

Development Strategy of Surabaya Aviation Polytechnic: An Ansoff Matrix Approach to Enhancing the Competitiveness of Aviation Vocational Education

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ARTICLE INFO

Article History

Received: 04 July 2026

Revised: 27 August 2026

Accepted: 25 September 2026

Keywords

Ansoff matrix, Aviation vocational education, Competency-based training, Institutional readiness, Public-sector strategy



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ABSTRACT

Aviation vocational institutions must respond to technological change and workforce demand while complying with civil-aviation regulations. This study examines how four Ansoff growth options are manifested and prioritized at Surabaya Aviation Polytechnic. Using a single-case design, data were collected through semi-structured interviews with 12 informants, 15 observations from January to March 2026, and analysis of strategic plans, performance reports, accreditation records, and partnership agreements. Hybrid framework analysis combined inductive coding with deductive mapping to Ansoff quadrants. The findings show that market penetration is embedded in quality improvement and competency certification, while market development involves partnerships, exchanges, and international training. Product development focuses on applied-degree transformation, specialist training, and facility modernization, whereas diversification remains a higher-risk, long-term option. Product and market development are the most feasible medium-term priorities, subject to regulatory approval, institutional capacity, infrastructure, and partnership readiness. The study offers a contextual adaptation of Ansoff for a safety-critical public institution. As a single-site study dominated by internal perspectives, the findings reflect strategic perceptions and documented intentions rather than verified outcomes.

1. INTRODUCTION

The aviation workforce is being reshaped by automation, artificial intelligence, advanced air mobility, cybersecurity, and sustainability requirements (Abu Talib et al., 2025). The International Civil Aviation Organization (ICAO) identifies workforce shortages and changing competence requirements as strategic risks to the safety and continuity of global aviation. Its Next Generation of Aviation Professionals (NGAP) strategy therefore emphasizes workforce forecasting, relevant education and training, collaboration among regulators, industry, and academia, and the international recognition of competencies (International Civil Aviation Organization, 2025). These pressures require aviation education providers to treat curriculum renewal as both an employability issue and a safety-governance obligation.

This challenge is especially pronounced in technical and vocational education and training (TVET), where institutional relevance depends on the alignment of curricula, instructors, equipment, assessment, and workplace practice. UNESCO's TVET Strategy 2022-2029 places digital and green transitions, inclusive access, and private-sector collaboration at the center of system transformation (UNESCO, 2022). Cedefop (2023) likewise shows that digital and green transitions are changing skill demand and increasing the importance of timely skills intelligence (Cedefop, 2023). At the institutional level, digital change cannot be reduced to purchasing new technology; it requires coordinated development of teaching, personnel, organization, partnerships, and technical support (Wagner & Gerholz, 2026).

Aviation vocational education also differs from a conventional education market because program innovation is bounded by civil-aviation regulation. Where an institution offers regulated pilot or aircraft-maintenance training, Indonesian certification and surveillance requirements under Civil Aviation Safety Regulations (CASR) Parts 141 and 147 govern syllabi, facilities, instructors, operating procedures, and continuing oversight (Directorate General of Civil Aviation, 2017a, 2017b). New technology-oriented programs must also retain human-factors and safety-management content so that automation, cyber systems, and advanced equipment are introduced without weakening situational awareness, teamwork, or risk control (International Civil Aviation Organization, 2018). Accordingly, growth in this sector is not simply a matter of adding products or entering markets; it is a regulated capability-development process (Bjerke, 2026; Zhou et al., 2026).

The Ansoff product-market growth matrix distinguishes four strategic options: market penetration, market development, product development, and diversification (Ansoff, 1957; Cullen, 2026; Sufyandi Aditiya & Kirana, 2024). Its simplicity makes it useful for structuring growth choices, but its assumptions originated in a for-profit corporate setting characterized by price signals, flexible resource allocation, and commercial returns. Higher education operates under different conditions, including public mandates, professional regulation, multiple stakeholders, and contested definitions of performance. Strategic management in higher education therefore requires adaptation rather than direct transfer of corporate models (Ozsen et al., 2023).

Prior work demonstrates both the usefulness and the limits of applying Ansoff in education. Murage et al. (2025) examined chartered universities in Kenya and found that the joint Ansoff model was associated with institutional performance; market development had a positive relationship, whereas diversification had a negative relationship (Murage et al., 2025). This evidence is important, but it concerns university-level performance measured through a cross-sectional survey rather than qualitative implementation in a safety-critical vocational institution. Broader studies of vocational

systems emphasize governance, institutional coordination, and policy transfer (Tütlys et al., 2021), while research on digital vocational-school development identifies personnel and technological capability as decisive conditions (Wagner & Gerholz, 2026). What remains insufficiently explained is how the four Ansoff options are interpreted, evidenced, and sequenced inside a regulator-bound aviation polytechnic.

Surabaya Aviation Polytechnic provides an informative case because it combines an aviation-safety mandate with the financial and operational flexibility of an Indonesian Public Service Agency (Badan Layanan Umum, BLU). BLU governance permits flexible financial management to improve public services, but the institution remains a government unit that does not primarily pursue profit (Government of Indonesia, 2005). This creates a mission paradox between public educational obligations and non-tax revenue generation, and a capability paradox between ambitions for digital specialization and public-sector constraints on talent, investment, and procurement. These features make the case analytically relevant for testing how a corporate growth framework must be moderated by public-service and regulatory conditions.

This study therefore aims to analyze the development strategy of Surabaya Aviation Polytechnic through a contextually adapted Ansoff framework. Its contribution is empirical and contextual: it shows how product-market choices interact with regulation, institutional readiness, and BLU governance in aviation vocational education. The study addresses three research questions: (RQ1) How are the four Ansoff quadrants manifested in the strategic practices and plans of Surabaya Aviation Polytechnic? (RQ2) Which quadrants are prioritized, and on what institutional grounds? (RQ3) What readiness conditions and regulatory constraints enable or limit each strategy?

2. METHODS

Research Design and Positionality

This study used a descriptive qualitative single-case design. A case approach was appropriate because the research questions concern how strategic categories are interpreted and enacted within a specific institutional, regulatory, and governance setting rather than the statistical effect of strategies across institutions. Reporting was strengthened with reference to the Standards for Reporting Qualitative Research (Braun & Clarke, 2025; Zhao et al., 2026).

The author team included three researchers affiliated with the institution under study and two researchers from external universities. The insider position improved access to institutional processes and documents but also created risks of social-desirability bias and overly favorable interpretation. In the revised reporting, reflexive safeguards include anonymized participant codes, comparison of interview accounts with observations and formal documents, explicit separation of ongoing activities from planned initiatives, and cautious wording of claims. These procedures reduce, but do not eliminate, insider bias; the retained study record does not document a separate member-checking exercise.

Participants and Data Collection

Table 1. Informant Composition and Selection Rationale

Code(s)	Role group	n	Sector	Selection relevance
L1-L3	Institutional leaders	3	Internal	Strategic planning, governance, and institutional direction

F1-F4	Senior lecturers	4	Internal	Curriculum, teaching, laboratories, and competency development
S1-S3	Academic support staff	3	Internal	Academic services, administration, and implementation support
I1-I2	Aviation-industry partners	2	External	Industry demand, partnership expectations, and program relevance

Twelve key informants were selected purposively because of their direct involvement in strategic planning, curriculum management, academic services, or industry collaboration. Ten participants were internal and two represented aviation-industry partners. Semi-structured interviews explored current programs, emerging competency needs, institutional readiness, partnership opportunities, constraints, and strategic priorities. Interviews were conducted during the January-March 2026 data-collection period. Later interviews repeated the established categories and yielded no new strategic dimension; because an interview-by-interview saturation log was not retained, this is reported conservatively as thematic sufficiency rather than as a precise numerical saturation threshold.

Fifteen participatory observation sessions were conducted during the same three-month period in flight-simulator activities, aviation-maintenance workshops, vocational training sessions, and academic-planning meetings. For reporting and triangulation, the observation material was organized around five analytic prompts: (1) activity and setting; (2) curriculum-practice alignment; (3) instructor, facility, and technology readiness; (4) evidence of industry or regulatory linkage; and (5) implementation status or constraint. Observations were used to assess operational readiness and to corroborate program claims; they were not treated as direct evidence of market demand by themselves. A session-level observation protocol was not retained and therefore cannot be reproduced.

Table 2. Documentary Corpus Used for Triangulation

Document corpus	Period	Access/source	Analytical use
Institutional strategic plans (Renstra)	2020-2024; 2025-2029	Official internal records	Strategic priorities, planned programs, and time horizon
Annual performance reports	2023-2025	Official internal records	Implemented activities and institutional performance evidence
Program accreditation documents	2024	Official quality-assurance records	Curriculum, facilities, certification, and quality evidence
Industry partnership agreements/MoUs	2022-2025	Official institutional records	Formal partnership intent and market-development evidence

Data Analysis

Data were reported using a hybrid framework method (Turet & Costa, 2022). First, the retained material was organized into descriptive first-order codes such as certification, curriculum upgrading, international partnership, simulator modernization, digital training, resource constraint, and regulatory approval. Second, related codes were grouped into second-order themes concerning service quality, geographic or stakeholder expansion, program innovation, and new institutional functions. Third, the themes were mapped deductively to the four Ansoff quadrants using two decision dimensions: whether the educational service was existing or new, and whether the

learner/client market was existing or new. The retained study record does not identify the qualitative-data-analysis software, the number of coders, or an intercoder statistic; no unsupported claim about these mechanics is therefore made.

The Ansoff quadrants were therefore not treated as themes that emerged spontaneously from the data. They functioned as a pre-specified analytical template, while the programs, readiness conditions, and constraints within each quadrant were derived from the empirical material. The final mapping was reviewed across the author team and resolved by discussion. A formal chance-corrected inter-coder reliability coefficient was not calculated because the study used consensus-based interpretive coding rather than independent categorical coding.

Table 3. Coding Hierarchy and Ansoff Mapping Rules

Representative evidence	First-order code	Second-order theme	Mapping rule / quadrant
Competency certification, teaching quality, institutional promotion; retained interview quotation from Informant 2	Certification and service quality	Consolidating existing provision	Existing services + existing learner market = Market penetration
MoUs, international networks, planned exchanges, and overseas delivery	Partnership and geographic reach	Extending institutional reach	Existing services + new geographic/institutional market = Market development
D4 transformation, SPUKTA, boarding-bridge, PKP-PK, cyber, laboratories, and simulators	Curriculum and facility innovation	Creating or upgrading provision	New services + existing/core aviation market = Product development
Research centers, Digital Academy, incubator, safety consulting, and certification services	New institutional functions	Serving new clients and revenue channels	New services + new client/revenue market = Diversification

Trustworthiness and Ethics

Trustworthiness was pursued through source triangulation, methodological triangulation, reflexive disclosure, and an audit-oriented evidence matrix. One convergence example concerned competency certification: the retained interview quotation described certification as central to employability, observations documented practice-oriented learning and facility improvement, and accreditation and performance records provided formal evidence of quality-assurance activity. A second, disconfirming example concerned diversification. Strategic documents described research, incubation, and consulting ambitions, but observations did not show these initiatives operating at the same maturity as core teaching activities. Rather than treating the sources as equivalent, the discrepancy was resolved by classifying diversification as planned and long term, not as an implemented result. Because the underlying transcripts, field notes, and a member-checking record were not available for this revision, the article does not claim a reproducible quotation-level audit trail.

The analysis also searched for constraints and counter-evidence. Regulatory approval, specialized staffing, infrastructure, financing, and the difference between signed partnerships and active delivery were coded alongside opportunities. The available material did not support reliable

attribution of competing priorities to specific participant groups; accordingly, the paper does not claim consensus among all 12 informants.

Formal ethical clearance was granted by the Ethics Committee of Surabaya Aviation Polytechnic (No. 048/KEP-POLTEKBANG/2026). All participants provided written informed consent after receiving information about the study purpose, voluntary participation, confidentiality, and data handling. Participant identities are reported only through role-based codes.

3. RESULTS

Evidence-Based Mapping of Development Strategies

The evidence mapped institutional activity and strategic intention across all four Ansoff quadrants, but the quadrants differed in maturity, risk, and evidentiary strength. Market penetration was the most operationally established. Market development combined active partnership-building with planned delivery to new groups and locations. Product development included both ongoing program transformation and planned technology-intensive provision. Diversification consisted mainly of longer-term concepts for new services and client groups. Figure 1 and Table 4 summarize this contextual mapping.

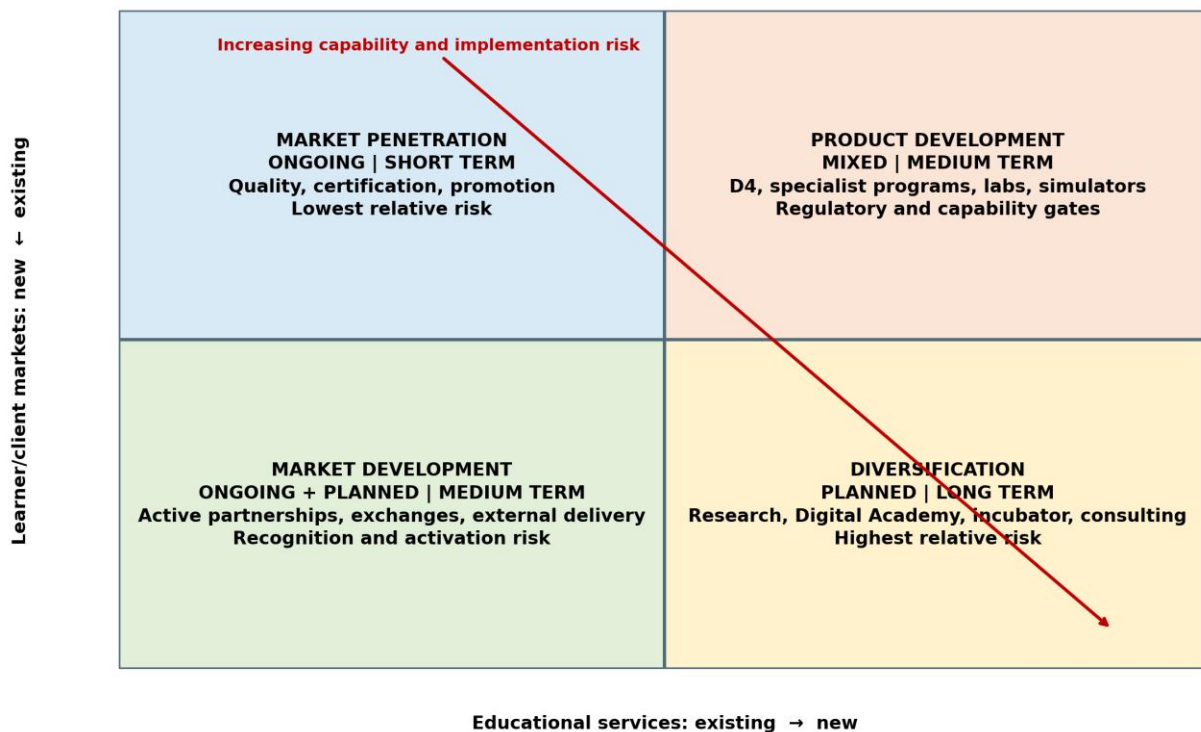


Figure 1. Contextualized Ansoff Matrix for Surabaya Aviation Polytechnic

Table 4. Integrated Strategy, Status, Risk, and Monitoring Matrix

Quadrant	Empirical basis and principal programs	Status / horizon	Main constraint or risk	Proposed monitoring indicator
Market penetration	Interview, observation, accreditation and performance records: promotion, competency certification, teaching and laboratory quality	Ongoing / short term	Quality inconsistency; certification capacity	Enrollment conversion; certification completion; learner satisfaction

Market development	MoUs and interview synthesis: international partnerships, exchanges, and external training delivery	Partnerships ongoing; exchanges/delivery planned / medium term	Inactive MoUs; partner and recognition dependence	Active partnerships with delivered activity; inbound/outbound participants
Product development	Strategic and accreditation records plus observation: D4 transformation, SPUKTA, PBB operator, PKP-PK, cyber, laboratories and simulators	Mixed ongoing and planned / medium term	DGCA approval, instructor competence, facilities, recurrent cost	Programs passing regulatory/readiness gate; employer validation; certification outcomes
Diversification	Strategic-document and interview synthesis: research centers, Digital Academy, incubator, safety consulting and certification	Concept/planned / long term	Highest financial and capability risk; mission drift	Pilots passing business, public-value and safety gates; external revenue with service-quality protection

Market Penetration

Market penetration was evidenced through the strengthening of existing educational services for the institution's established learner market. The program cluster included institutional promotion, national and international competency certification, curriculum updating, laboratory enhancement, and practice-based learning. These activities appeared in performance and accreditation records and were visible in the observed teaching and facility settings.

The strongest retained verbatim evidence came from an academic executive: "To maintain our existing market share, we do not only rely on traditional student recruitment. We are aggressively embedding national and international competency certifications into our core curriculum so that our graduates are immediately job-ready upon graduation" (Informant 2, February 2026). The quotation links market position to the quality and portability of graduate competence rather than to recruitment volume alone. On this evidence, market penetration was classified as ongoing and as the operational foundation for the higher-risk strategies.

Market Development

Market development involved bringing existing educational and professional-training capabilities to new geographic, institutional, or participant segments. The documentary corpus contained partnership agreements from 2022-2025, while interview synthesis identified international networking, student and faculty exchange, and external training delivery as intended mechanisms. The evidence supported active relationship-building, but it did not demonstrate that all signed agreements had produced exchanges or recurring programs.

Accordingly, the analysis distinguishes partnership formation from market entry. Existing MoUs were coded as ongoing enabling activity, whereas exchanges and overseas training were coded as planned medium-term outcomes. No specific foreign region was treated as a confirmed priority because the retained evidence did not include a documented comparative market analysis. This conservative classification prevents partnership aspirations from being reported as implemented internationalization.

Product Development

Product development was the most substantial medium-term opportunity. The identified portfolio comprised the transformation of Diploma 3 programs into Applied Bachelor's Degree (D4) programs; Small Unmanned Aircraft System Pilot (SPUKTA), passenger boarding bridge operator, and aircraft rescue and firefighting (PKP-PK) training; Aviation Data Cyber Security; and modernization of laboratories and simulators. Observation records supported the relevance of practical facilities, while strategic and accreditation documents linked curriculum and equipment to institutional quality.

The portfolio was not treated as uniformly implemented. D4 transformation and selected specialist training were categorized as active or under development, whereas the cyber program and major simulator modernization were treated as planned where the evidence did not demonstrate completed deployment. Readiness depended on instructor competence, facilities, financing, and the applicable DGCA approval pathway. This evidence explains why product development was prioritized but also why implementation must proceed through regulatory and safety gates.

Diversification

Diversification comprised five proposed functions beyond the institution's established academic offer: an Applied Aviation Research and Innovation Center, a Smart Airport and Green Aviation Center, an Aviation Digital Academy, an Aviation Technology Startup Incubator, and an Aviation Safety Consulting and Certification Center. These initiatives appeared principally as strategic intentions in documents and interviews rather than as mature operating units.

The documentary record available for this study did not demonstrate dedicated budgets, target launch dates, or verified delivery outcomes for each initiative. Diversification was therefore classified as planned and long term. The classification is analytically important because it separates potential public value and alternative revenue from evidence of current capability. Among the four quadrants, diversification carried the greatest risk of specialist-talent gaps, financial exposure, governance complexity, and mission drift.

Strategic Priorities and Cross-Quadrant Tensions

Product development and market development emerged as the most feasible medium-term priorities within this institutional context. Product development responds directly to curriculum and technology change, while market development can extend the reach of existing capabilities through active partnerships. Market penetration remains necessary because the credibility of expansion depends on the quality of core provision. Diversification should follow only after capability, public value, regulatory fit, and financial sustainability are demonstrated.

The data did not show four unambiguously positive or equally mature strategies. Instead, they revealed recurring tensions between ambition and readiness: new programs versus approval capacity, international visibility versus active partnership outcomes, alternative revenue versus the public-service mission, and digital specialization versus specialist staffing and infrastructure. These tensions explain the sequencing shown in Figure 1 rather than supporting simultaneous full-scale implementation of all four quadrants.

4. DISCUSSION

Prioritization in a Regulated Vocational Context

The findings suggest that Ansoff is most useful here as a disciplined vocabulary for sequencing choices, not as evidence that institutional growth is inherently beneficial. Product development and market development were prioritized because they build on the polytechnic's established aviation identity while responding to new competencies and learner or partner groups. This pattern is partly consistent with Murage et al. (2025), who found a positive relationship between market development and university performance and a negative relationship for diversification (Murage et al., 2025). The present study adds a qualitative explanation: diversification may be attractive, but it demands new capabilities, governance arrangements, and markets at the same time.

The result also supports research showing that vocational-school digitalization is an organizational-development process involving personnel, teaching, cooperation, and technology rather than a stand-alone equipment project (Wagner & Gerholz, 2026). New cyber, automation, and simulator-based provision should therefore be preceded by instructor development, technical support, curriculum validation, and recurrent-cost planning. Product innovation without these complementary capabilities may increase visible infrastructure without producing reliable competence.

Regulatory Friction, Competency-Based Training, and Human Factors

In aviation, product development is constrained and enabled by regulation. For programs falling within pilot-school or aircraft-maintenance training approval, CASR Parts 141 and 147 require certification, approved procedures and curricula, qualified personnel, facilities, and continuing surveillance (Directorate General of Civil Aviation, 2017a, 2017b). Regulatory alignment should therefore be built into program design from the preliminary study rather than checked after curriculum development. ICAO Doc 9941 similarly organizes competency-based course development around performance problems, job and population analysis, curriculum and module design, developmental testing, and evaluation (International Civil Aviation Organization, 2011).

Technology-oriented programs must also integrate safety management and human factors. Cybersecurity, automation, and data-intensive systems change the interaction between people, procedures, and technology; technical proficiency alone does not guarantee safe performance. Curriculum approval should therefore include explicit outcomes for teamwork, communication, situational awareness, workload, decision-making, and reporting within an SMS-informed learning environment (International Civil Aviation Organization, 2018). This requirement differentiates aviation product development from ordinary educational product expansion.

A Public-Sector Adaptation of Ansoff

The study does not claim to extend Ansoff as a universal theory. It offers a public-sector contextual adaptation in which BLU governance moderates the relationship between a growth option and its feasibility. Indonesian BLUs receive flexibility to improve public services through sound business practices, but remain government units and do not primarily pursue profit (Government of Indonesia, 2005). Growth must therefore be assessed against public value, service quality, safety, and accountability as well as revenue.

Two structural paradoxes follow. The mission paradox requires the institution to balance broader access, national workforce development, and safety obligations with PNPB generation. The

capability paradox arises when high-technology programs require scarce specialists and recurrent investment that may be difficult to secure within public-sector staffing and budgeting arrangements. BLU flexibility creates room for partnership and service innovation, but it does not remove ministerial accountability, regulatory approval, or resource constraints. In this adapted model, institutional readiness and governance act as boundary conditions for every quadrant.

International Relevance

The medium-term priorities align with ICAO's NGAP strategy, which calls for relevant education, workforce planning, collaboration among civil aviation authorities, educational institutions, and industry, and recognition of competencies across jurisdictions (International Civil Aviation Organization, 2025). Market development should thus be measured through active learning, training, mobility, or recognition outcomes rather than the number of MoUs. Product development should be linked to forecast skill gaps and competency-based design. These principles allow a local institutional strategy to contribute to the broader challenge of attracting, educating, and retaining a competent aviation workforce.

Three-Tier Implementation Roadmap

Table 5 presents proposed management controls rather than observed outcomes. The numeric controls should be reviewed against the institution's 2026 baseline and adjusted through formal planning and regulatory processes.

Table 5. Proposed Three-Tier Implementation Roadmap

Level	2027-2029 action	Lead responsibility	Proposed measurable control
Institutional	Gate new programs and diversification pilots through regulatory, human-factors, market, capability, and financial review	Directorate; academic, quality, safety, and BLU finance units	100% of new programs complete the five-part gate before launch; annual six- and 12-month graduate tracking; at least two industry-validated curriculum modules per year
Ministry / regulator	Map D4 curricula and specialist training to licensing and competency requirements; coordinate facility and instructor approval pathways	Ministry of Transportation; DGCA; education authorities	One published curriculum-to-licence crosswalk per regulated program; annual joint compliance review; zero program promotion before approval status is documented
International	Convert partnerships into delivered mobility, joint training, and recognition work	International office; program heads; partner institutions	At least two partnerships with documented annual activity by 2029; one mutual-recognition or simulator-equivalence feasibility study; annual partnership outcome report

Research Limitations and Future Directions

The findings require cautious interpretation. First, the study concerns one institution and supports analytical transfer rather than statistical generalization. Second, 10 of 12 informants were internal, and the study did not include students, alumni, or graduate employers. Claims about employability and competitiveness therefore reflect institutional and limited industry perceptions rather than measured graduate outcomes. Third, members of the author team were institutional insiders; triangulation, anonymization, explicit status labels, and reflexive disclosure reduce but cannot remove social-desirability and interpretive bias.

Fourth, the evidence mainly captures strategic practice and intention during January-March 2026, not longitudinal implementation or impact. Several initiatives, particularly diversification, lacked verified budgets, milestones, or outcomes and were therefore classified as planned. Fifth, the retained study record did not permit reconstruction of individual interview durations, an interview-by-interview saturation threshold, a formal translation audit, or additional verbatim quotations across all role groups. The absence of an independent double-coding statistic also limits reproducibility. Future research should follow implementation longitudinally, include students, alumni, employers, regulators, and more industry partners, and compare aviation polytechnics using graduate, certification, partnership, safety, and financial indicators.

5. CONCLUSION

This study shows that the four Ansoff options are present at Surabaya Aviation Polytechnic but differ substantially in maturity and feasibility. Market penetration is embedded in the continuing improvement of core education and certification. Market development combines ongoing partnership-building with planned delivery to new groups and locations. Product development offers the clearest medium-term response to D4 transformation, specialist training, cybersecurity, and facility modernization. Diversification offers longer-term public and financial value but remains the least mature and highest-risk option. Product development and market development are therefore the most defensible medium-term priorities, conditional on regulatory approval, instructor capability, infrastructure, financing, and active partnerships.

The case contributes beyond one institution by demonstrating that Ansoff must be adapted when growth occurs inside a safety-critical public-service agency. BLU flexibility moderates rather than removes public accountability, while aviation regulation makes capability and safety gates central to every new program. The practical roadmap is three-tiered: institutional leaders should apply quantified readiness and outcome controls; ministries and regulators should align curricula, licensing, facilities, and instructor approval; and international partnerships should produce delivered mobility, training, or recognition outcomes rather than remain at MoU level. This interpretation positions Ansoff as a transparent sequencing tool for regulated vocational education, not as a substitute for evidence of implementation or impact.

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