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ANALYSIS OF THE GRADUATES' REQUIREMENT OF AVIATION VOCATIONAL COLLEGES IN INDONESIA

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Abstract: There is a gap between the growing demand for competent human resources in Indonesia's aviation industry and the low absorption rate of graduates from aviation vocational colleges under PPSDMPU. This research examines the importance of Human Resource (HR) competencies in the rapidly growing aviation industry in Indonesia, highlighting the need for improved flight services and operations. HR competencies encompassing knowledge, skills, attitudes and personal values are needed, with a focus on HR management functions vital to operational success. This study uses a descriptive quantitative method with data collection through questionnaires to 60 respondents obtained through purposive sampling and audience interviews to analyze the needs and evaluations of 28 aviation industry stakeholders regarding vocational college graduates. The research found that the market demand for vocational college graduates is high, especially for those with relevant licenses and certifications. Stakeholder satisfaction with the performance and quality of graduates is high, determined by the relevance of the curriculum, quality of training, and field work experience. Minimum expected skill standards include communication skills, critical thinking, leadership, safety awareness and interpersonal skills. Recommendations include aligning the curriculum with industry needs, developing soft skills, and integrating the latest technology in learning to prepare graduates for the challenges of the aviation industry.

Keywords: aviation industry, college graduates, stakeholders, vocational college

Introduction

The aviation industry in Indonesia has experienced rapid growth in the last two decades. The increase in the number of passengers, airlines, and the expansion of domestic and international route networks shows that this sector is one of the driving forces of national economic growth (Jumadin, 2024). Along with this development, the need for quality, efficient, and safety-oriented flight services is also increasing. This requires the availability of competent human resources (HR), not only in terms of technical aspects, but also in terms of managerial, professional attitudes, and work ethics. Competence is the keyword in answering these demands. Competence is defined as the integration of knowledge, skills, attitudes, and personal values needed to carry out tasks effectively. (Muharomansyah et al., 2021), Fulfilling the needs of the aviation industry, requires competent human resources, with human resource management functions including planning, organizing, directing, controlling, procurement, development, compensation, integration, maintenance, discipline, and dismissal.(Nurcahyo et al., 2023). Human resources are often referred to as Human Resources, about or human strength (energy and power).

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Resources which are also called sources of energy, ability, strength, expertise owned by humans, are also owned by other organisms, for example: in animals, plants (Bunahri, 2023).

Humans as planners, controllers and evaluators of development and enjoy the results of this evaluation greatly influence the success of development, because humans have a very determining role.(Hilal, 2020). The quality of higher education is defined as a standard that meets the expectations of universities and stakeholders.(Vonnisye et al., 2022). Producing competent human resources in the aviation industry is a major challenge for vocational colleges engaged in the aviation industry. In contrast to the need for aviation human resources for the development of the aviation industry, in reality there are still many graduates of Aviation Vocational Colleges (PTV) in Indonesia who have not been absorbed into work in the aviation industry.

Table 1. Number of Cadets per Study Program per Year

Study Program	2015	2016	2017	2018	2019	2020	2021	2022	2023
D4 Pilot	48	22	82	23	23	-	-	-	-
D4 Aircraft Engineering	30	27	71	41	33	-	-	-	-
D4 Air Navigation Engineering	24	22	70	71	45	24	-	-	-
D4 Aviation Electrical Engineering	11	0	41	0	0	-	-	-	-
D4 Airport Engineering	30	27	85	23	23	-	-	-	-
D4 Air Traffic Engineering	0	0	0	0	0	-	-	-	-
D3 Fixed Wing Pilot	0	0	0	0	0	-	-	-	-
D3 Aircraft Engineering	46	70	92	120	72	74	-	-	-
D3 Aircraft Technology	0	0	0	0	0	-	-	-	-
D3 Air Navigation Engineering	139	186	138	48	72	-	-	-	-
D3 Airport Engineering	0	0	0	0	0	-	-	-	-
D3 Airport Electrical Engineering	94	153	162	119	46	-	-	-	-
D3 Airport Construction Engineering	31	-	-	-	-	-	-	-	-
D3 Airport Mechanical Engineering	14	20	74	24	-	-	-	-	-
D3 Airport Electrical Engineering	0	0	0	0	0	-	-	-	-
D3 Air Traffic Engineering	133	108	-	-	-	-	-	-	-
D3 Aviation Communication	32	22	46	48	24	-	-	-	-
D3 Air Transport Management	0	0	0	0	0	-	-	-	-
D3 Aviation Operations	22	23	47	48	-	-	-	-	-
D3 Airport Management	0	0	0	0	0	-	-	-	-
D3 Airport Personnel	13	16	0	0	-	-	-	-	-
D3 Aviation Safety	0	0	0	0	0	-	-	-	-
D3 Fire & Rescue	0	0	0	0	0	-	-	24	-
D3 Aeronautical Lighting	16	0	0	0	0	-	-	-	-
D2 Pilot	-	-	-	-	-	-	-	-	-

This table presents the number of cadets enrolled in each study program at air transportation vocational colleges from 2015 to 2023. The data indicates that the highest number of cadets was observed in 2018, especially in programs like D3 Air Traffic Management (153 cadets), D3 Airport Engineering (147 cadets), and D3 Aircraft Engineering (120 cadets). Programs such as D3 Aircraft Engineering and D3 Air Traffic Management have consistently high enrollment, suggesting strong interest and demand. Meanwhile, some programs such as D3 Aviation Safety, D3 Fire and Rescue, and D3 Aeronautical Lighting have shown very low or no cadet enrollment in many years. The overall trend suggests a fluctuating but concentrated interest in technical aviation programs that are closely aligned with core air transport operations.

Table 2. Number of Graduates per Program per Year

Study Program	2018	2019	2020	2021	2022	2023
D4 Pilot	48	22	82	39	27	23
D4 Aircraft Engineering	23	23	33	36	24	21
D4 Air Navigation Engineering	19	21	45	31	18	23
D4 Aviation Electrical Engineering	0	0	0	0	0	0
D4 Airport Engineering	21	41	41	26	23	21
D4 Air Traffic Engineering	0	0	0	0	0	0
D3 Fixed Wing Pilot	0	0	0	0	0	0

Study Program	2018	2019	2020	2021	2022	2023
D3 Aircraft Engineering	46	70	92	81	72	47
D3 Aircraft Technology	0	0	0	0	0	0
D3 Air Navigation Engineering	112	139	186	94	72	80
D3 Airport Engineering	0	0	0	0	0	0
D3 Airport Electrical Engineering	63	97	122	81	46	30
D3 Airport Construction Engineering	0	0	0	0	0	0
D3 Airport Mechanical Engineering	14	20	74	24	-	-
D3 Airport Electrical Engineering	0	0	0	0	0	0
D3 Air Traffic Engineering	133	108	-	-	-	-
D3 Aviation Communication	-	22	46	48	24	24
D3 Air Transport Management	0	0	0	0	0	0
D3 Aviation Operations	22	23	47	43	-	-
D3 Airport Management	0	0	0	0	0	0
D3 Airport Personnel	13	16	0	0	-	-
D3 Aviation Safety	0	0	0	0	0	0
D3 Fire & Rescue	0	0	0	24	-	-
D3 Aeronautical Lighting	16	0	0	0	0	0

Table 2 shows the number of graduates from each study program from 2018 to 2023. The programs with the most graduates over the six-year span include D3 Air Traffic Management (totaling over 660 graduates), D3 Aircraft Engineering (more than 470 graduates), and D3 Airport Engineering (over 400 graduates). These figures reflect strong continuity and graduation output in technical and operational aviation fields. In contrast, some programs such as D3 Aviation Safety, D3 Aeronautical Lighting, and D3 Fire and Rescue produced no graduates during this period. The data also highlights that the majority of aviation human resources are being supplied by only a few core programs, indicating both specialization and potential concentration of job-market competition in these areas.

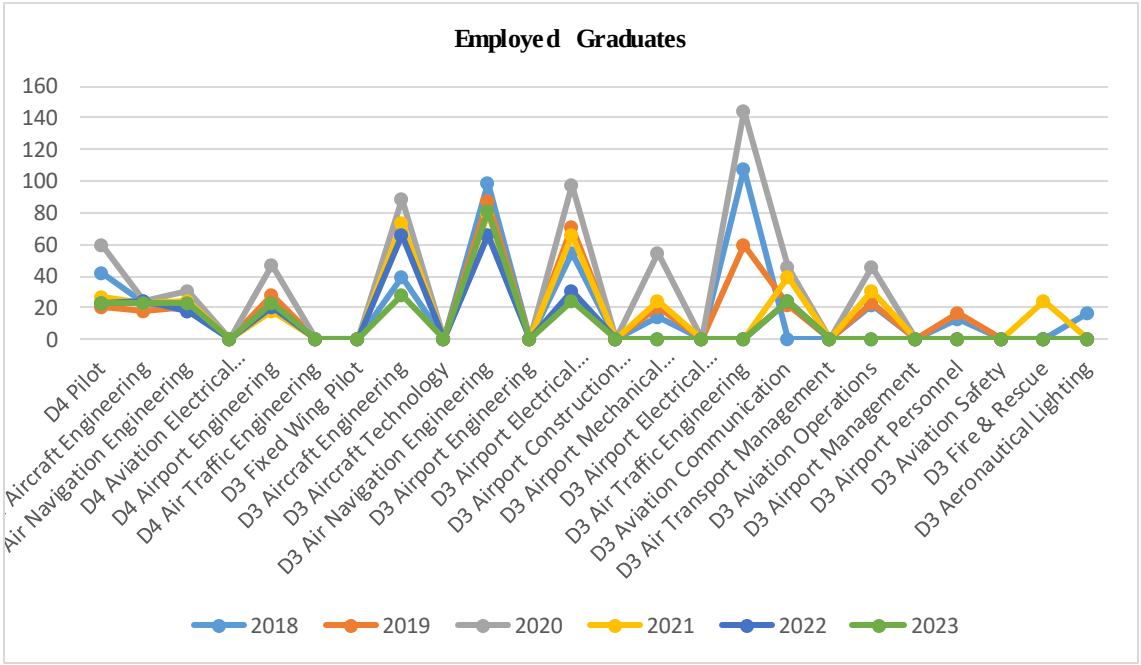

Figure 1. Number of Employed Graduates per Program per Year

This figure 1 outlines the number of graduates absorbed into the workforce annually from each study program between 2018 and 2023. D3 Air Traffic Management and D3 Aircraft Engineering again stand out, with more than 600 and 450 graduates absorbed respectively during this period, reflecting strong industry alignment and demand. Notably, in 2020 and 2021, absorption rates dropped slightly, which may correlate with broader disruptions such as the COVID-19 pandemic. Programs like D3 Airport Engineering and D3 Airline Operations also

show steady absorption with totals above 300. However, several programs have zero absorption recorded across the years, including D3 Aviation Safety, D3 Aeronautical Lighting, and D3 Fire and Rescue, indicating either a lack of data, low demand, or limited graduate output. This table highlights which programs are most effectively meeting the needs of the aviation industry and where improvements or restructuring may be needed.

In Indonesia, there are seven vocational colleges (PTV) under the auspices of the Center for Human Resources Development for Air Transportation (PPSDMPU), namely the Indonesian Aviation Polytechnic Curug, Surabaya Aviation Polytechnic, Makassar Aviation Polytechnic, Medan Aviation Polytechnic, Palembang Aviation Polytechnic, Banyuwangi Aviation Academy, and Jayapura Aviation Polytechnic. These institutions were established to meet the need for human resources in the aviation sector who have special competencies in accordance with regulations and technical operational needs in the field. In practice, there are a number of companies and institutions that are the main users of PTV graduates, such as AIRNAV Indonesia, GMF AeroAsia, Citilink, GAPURA, PT JAS, and others. It is also known that the success of an organization in the aviation industry is greatly influenced by the quality of its human resources (Susan, 2019), so the existence of vocational education institutions that are able to produce ready-to-use workers is very important (Susan, 2019).

The absorption of graduates from vocational colleges under the auspices of PPSDMPU is one way to meet the needs for flight service and operational management. There needs to be a link and match between stakeholders in the aviation industry and PTV as a producer of Aviation HR graduates in order to produce a way out or solution to overcome problems related to the fulfillment of competent Aviation HR according to the needs of the Aviation Industry, as well as to overcome the problem of many PTV alumni who have not been absorbed into working in the aviation world.

However, even though the industry's need for competent human resources is increasing, in reality there are still many graduates from PTV who have not been absorbed into the workforce. There is still a gap between the competencies possessed by graduates and the expectations of the user industry (Samuel, 2021). It is not yet known for certain to what extent PTV graduates are currently able to meet the criteria and competency standards expected by stakeholders in the aviation industry. In addition, there is still minimal information regarding the level of satisfaction of graduate users with the work performance of graduates, and it is not clear what minimum skill standards are considered mandatory by the aviation industry to be met by vocational graduates (Baruno & Padama, 2024).

Previous studies have indeed discussed the importance of improving the quality of human resources through vocational education and job training, including in the transportation sector. Several studies have touched on the issue of link and match between vocational education and the needs of the business world and industry (DUDI). Cahyadi et al. (2022) in their study stated that vocational education must be designed based on industry needs to ensure graduates have the competencies needed in the world of work, especially in the transportation and aviation sectors. Meanwhile, Pranita et al. (2025) explained that the mismatch between vocational education output and industry demand remains a major challenge in Indonesia, emphasizing the urgency of stronger collaboration between educational institutions and industry players. However, studies that specifically analyze the suitability between the output of aviation PTV graduates in Indonesia and the real needs of the aviation industry are still very limited. There have not been many studies that use an evaluative approach to stakeholder needs (user needs analysis) directly, especially involving more than one aviation vocational education institution in its scope (Agussalim et al., 2024).

This study is unique (novelty) in the context of the focus of the study and data coverage. This study not only looks at the phenomenon of graduate mismatch with industry needs in general, but specifically maps the needs of the aviation job market for graduates from seven aviation vocational education institutions under PPSDMPU. This study also seeks to explore the level of stakeholder satisfaction with the competencies possessed by graduates and identify the minimum standards of skills and knowledge expected by the industry. With this approach, the study will provide a more comprehensive and contextual picture of the relationship between vocational education institutions and graduate users in the Indonesian aviation sector.

This research is expected to provide real contributions in the development of vocational education policies in the aviation sector, both at the educational institution level and at the ministry level. The results of this study can be the basis for formulating a curriculum that is more responsive to industry needs, compiling relevant internship programs, and improving the quality of teaching based on labor market needs. In addition, this study can also be a reference for the aviation industry in compiling more structured and competency-based recruitment standards. The synergy between PTV and the aviation industry through the results of this study is expected to increase the number of graduates' employment and ensure the sustainability of the supply of professional workers in the national aviation sector. Therefore, based on this background, the formulation of the problem in this study is "To what extent do the competencies of graduates of aviation vocational colleges under the auspices of PPSDMPU match the needs and expectations of stakeholders in the aviation industry in Indonesia?"

Method

This study uses a descriptive quantitative method to analyze and evaluate the market needs of the aviation industry from the perspective of stakeholders, without variable manipulation. Data were collected through questionnaires distributed to 60 respondents from various aviation companies and institutions, followed by audience interviews to explore competency needs, graduate quality, recruitment processes, career development, and evaluation of previous cooperation. The research stages include data collection through alumni mapping and questionnaire distribution, conducting audience interviews with predetermined indicators, and analyzing stakeholder needs using descriptive techniques based on questionnaire data and interview results, to obtain an in-depth picture of the needs of aviation vocational college graduates.

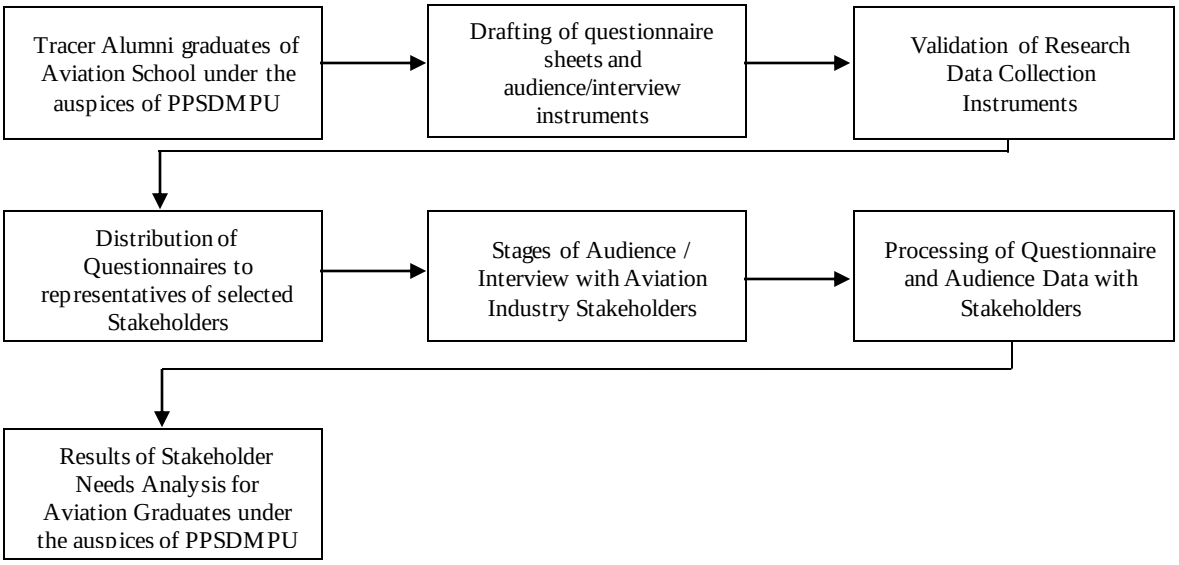

Figure 2. Research Flow Diagram

Discussion

Most of the study respondents were male (66.7%), while females amounted to 33.3%. The most dominant age group was 31-40 years (41.7%), indicating the majority of respondents were at productive age. In terms of education, the majority of respondents had a Bachelor's degree (58.3%), followed by Master's degree (25%) and Diploma (16.7%). In addition, based on the company, respondents in this study, namely the Aviation Navigation Services sector, were only represented by AirNav Indonesia with 3 respondents (5%). The Airline & MRO sector dominates with 26.6% of respondents from several companies, such as Citilink, Lion Group, and GMF. The Airport Operator sector was represented by Angkasa Pura I & II and several airports with a total of 20.1%. The Aviation Support Industry accounted for 15% of respondents, while the Non Aviation Industry sector had 29.7%, reflecting significant interest from sectors outside of aviation. The Ministry of Transportation was represented by 2 respondents (3.3%). In terms of position, 25% of respondents are Managers, indicating their role in strategic decision-making. A total of 16.7% of respondents were Supervisors, responsible for team supervision, and another 25% served as Division/Department Heads, with higher leadership roles. Senior Staff accounted for 16.7%, providing deep technical insight, while Junior Staff (8.3%) offered an early career perspective in the industry. A total of 8.3% of respondents were in other positions, providing additional insight into the dynamics of the aviation industry.

1. Number and Distribution of Graduates of Aviation Schools under the auspices of PPSDMPU

Based on data on the number of graduates from various study programs under the auspices of PPSDMPU (Center for Human Resources Development for Air Transportation) from 2019 to 2023, it can be seen in the following table.

Table 3. Number of Graduates in 2019-2023 under the auspices of PPSDMPU

No	Study Program	Number of Graduates	Absorbed	Not yet	Absorption (%)
1	PKP/PPKP	284	284	0	100%
2	Airport Engineering	24	24	0	100%
3	Airport Mechanical Engineering	151	147	4	97.35%
4	The Pilot	96	84	12	87.50%
5	Building and Foundation Engineering	315	281	34	89.21%
6	Airport Operations/Airport Management	359	305	54	84.96%
7	Aircraft Engineering/Aircraft Maintenance Engineering	795	637	188	80.13%
8	Air Traffic Management	90	68	22	75.56%
9	Aircraft Operations	24	17	7	70.83%
10	Airport Electrical Engineering	972	586	386	60.29%
11	Air Navigation Engineering/Air Navigation Technology/Air Navigation Telecommunication Engineering	840	469	371	55.83%
12	Air Transport Management	187	103	84	55.08%
13	Air traffic	583	318	264	54.55%
14	Aviation Communications	182	65	117	35.71%
	TOTAL	4.902	3.388	1,543	74.79%

Table 4 shows that of the 4,902 graduates of study programs under the auspices of PPSDMPU for the 2019-2023 period, 3,388 graduates (74.79%) have been absorbed in various industrial sectors. Study programs with high absorption rates include PKP/PPKP,

Airport Engineering, Airport Mechanical Engineering, Aviation, and Runway Building Engineering. Moderate absorption rates are found in Aircraft Engineering, Airport Management, Air Traffic Management, and Aircraft Operations. Meanwhile, low absorption occurs in Air Navigation Engineering, Air Transportation Management, and Aviation Communications.

Table 4. Distribution of Graduate Absorption Locations

Sector	Number of Graduates Absorbed	Percentage (%)
Air Navigation Service	150	4.43
Airline & MRO	980	28.92
Airport Operator	700	20.66
Aviation Support Industry	600	17.71
Non Aviation Industry	508	15.00
Ministry of Transportation	450	13.28
Total	3.388	100

A total of 150 graduates (4.43%) were absorbed in the Aviation Navigation Services sector, while the Airline & MRO sector absorbed 980 graduates (28.92%), being the sector with the largest absorption. In addition, the Airport Operator sector absorbed 700 graduates (20.66%), the Aviation Support Industry sector absorbed 600 graduates (17.71%), the Non Aviation Industry sector absorbed 508 graduates (15.00%), and the Ministry of Transportation sector absorbed 450 graduates (13.28%).

2. Competencies Required by Industry

The required competencies are divided into two main categories, namely technical competencies and non-technical competencies (soft skills). Based on interviews/audiences with various companies/related agencies, the following results were obtained.

Table 5. Results of Technical Competency Needs Analysis

Technical Competence	Description
License and Rating	Personnel who have Licenses and ratings such as Basic license (A1, A2, A4 & C1, C2, C4), Flight Navigation Service License, Dangerous Goods Handling License, and Competency Certificate (Avsec, Airport Technician, PK Personnel, Aircraft Operations Personnel) are highly needed for operational positions (Diploma Three).
Technical Competence of Safety Management System and Human Factor	Mastery of technical competencies related to Safety Management Systems and Human Factors and their implementation in each sector is very important to ensure operational safety and efficiency in the aviation industry.
English Language Ability	Adequate English language skills (TOEIC/TOEFL/IELP) are required so that graduates can compete with other university graduates and communicate well in an international environment.
Industrial Management Competence	Mastery of competencies in Industrial Management, including Design, Production, Fabrication, Warehouse Management, Supply Chain, HR management, and Finance, is important for graduates. This requires upgrading the level of Education to Applied Bachelor.
Digital Literacy	Improving digital literacy is essential to face the challenges of technology and digitalization in the aviation industry.

Based on Table 6 above, it can be seen that the aviation industry involved in this study requires personnel who have various licenses and certifications, including Basic License (A1, A2, A4 & C1, C2, C4), Aviation Navigation Service License, Dangerous Goods

Handling License, as well as Certificates of Competency for Avsec, Airport Technicians, PK Personnel, and Aircraft Operations Personnel. These competencies are important for operational positions that are usually filled by diploma three graduates. In addition, mastery of technical competencies related to the Safety Management System and Human Factors and their implementation in each sector is also very important. Mastery of English with an adequate TOEIC/TOEFL/IELP score is also required so that graduates can compete with other university graduates and communicate well in an international environment. Competence in Industrial Management fields such as Design, Production, Fabrication, Warehouse Management, Supply Chain, HR management, and Finance is also required. Therefore, upgrading the education level to a Bachelor of Applied Science should be considered. Good digital literacy and the ability to work in various operational areas (multi-competency) are also very important to increase work flexibility and efficiency.

Table 6. Results of Non-Technical Competency Needs Analysis

Non-Technical Competence	Description
Communication Skills	Good communication skills are needed to establish effective relationships with coworkers, superiors, and customers.
Analytical/Critical Thinking	Analytical and critical thinking skills to solve problems and make informed decisions based on available data and information.
Hospitality	Ability to provide friendly and professional service to customers and passengers.
Leadership/Decision Making	Ability to lead and make effective decisions in complex and dynamic situations.
Innovative	Ability to innovate and find new ways to improve processes and services in the aviation industry.
Interpersonal Skill	Ability to interact and work well with others, both within a team and in a wider work environment.
Entrepreneurship	Ability to identify business opportunities and develop profitable initiatives.
Operational Excellence	Ability to achieve operational excellence through efficiency and effectiveness in carrying out duties and responsibilities.
Ensure Accountability	Ability to take responsibility for actions and work results, and ensure that high standards of work are always met.
Drive Results	The ability to focus on achieving desired results and exceeding set targets.
Cultivate Innovation	Ability to drive and support innovation within the organization, both through the development of new ideas and the implementation of the latest technologies.
Safety Awareness	Awareness of the importance of safety in all aspects of operations and the ability to apply best safety practices in daily work.

Based on Table 7, the aviation industry involved in this study expects graduates to have a number of important non-technical competencies. The ability to communicate, think analytically and critically, and provide friendly and professional service are highly valued. In addition, leadership and decision-making skills, innovation, and interpersonal skills are also considered vital. Other expected competencies include the ability to identify business opportunities, achieve operational excellence, ensure accountability, focus on results, support innovation, and awareness of safety in every aspect of operations.

3. Graduate Readiness and Suitability Factors

The results of the interview analysis identified several key factors that influence the readiness and suitability of aviation vocational college graduates, namely the education curriculum, field work experience and technology mastery. The educational curriculum

implemented in aviation vocational colleges has a significant influence on the readiness and suitability of graduates with industry demands. A curriculum that is comprehensively designed and oriented towards the real needs of the aviation industry will produce graduates who not only understand the theory, but also have the necessary practical skills. Stakeholders in this study emphasized the need for integration of technical licenses and ratings, in-depth understanding of the Safety Management System, and mastery of English into the curriculum. In addition, field work experience is crucial; industrial practice gives students the opportunity to apply theory in real-life situations, while building skills that are relevant in the world of work. Graduates who have internship experience in the aviation industry tend to show better adaptability and higher job performance. Finally, in today's digital age, mastery of cutting-edge technology is indispensable. Stakeholders emphasize the importance of digital literacy and adaptability to new technologies as an integral part of graduate competencies, including the use of flight management software, navigation systems, and modern communication tools that are essential in daily flight operations. The combination of these three aspects-educational curriculum, fieldwork experience, and technological mastery-is a solid foundation for preparing graduates who are ready to compete in the dynamic aviation industry.

4. Stakeholder Satisfaction Level

a. Satisfaction with Graduate Quality

This study evaluates the level of stakeholder satisfaction with the quality of aviation vocational college graduates working in their institutions, focusing on two main aspects: graduates' performance in the workplace and their adaptability and job performance. Through a survey conducted using a questionnaire, the majority of stakeholders expressed high satisfaction with the graduates, indicating that the graduates are able to carry out their responsibilities well and show performance that meets expectations. From the analysis, about 25% of the stakeholders were very satisfied, noting the graduates' strong technical skills and positive contribution to the organization's achievements. On the other hand, 50% were satisfied, noting that graduates had adequate competencies although there were still some areas for improvement, while another 20% were moderately satisfied with the graduates' work.

In terms of adaptation and work performance, the survey results showed that 30% of stakeholders were very satisfied with graduates' ability to adapt to new work environments, as well as their ability to understand team dynamics and demonstrate consistent performance. A total of 45% of stakeholders also expressed satisfaction, assessing graduates as being able to adjust to the demands of the job and contribute positively to the team. However, 20% of stakeholders were moderately satisfied, indicating that although graduates are adaptable, there are still certain aspects that need to be improved. Only 5% of stakeholders expressed dissatisfaction, indicating that despite some challenges in adjustment and job performance, no one was very dissatisfied, so it can be concluded that graduates are generally able to adjust and perform well in a professional environment. These findings underscore the importance of continuous improvement in the education curriculum to meet the evolving expectations of the industry.

b. Stakeholder Satisfaction Factors

Based on an analysis of the interviews and hearings conducted, several key factors that influence stakeholder satisfaction with the quality of graduates of aviation vocational colleges under the auspices of the Civil Aviation Human Resources

Development Center (PPSDMPU) have been identified. One important factor is the performance of graduates in the workplace; graduates who demonstrate good technical and non-technical competencies-such as technical licenses and ratings, mastery of the Safety Management System, and skills in using the latest technology-tend to increase stakeholder satisfaction. Research shows that graduates who possess these competencies are more prepared and effective in the aviation industry environment. In addition, graduates' adaptability to a dynamic work environment also plays a significant role in stakeholder assessment.

Graduates who can quickly adapt to changes and job demands, as well as demonstrate good work performance, receive positive ratings. These capabilities include soft skills such as communication, leadership, critical thinking, and safety awareness, which enable them to work together in teams, make the right decisions, and show initiative in facing challenges. Finally, the alignment of the education curriculum with industry needs determines stakeholder satisfaction; they expect graduates to have knowledge and skills that are up-to-date in accordance with technological developments and procedures in the aviation industry. An education program that adapts to industry needs, and includes practical training, internships and certification competency, contributes greatly to the readiness of graduates and ultimately increases stakeholder satisfaction with the quality of those graduates. The combination of performance, adaptability, and curriculum relevance creates graduates who are ready to meet the changing demands of the aviation industry.

The level of satisfaction of aviation industry stakeholders with vocational college graduates varies, influenced by the technical competence, adaptability, and soft skills of graduates. Generally, stakeholders are satisfied with the technical performance of graduates who have relevant licenses and certifications, such as flight navigation service licenses, which are considered capable of carrying out operational tasks according to industry standards (Miani et al., 2021). High technical competence in graduates results from an educational curriculum that is structured to meet industry needs, but regular curriculum updates are needed to remain relevant to the latest technological developments (Asopwan, 2018). In addition to technical knowledge, graduates' ability to adapt to the work environment is also important, demonstrating that they possess soft skills such as communication, critical thinking, and leadership that support effective interaction and understanding of aviation industry procedures (Othman et al., 2018). Stakeholders expect graduates who are not only capable of performing technical tasks, but also able to communicate well, work in teams, and show initiative in solving complex problems (Fajar & Hartanto, 2019).

The level of mastery of English and digital literacy greatly affects stakeholder satisfaction, as English is required for international communication and understanding technical documentation, while digital literacy is important for adapting to technology in flight operations (Harmawati et al., 2024; Zhou et al., 2024). Stakeholders consider that graduates who are skilled in these two competencies can adapt more quickly and make significant contributions in the workplace (Ahmed & Roche, 2021). These findings emphasize the importance of an educational curriculum that includes the development of soft skills and English language competencies, as well as innovations in teaching methods to meet industry expectations (Reddy, 2016). Graduates' readiness for the world of work can be improved through internship programs and cooperation with industry, so stakeholder satisfaction is influenced by a combination of technical competence, adaptability, and mastery of soft skills (Eskandar, 2023). Improving the

quality of vocational education and the relevance of the curriculum to industry needs are key steps to improve stakeholder satisfaction and graduate competitiveness in the global job market (Raharjo & Arifin, 2023).

5. Minimum Standards of Graduate Skills

This research identifies the minimum standards of expertise that must be possessed by graduates of aviation vocational colleges in accordance with the needs expected by stakeholders in the aviation industry. Based on the measurement results through questionnaires, the minimum standard of expertise desired by stakeholders in the aviation industry shows several competencies that are considered very important. The most dominating competencies are communication skills, safety awareness, and ownership of licenses and ratings, each considered very important by 70% of respondents. In addition, competencies in Safety Management Systems, analytical and critical thinking skills, and mastery of English were also highly rated, with 65% and 60% of respondents considering them very important, respectively. Competencies in industrial management and digital literacy were also rated as important by the majority of stakeholders. Meanwhile, interpersonal competencies and the ability to innovate and have an entrepreneurial spirit received significant attention, as they were slightly lower than the other skill requirements.

The results of this study show that the aviation industry in Indonesia has complex needs for vocational college graduates, demanding both technical and non-technical competencies for effective contribution in the workplace. Good English language skills and digital literacy are recognized as essential requirements for international communication and understanding of technical documentation, in accordance with ICAO standards, and in line with increasing digitization in aircraft operations and maintenance (Alt & Raichel, 2020; IATA, 2018; Jang et al., 2021). The aviation industry requires graduates with not only technical competence, but also a strong understanding of industrial management, including design, production, warehouse management, supply chain, and human resource and financial management, to manage operational complexity and improve efficiency and productivity (Bunahri et al., 2023; Tabaković & Durakovic, 2021). These skills are required to manage efficient flight operations and adapt to changing market dynamics (Rawashdeh et al., 2021). According to a report from Boeing, the ability to manage and adapt to changes in the global supply chain is critical to the aviation industry, especially in the face of demand fluctuations and operational disruptions(Woo et al., 2021).

A study also showed that applied education programs that focus on practical and managerial skills can significantly improve graduates' readiness to enter the job market and meet industry needs, including the aviation sector (Ritter et al., 2017). The aviation industry highly values soft skills such as communication, analytical thinking, and leadership, as these skills are essential for safety, efficiency, and collaboration, as well as helping graduates adapt to dynamic work environments and work effectively in teams (Agustin et al., 2023). Innovation and entrepreneurship skills are essential to drive improvement and adaptation to changes in the aviation industry, as well as maintaining a competitive advantage in a dynamic and technology-oriented environment (Moraes et al., 2020). Thus, the implications of the results of this study suggest that to meet the needs of the industry, the curriculum should include comprehensive practical training, relevant internship programs, and learning integrated with the latest technology (Kurniawan et al., 2021). In addition, the provision of internationally recognized certification and licensing programs will significantly improve the competitiveness of graduates in the global job market for the educational curriculum in aviation vocational colleges. To meet the needs of the industry, the curriculum should

include comprehensive practical training, relevant internship programs, and learning integrated with the latest technology. In addition, the provision of internationally recognized certification and licensing programs will enhance the competitiveness of graduates in the global job market.

Conclusion

The conclusion of this study shows that the demand of aviation industry in Indonesia for vocational college graduates is very high, especially for graduates who have relevant licenses and certifications, as well as technical competencies such as flight navigation, Avsec, and airport technicians. The level of stakeholder satisfaction with the performance of graduates is quite high, especially in their technical and operational capabilities. The minimum standard of expertise expected by the industry includes communication skills, critical thinking, leadership, and interpersonal skills. Recommendations from this study are for vocational colleges to adjust the curriculum to industry needs, strengthen students' soft skills, and integrate the latest technology in the learning process.

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