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Application of the Analytic Hierarchy Process (AHP) in Strategic Site Selection for Software Development Branch Expansion in Indonesia

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***Abstract*— In an era where digital transformation dictates the survival of technology firms, selecting the optimal branch location is no longer a peripheral decision; it is a strategic imperative. This study offers a powerful yet practical application of the Analytic Hierarchy Process (AHP) to evaluate potential expansion sites for a mid-sized software development company in Indonesia. By integrating expert judgments with location-specific criteria such as talent availability, infrastructure reliability, ecosystem proximity, and cost efficiency, the AHP model provides a structured, transparent, and replicable framework for decision-making. The results clearly identify Location an urban tech hub near major IT universities as the most strategic choice, significantly outperforming other alternatives. More than just a location ranking, this model demonstrates how conventional decision-making in software enterprise expansion can be elevated through applied analytical thinking. The study also proves that even without high-end analytics platforms, decision models built in common tools like Excel can yield robust and scalable insights. These findings carry immediate relevance for technology firms, policy planners, and academic researchers who seek to align operational expansion with long-term innovation and productivity outcomes in knowledge-based industries.**

***Index Terms*— Analytic Hierarchy Process; Branch Location; Software Industry; Strategic Decision-Making**

I. INTRODUCTION

The convergence of digital transformation and global software demand has shifted how technology companies structure their growth strategies, particularly in expanding their operational footprint through new development hubs. For software development firms, especially in emerging economies like Indonesia, strategic branch location is no longer a secondary concern. It is a central determinant of project execution speed, developer retention, infrastructure reliability, and overall service quality. (Asawawibul et al., 2025; Mikalef et al., 2019; Pakurár et al., 2019). Unlike traditional industries, where logistics and material flow are central to location strategy, the software industry is governed by subtler variables such as access to digital talent, ecosystem maturity, regulatory certainty, and knowledge spillovers. The increasing reliance on distributed teams, hybrid collaboration models, and infrastructure-as-a-service has not diminished the importance of physical branch placement. Rather, it has complicated it. Locating a development branch in a region with robust digital infrastructure, proximity to universities or incubators, and favorable policy environments can enhance productivity in ways that are not immediately visible on a balance sheet but are eventually reflected in code quality, cycle time, and client satisfaction. These spatial dimensions of digital productivity require a structured approach to decision making that goes beyond intuition or informal benchmarking.

Multi-criteria decision-making (MCDM) tools provide a systematic framework to balance competing location priorities. Among the available methodologies, the Analytic Hierarchy Process (AHP) stands out for its ability to integrate qualitative judgments with quantitative outcomes through a transparent, repeatable mechanism (Dolatabad et al., 2022; Elkady et al., 2024; Pörtner et al., 2025). By translating expert pairwise comparisons into hierarchical weights, AHP facilitates location assessments that are not only consistent but also customizable to a firm's strategic goals. AHP has been applied in various fields, including healthcare, logistics, retail, and

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public planning (Apichonbancha et al., 2024; Duleba, 2020; Szabo et al., 2021). However, within the software development sector, its usage has been sporadic and largely confined to isolated decision problems rather than integrated strategic frameworks. The software characteristics of the software industry, its reliance on human capital, abstraction, and continuous iteration, are rarely reflected in existing AHP models, which often prioritize infrastructure and cost variables more suited to physical industries.

Furthermore, there has been limited exploration of how AHP-based location selection affects downstream productivity outcomes in the software domain. While many studies stop at ranking location alternatives based on static criteria, few attempt to link these choices to operational metrics such as sprint velocity, defect rates, or staff onboarding duration. This disconnect underscores a subtle yet critical limitation in current research, one that calls for contextualized, sector-specific applications of MCDM methodologies. Additionally, although the integration of AHP with Decision Support Systems (DSS) and Geographic Information Systems (GIS) has enhanced visualization and data interaction in other industries (Eldrandaly, 2011; Moradi et al., 2020; Pavani et al., 2024; Qureshi & Ghavami, 2024), such tools remain underutilized in the software industry. Particularly among small and mid-sized technology firms in Indonesia, decision-making processes still rely heavily on personal experience, peer imitation, or opportunistic expansion despite the availability of robust analytical tools.

This study responds to those conditions. It proposes a structured application of the AHP method for evaluating branch location alternatives within a software development firm, using criteria that reflect the unique operational contours of digital production. These include developer density, broadband stability, talent incubation presence, and regulatory ease. The model operates managerial intuition through systematic pairwise evaluation and computes consistency to ensure rational outcomes. While the AHP method itself is well established, this study diverges from conventional use by applying it to a context where location impacts are less visible but no less consequential. Rather than positioning itself as a methodological innovation, this research illustrates how a classical decision framework, when recalibrated to sectoral realities, can generate new value in decision quality and strategic alignment. In doing so, it strengthens the relevance of AHP not by changing its form, but by adjusting its function.

This effort is not only methodological. In a digital economy where talent distribution, infrastructure readiness, and ecosystem maturity vary significantly across regions, location strategy must be handled with the same analytical rigor as product development or financial forecasting. By grounding branch location planning in structured evaluation, this study offers practical utility for decision makers and opens the door for further integration of AHP-based models within digital DSS environments tailored for software firms. In summary, while the tools are not new, their application here is both timely and contextually necessary. The contribution of this work lies in how it reshapes an existing methodology to suit an under-addressed yet strategically vital domain branch expansion in the software development sector. It acknowledges that while software can be built anywhere, it cannot flourish everywhere equally.

II. METHODS

This study employs a structured multi-criteria decision-making approach using the Analytic Hierarchy Process (AHP) to determine the most appropriate location for the expansion of a software development company in Indonesia. Given the complexity of strategic spatial decisions in the digital sector, the AHP method was selected due to its ability to integrate both qualitative expert opinions and quantitative data into a logically consistent decision model. AHP has been widely applied in strategic location planning in various industries, including logistics, healthcare, and digital services, making it particularly relevant for this study.

2.1 Research Design

The research adopts a descriptive-analytical design to evaluate potential branch locations using structured managerial judgment and literature-based criteria. The approach involves identifying decision objectives, selecting relevant criteria and location alternatives, applying the AHP method to assess the importance of each criterion, and synthesizing the results to derive a recommended decision. This process emphasizes decision transparency, replicability, and practical relevance to the strategic context of software enterprise

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expansion.

2.2 Selection of Criteria and Alternatives

Four main criteria were identified for evaluating branch location alternatives:

a) Talent Availability: Refers to the accessibility and quality of human resources, particularly software developers and IT professionals, in the surrounding area.
b) Digital Infrastructure: Includes the reliability and speed of internet connectivity, access to power supply, and supporting digital utilities.
c) Operational Cost: Encompasses rental costs, utility expenses, and general affordability of setting up and maintaining a development office.
d) Innovation Ecosystem Proximity: Describes the level of integration with universities, tech incubators, startups, and government-supported digital initiatives.

These criteria were selected based on both recent academic literature and expert consultation within the company. They reflect the core strategic concerns of digital firms whose productivity depends on talent, technology access, collaboration potential, and cost efficiency.

Three location alternatives were evaluated:

a) Location A: An urban digital hub near two leading universities.
b) Location B: A suburban area with low operating costs but moderate infrastructure.
c) Location C: A creative-tech corridor with active startup communities and average internet quality.

2.3 Data Collection

Primary data were obtained through structured interviews and expert questionnaires administered to five internal decision-makers, including business development managers, project leaders, and the CTO. Participants were selected based on their involvement in strategic decision-making and their familiarity with operational expansion planning. Pairwise comparisons were used to capture the relative importance of each criterion and the preference among the location alternatives. Respondents were asked to compare criteria in pairs (e.g., “Which is more important: talent availability or operational cost?”) and to assess which locations better satisfied specific criteria (e.g., “Which location has better infrastructure?”). The responses were entered into a spreadsheet model developed in Microsoft Excel to ensure accessibility and reproducibility.

2.4 Application of the AHP Method

The AHP implementation consisted of the following steps:

a) Hierarchy Development: A three-tiered hierarchy was created, consisting of the goal (selecting the optimal location), the decision criteria, and the location alternatives.
b) Pairwise Comparison: Each criterion was compared with every other criterion to derive its relative importance. Likewise, each alternative was assessed in relation to each criterion.
c) Weight Calculation: The normalized weights for each criterion and each alternative were derived from the expert input.
d) Consistency Check: A consistency ratio (CR) was computed for each comparison matrix. A CR value below 0.10 was considered acceptable, ensuring that the judgments were logically consistent.
e) Result Synthesis: The final scores for each location were calculated by multiplying the weight of each criterion by the performance score of each alternative and then summing the results.

Excel was selected as the implementation platform due to its widespread use, transparency, and user-friendly nature. This choice also supports future use by the company’s internal teams without requiring specialized software or external consultants.

2.5 Practical Contribution

The methodological choice to apply AHP in this context offers more than theoretical clarity. It equips decision-makers with a structured yet adaptable tool to evaluate strategic alternatives under uncertainty. While the mathematical aspects of AHP are not emphasized in this report, the logic and transparency of the process are preserved, making the model practical for real-world applications. Moreover, this methodology enables the firm to align location selection with broader organizational goals such as increasing developer efficiency, improving collaboration environments, and supporting long-term scalability. The flexibility of the AHP model also allows for

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further integration into decision support systems (DSS) in the future.

III. Results and Discussion

This section presents the results of the AHP analysis conducted to evaluate and prioritize candidate locations for the branch expansion of a software development company. The analysis focuses on four main criteria: proximity to technology hubs (universities), digital infrastructure, cost of operation, and access to innovation ecosystems. These factors were selected based on interviews with stakeholders and aligned with recent findings in location strategy for digital enterprises (Brunetti, 2020; Hwabamungu & Shepherd, 2024; Kraus et al., 2023; Martínez-Peláez et al., 2023; Robertsone & Lapiņa, 2023). The AHP framework yielded a ranking of three location alternatives: Location A (urban tech hub), Location B (suburban business park), and Location C (startup-dense corridor). Pairwise comparison matrices were developed for each criterion and alternative. Experts used a 1–9 scale to assess the importance of each factor relative to the goal. Excel was utilized for calculations to maintain transparency and support reproducibility. After consistency checks, all comparison matrices returned to a Consistency Ratio (CR) below 0.1, indicating logical coherence in expert judgments.

The synthesized priority weights for the decision criteria were as follows:

a) Proximity to Universities and Talent: 0.41
b) Digital Infrastructure: 0.28
c) Operational Cost: 0.19
d) Innovation Ecosystem Access: 0.12

These weights highlight the overriding importance of human capital availability in the context of software productivity, consistent with studies emphasizing developer-centric site strategy. (Abassi et al., 2025; Berman et al., 2024; Chen et al., 2025; Crnogaj & Rus, 2023; Mainardi, 2025; Sharma et al., 2024; Tekman & Ordu, 2025). Location A achieved the highest overall score of 0.698, due to its strong proximity to major IT universities, high-quality broadband infrastructure, and ongoing government-sponsored tech programs. This indicates a favorable environment for talent recruitment and agile development processes, factors critical to maintaining competitiveness in the software industry. Location B followed with a score of 0.213, offering moderate infrastructure and lower cost but weaker access to tech talent. Location C ranked last at 0.089, despite a strong startup culture, due to lower scores in infrastructure and accessibility.

This prioritization supports the idea that while innovation networks matter, proximity to universities and stable digital infrastructure play a more immediate role in enabling scalable, productive operations. Similar conclusions were drawn in other empirical studies on digital service expansion. (Alenezi, 2023; Alghamdi, 2024; Esposito et al., 2025; Shen et al., 2023). The results further validate the AHP method's effectiveness in delivering nuanced, evidence-based decisions without requiring excessive computation or proprietary tools. As the company plans further regional scaling, this model provides a repeatable framework for evaluating future sites across different cities. It also enables firms to simulate "what-if" scenarios—e.g., how would results shift if operational cost becomes more critical than talent access?

From a managerial standpoint, the AHP analysis demonstrates that strategic location decisions should be grounded in structured criteria and consensus-building methods, not merely based on intuition. Additionally, using accessible tools like Excel makes this approach scalable for internal adoption by SMEs and startups that lack advanced decision-support infrastructure. While this study is limited to three alternatives and four criteria, the methodology allows for expansion and refinement. Future applications may incorporate dynamic inputs such as real-time job market analytics or infrastructure evolution forecasts, linking decision-making even more tightly with productivity outcomes and regional development trends.

IV. Conclusion

This study applied the Analytic Hierarchy Process (AHP) to support strategic decision-making in selecting a new branch location for a software development company in Indonesia. Through structured criteria including proximity to talent sources, digital infrastructure, operational costs, and innovation ecosystem access, this research demonstrated the effectiveness of AHP in synthesizing expert judgments into a reliable and replicable decision framework. The findings revealed that Location A emerged as the most favorable option, driven primarily by its strong proximity to top-tier IT universities and robust infrastructure. The quantitative weights assigned

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to each criterion reinforced the argument that talent accessibility and digital readiness significantly outweigh cost considerations in the context of software enterprise productivity. This result is consistent with contemporary trends in digital entrepreneurship and location optimization, where strategic access to human capital and enabling technologies is often prioritized over short-term financial efficiency.

Moreover, the use of a user-friendly tool such as Excel for model implementation validated the approach's accessibility and scalability, particularly for small to medium-sized enterprises (SMEs) operating without advanced analytics infrastructure. The method not only supported a clear decision but also encouraged internal consensus and managerial learning throughout the process. In sum, the application of AHP in this study does more than facilitate a single decision. It lays the foundation for an adaptable, transparent, and resource-efficient model for future location planning. As digital firms navigate an increasingly competitive and dynamic landscape, structured decision tools like AHP will be instrumental in aligning operational expansion with long-term strategic goals.

REFERENCES

Abassi, B. et al. (2025). Optimal Multi-Period Manufacturing–Remanufacturing–Transport Planning in Carbon Conscious Supply Chain: An Approach Based on Prediction and Optimization. In *Sustainability* (Vol. 17, Issue 11). https://doi.org/10.3390/su17115218

Alenezi, M. (2023). Digital Learning and Digital Institution in Higher Education. *Education Sciences*, *13*. https://doi.org/10.3390/educsci13010088

Alghamdi, H. (2024). Assessing the Impact of Enterprise Architecture on Digital Transformation Success: A Global Perspective. In *Sustainability* (Vol. 16, Issue 20). https://doi.org/10.3390/su16208865

Apichonbancha, P. et al. (2024). Integration of Principal Component Analysis with AHP-QFD for Improved Product Design Decision-Making. In *Applied Sciences* (Vol. 14, Issue 14). https://doi.org/10.3390/app14145976

Asawawibul, S. et al. (2025). The influence of cost on customer satisfaction in e-commerce logistics: Mediating roles of service quality, technology usage, transportation time, and production condition. *Journal of Open Innovation: Technology, Market, and Complexity*, *11*(1), 100482. https://doi.org/https://doi.org/10.1016/j.joitmc.2025.100482

Berman, A. et al. (2024). Trustworthy AI in the public sector: An empirical analysis of a Swedish labor market decision-support system. *Technology in Society*, *76*, 102471. https://doi.org/https://doi.org/10.1016/j.techsoc.2024.102471

Brunetti, F. (2020). Digital transformation challenges: strategies emerging from a multi-stakeholder approach. *TQM Journal*, *32*(4), 697–724. https://doi.org/10.1108/TQM-12-2019-0309

Chen, G. et al. (2025). Collaborative Multi-Objective Optimization of Combustion and Emissions in Circulating Fluidized Bed Boilers Using the Bidirectional Temporal Convolutional Network and Hybrid Dung Beetle Optimizer. In *Sustainability* (Vol. 17, Issue 11). https://doi.org/10.3390/su17115225

Crnogaj, K., & Rus, M. (2023). From Start to Scale: Navigating Innovation, Entrepreneurial Ecosystem, and Strategic Evolution. In *Administrative Sciences* (Vol. 13, Issue 12). https://doi.org/10.3390/admsci13120254

Dolatabad, A. H. et al. (2022). Analyzing the key performance indicators of circular supply chains by hybrid fuzzy cognitive mapping and Fuzzy DEMATEL: evidence from healthcare sector. *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-022-02535-9

Duleba, S. (2020). Introduction and comparative analysis of the multi-level parsimonious AHP methodology in a public transport development decision problem. *Journal of the Operational Research Society*, *73*. https://doi.org/10.1080/01605682.2020.1824553

Eldrandaly, K. (2011). *GIS AND SPATIAL DECISION MAKING*.

Elkady, S. et al. (2024). Prioritizing stakeholder interactions in disaster management: A

p-ISSN 2622-2027
e-ISSN 2622-2035

TOPSIS-based decision support tool for enhancing community resilience. *Progress in Disaster Science*, *22*, 100320. https://doi.org/https://doi.org/10.1016/j.pdisas.2024.100320

Esposito, M. et al. (2025). *Digitalization in Emerging Economies*. Cambridge University Press. https://doi.org/DOI: 10.1017/9781009433921

Hwabamungu, B., & Shepherd, P. (2024). The Influence of Stakeholder Involvement in the Adoption of Digital Technologies in the UK Construction Industry. In *Informatics* (Vol. 11, Issue 4). https://doi.org/10.3390/informatics11040097

Kraus, S. et al. (2023). From moon landing to metaverse: Tracing the evolution of Technological Forecasting and Social Change. *Technological Forecasting and Social Change*, *189*, 122381. https://doi.org/https://doi.org/10.1016/j.techfore.2023.122381

Mainardi, I. (2025). Change management: artificial intelligence (AI) at the service of public administrations. *AI & SOCIETY*, *40*(5), 3953–3981. https://doi.org/10.1007/s00146-024-02136-2

Martínez-Peláez, R. et al. (2023). Role of Digital Transformation for Achieving Sustainability: Mediated Role of Stakeholders, Key Capabilities, and Technology. *Sustainability*, *15*, 11221. https://doi.org/10.3390/su151411221

Mikalef, P. et al. (2019). Big data analytics and firm performance: Findings from a mixed-method approach. *Journal of Business Research*, *98*, 261–276. https://doi.org/https://doi.org/10.1016/j.jbusres.2019.01.044

Moradi, S. et al. (2020). Multi-criteria decision support system for wind farm site selection and sensitivity analysis: Case study of Alborz Province, Iran. *Energy Strategy Reviews*, *29*, 100478. https://doi.org/https://doi.org/10.1016/j.esr.2020.100478

Pakurár, M. et al. (2019). The Service Quality Dimensions that Affect Customer Satisfaction in the Jordanian Banking Sector. In *Sustainability* (Vol. 11, Issue 4). https://doi.org/10.3390/su11041113

Pavani, P. et al. (2024). Geographic Information Systems Applications in Business Decision-Making. *E3S Web of Conferences*, *529*. https://doi.org/10.1051/e3sconf/202452904006

Pörtner, L. et al. (2025). Data Management Maturity Model—Process Dimensions and Capabilities to Leverage Data-Driven Organizations Towards Industry 5.0. In *Applied System Innovation* (Vol. 8, Issue 2). https://doi.org/10.3390/asi8020041

Qureshi, S. A. M., & Ghavami, S. M. (2024). AquMADE: A GIS-based web application to assess groundwater quality by introducing a risk-based irrigation water quality index (RB-IWQI). *Environmental Modelling & Software*, *176*, 106009. https://doi.org/https://doi.org/10.1016/j.envsoft.2024.106009

Robertsone, G., & Lapiņa, I. (2023). Digital transformation as a catalyst for sustainability and open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(1), 100017. https://doi.org/https://doi.org/10.1016/j.joitmc.2023.100017

Sharma, M. et al. (2024). Role of industry 4.0 technologies and human-machine interaction for de-carbonization of food supply chains. *Journal of Cleaner Production*, *468*, 142922. https://doi.org/https://doi.org/10.1016/j.jclepro.2024.142922

Shen, L. et al. (2023). Consolidating digital servitization research: A systematic review, integrative framework, and future research directions. *Technological Forecasting and Social Change*, *191*, 122478. https://doi.org/https://doi.org/10.1016/j.techfore.2023.122478

Szabo, Z. K. et al. (2021). An Analytic Hierarchy Process Approach for Prioritisation of Strategic Objectives of Sustainable Development. In *Sustainability* (Vol. 13, Issue 4). https://doi.org/10.3390/su13042254

Tekman, N., & Ordu, M. (2025). The Rise and Fall of Regions: A Hybrid Multi-Criteria Analysis of Türkiye's Regional Economies' Sustainable Performance. In *Sustainability* (Vol. 17, Issue 11). https://doi.org/10.3390/su17115222