South Sumatra Province, highlighting their respective addresses and geographical coordinates (latitude and longitude). This comprehensive information offers a spatial perspective on the distribution of higher education institutions in the region, which is essential for understanding their accessibility and proximity to industrial centers. The institutions listed in this table are mainly located in urban centers such as Palembang, which reflects the concentration of educational resources in areas with well-developed infrastructure and economic activities. Institutions such as the Sriwijaya State Polytechnic and the AKAMIGAS Polytechnic are strategically positioned to support key industries such as oil and gas, mechanical engineering, and chemical engineering, which are important to the South Sumatra economy.

Aligning Education with Industry Needs

These findings underscore the importance of a strategic approach to align educational outcomes with industry requirements in South Sumatra. While vocational schools and polytechnics are showing strength in traditional industries such as mining and manufacturing, there is an urgent need to modernize programs to address emerging trends, including digital transformation and sustainable development. Strengthening collaboration between educational institutions and industry is essential to achieve this alignment.

Addressing regional disparities is critical to ensuring equitable access to quality education and training. Investments in infrastructure, teacher training, and curriculum development in rural areas can help bridge the gap between urban and rural institutions. Policies that incentivize industry to establish training partnerships with schools and polytechnics in underserved areas can also play an important role in creating a balanced and inclusive workforce development system.

The integration of GIS and input-output analysis in this study provides a replicable framework for competency mapping. This method not only identifies gaps but also offers actionable insights for policymakers, educators, and industry leaders to design solutions collaboratively. By utilizing these tools, South Sumatra can position itself as a model region for aligning vocational education with industrial needs, encouraging sustainable economic growth and workforce development.

Table 4. Industri Unggulan Provinsi Sumatera Selatan

Category	Industry
A. Plantation-Based Industry	Rubber Industry
	Coffee Industry
	Palm Oil Industry
B. Agricultural Resource-Based Feed Industry	Livestock/Fish Feed Industry
	Corn Industry

	Cassava Industry
	Soybean Industry
	Plantation and Palm Oil Mill Waste Industry
	Fish Waste Industry
C. Oil, Gas, and Coal-Based Industry	Oil and Gas Industry
	Coal-Based Industry

Source: Department of Industry, South Sumatra Province, 2024.

Table 4 highlights the leading industries in South Sumatra Province, which are categorized into three main sectors: the plantation industry, the agricultural resource-based feed industry, and the oil and gas and coal-based industry. These industries form the backbone of the province's economy and reflect the region's rich natural resources and industrial potential.

Plantation Industry

This sector includes the rubber, coffee, and palm oil industries, which are very important for the economy of South Sumatra. This commodity is a major export product and promotes employment and income creation in rural areas.

Agricultural Resource-Based Feed Industry

This category consists of the livestock and fish feed industries that utilize by-products from agriculture and fisheries. Sub-industries such as corn, cassava, and soybean production, as well as the treatment of waste from plantations, palm oil mills, and the fish industry, highlight the province's focus on sustainable and resource-efficient practices.

Oil and Gas and Coal Based *Industries*

South Sumatra is known for its significant oil, gas, and coal reserves. These industries play an important role in regional and national energy supply chains, contributing to economic growth and industrialization.

This table serves as a valuable reference for aligning educational programs with the needs of this industry. By identifying the key sectors that drive South Sumatra's economy, vocational schools and polytechnics can tailor their curricula to equip graduates with the skills and expertise necessary to meet the demands of the industry today and tomorrow. In addition, the data provides a roadmap for policymakers and educators to design training and development programs that support workforce readiness and regional economic sustainability.

CONCLUSION

This study highlights the critical need to align educational outcomes with the dynamic industrial demands of South Sumatra Province. Vocational high schools and polytechnics play a crucial role in supplying skilled graduates to key sectors such as plantations, feed, oil and gas, and manufacturing. However, gaps remain in addressing emerging trends, such as digital transformation, environmental sustainability, and Industry 4.0 technology. The integration of GIS and input-output analysis provides actionable insights into the spatial distribution of educational institutions and the alignment of their competencies with industry needs. These tools identify gaps between urban and rural areas, where urban centers have a higher concentration of institutions and broader program offerings, while rural areas remain underserved. To address these challenges, it is critical to modernize the curriculum, invest in infrastructure and teacher training, and foster stronger partnerships between educational institutions and industry. The effort will ensure that students across the region have equitable access to quality education and training that prepares them for an ever-evolving workforce landscape. By utilizing the findings of this research, South Sumatra can position itself as a model for aligning education

with industrial needs, encouraging economic growth, and achieving sustainable workforce development. This strategic approach will not only improve employability for graduates but also contribute to the long-term competitiveness of the industry in the region on a national and global scale.

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