JAET: Journal of Airport Engineering Technology
Volume: 3. No. 1. December, 2022; pp. 28-36 http://e-journal.poltekbangplg.ac.id/
E-ISSN; P-ISSN: 2774-9622; 2775-4871
DOI: 10.52989/jaet.v3i1.73
Submitted: 28 September 2022; Rivised: 17 October 2022; Accepted: 26 October 2022

A Triple Helix Scheme Approach: The Development of Aviation Human Resources from Perspectives of Academician, Businessmen, and Government

Oke Hendra[1], Benny Kurnianto[2], Ika Endrawijaya[2], Rini Sadiatmi[2]
[1]Universitas Indonesia, [2]Politeknik Penerbangan Indonesia Curug
* e-mail: rini.sadiatmi.rs@gmail.com

Abstract

This research aims to explore the perspectives among aviation stakeholders on aviation human resources development in the triple helix scheme. How the academician, businessmen, and government thought on the produces the human resources that qualify with their needs is investigated. A qualitative method was implemented to elaborate this research both data collection and analyses. A depth interview was conducted with informants from the three parties. After that, a focus group discussion among them to crosscheck and validated the interview was realized. The result showed that the academic perspective builds the model which seems near to a laissez-faire configuration. On the other perspective the industry, offer different model among them. Airnav Indonesia could be part of laissez-faire configuration. Garuda Maintenance Facility (GMF) Aeroasia model seems exactly like the third configuration. Batam Aero Technic (BAT) follows the first configuration. The government perspective offers an Indonesia Directorate General of Civil Aviation (DGCA) collaboration model. It seemed like the statist configuration. Academicians, businessmen, and Government in the triple helix scheme have similar preparation to face the aviation technology development in the future. They anticipated the challenge by preparing the human resources competencies. On the other hand, academician is preparing new major in the field of air navigation and unmanned aircraft.

Keywords: aviation human resource; aviation technology; collaboration; link and match; triple helix scheme

INTRODUCTION

The challenges of global competition in the 21st century and the industrial revolution 4.0 that are being faced today demand that vocational education and training must be in line with the needs of competencies, and graduate qualifications and follow the development of knowledge and technology in the aviation industry field (Septiani, Amalia, & Cahyono, 2020). This requires close cooperation between educational institutions, industry, and regulators known as Triple Helix (Yoda & Kuwashima, 2020). According to Leydesdorff et al. (2014), Ye et al. (2013) and Ivanova & Leydesdorff (2014), and the Triple Helix consists of A (academician), B (businessman), and G (government).

The involvement of industry and regulators takes an important role in producing graduates who meet the link and match criteria (Kurnianto, 2019). From various studies, there is a framework model for the relationship between the aviation industry (read: airlines) and universities (Lutte & Mills, 2019). On the other hand, there is a barrier to collaboration between aviation universities and the aviation industry, in the form of the knowledge transfer (Ergun & Peksatici, 2019).

Collaboration is a term used to describe a pattern of cooperative relationships carried out

by more than one party. Some experts provide a variety of understandings of collaboration with different points of view. However, this diversity is based on the principles of togetherness, cooperation, sharing of duties, equality, responsibility, and responsibility. In general, collaboration is defined as a relationship between organizations that participate and agree with each other to achieve goals, share information, share resources, share benefits, and take responsibility in making joint decisions to solve various problems.

Lai (2011) explains that collaboration is the involvement of several parties in a coordinated effort to solve a problem together. Its interaction is characterized by a common goal, a structure equivalent to a high level of negotiation and interdependence. Collaboration dynamics among the academician, businessmen, and government could be analyzed using the triple helix scheme (Yoda & Kuwashima, 2020), (Ye et al., 2013), and (Leydesdorff et al., 2014). **Figure 1** depicts the relationship using three configurations as follows: (1) statist configuration which explained that government as the main role of collaboration; (2) laissez-faire configuration where there are separate spheres with strong borders among the parties; (3) balanced configuration, this scheme showed trilateral network and hybrid organization Ranga and Etzkowitz in (Yoda & Kuwashima, 2020).

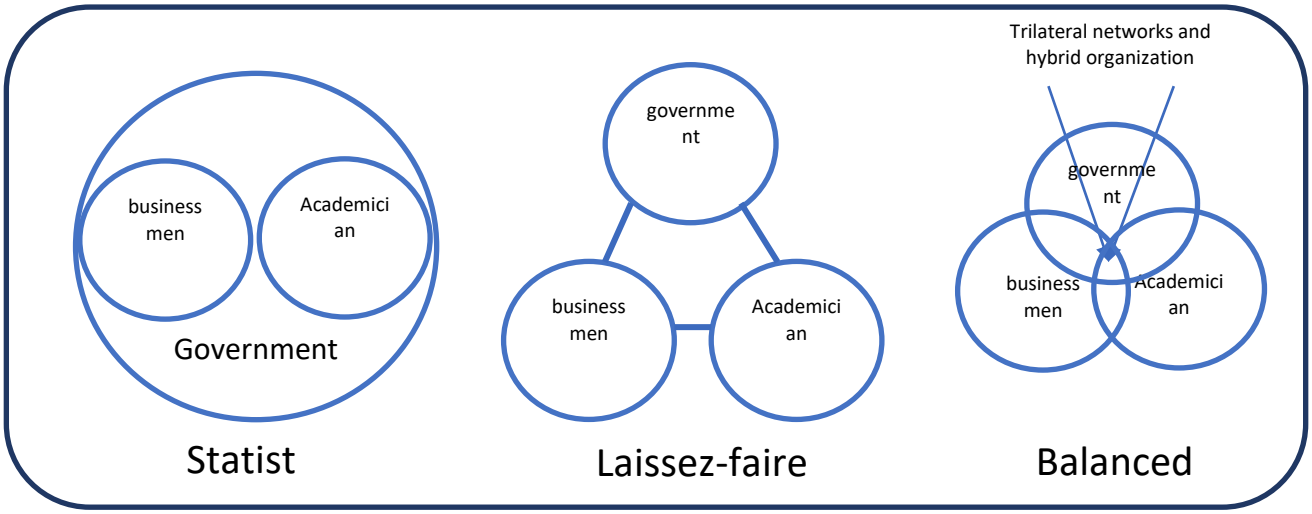

Figure 1. Triple Helix Configuration (Yoda & Kuwashima, 2020)

Based on the description above, this study aims (1) to explore the perspectives among aviation stakeholders on aviation human resources development in the triple helix scheme. In aviation it comprises academician (A), Businessmen (B), and Government (G). How the academician, businessmen, and government thought on the produces the human resources that qualify with their needs is investigated. (2) to describe the other perspectives of A, B, G facing the near future technology in aviation and how they are preparing the qualification of the human resource.

METHODS

This research will use qualitative methods by entering data in the form of text and images (Creswell & Báez, 2021). The data collection and analyses will be explained as follow:

In-depth interview activities were conducted to elaborate the results of the preliminary study form. It is done to get a deeper view from the parties, especially regarding the ideal quality of agreed graduates, the curriculum that facilitates the needs of the parties, and things that are deemed necessary based on the results of preliminary study studies. In-depth interviews were conducted with academia and government while for the industry it was not possible due to limited communication processes. Furthermore, the

industry was invited to participate in a focus group discussion (FGD). The parties visited for in-depth interviews were those involved in the triple helix scheme and collaborative governance in this study. The party is A or Academician, in this case it is the PPSDMPU Udara. Respondent is an echelon III official in charge of aviation Education activities. In addition, the academics who were visited for interviews were echelon IV officials in charge of academic administration and administrative activities and alumni. Each academic party will be interviewed twice, namely before and after the FGD activities between the parties. Furthermore, in-depth interviews were carried out by visiting the regulator in charge of standardizing aviation personnel from each aviation field such as DKUPPU and DNP, in their respective offices. Activities are carried out by interviewing each directorate represented by the Head of the Sub-Directorate who oversees standardizing aviation personnel. This activity of visiting different locations takes two days for the interview time and two days to validate the interview results.

FGD activities are carried out by inviting stakeholder representatives to openly give their views on the implementation of aviation human resources development. In addition, this activity is used as a place to bring together common ideas and accommodate the views of each stakeholder. The invited parties are representatives of two aviation industries that oversee HR development functions at least at the level of HR directors or managers, namely Airnav Indonesia and two AMOs consisting of GMF AeroAsia and Batam Aero Technic. Each party is also invited based on the representation of state and private companies in the field of aviation. Meanwhile, from government representatives, in this case, two directorates related to the standardization of aviation personnel are DNP and DKUPPU. Finally, the academics invited are PPI Curug and PPSDMPU. FGD activities are carried out once in the form of online FGDs. Research assistants are involved for three days, namely before, during, and after FGD activities. The implementation of the FGD is planned for three hours to explore the mental model of each of the parties related to the development of Aviation Human Resources and validate the information at the time of filling out surveys and interviews as part of triangulation.

The literature review focuses on collaborative governance theory such as its implementation either in the field of HR development or various other fields in previous research. Then the Literature study was also carried out on the type of HR development that uses methods outside of collaborative governance. This was done to see the position of this study compared to previous studies. Literature sources are focused on the latest articles that have been published in scientific journals both internationally and nationally, at least the last five years. However, for some things, the Literature review will also explore various theories regarding collaboration, governance, HR development, aviation human resources development.

The documents observed are about human resources development documents at aviation vocational schools, both in the form of curriculum, syllabus, standard operating procedures, teaching materials, and documents related to vocational training. In the industry, we will be explored regarding standardization related to human resources, such as recruitment, training, and competence. Meanwhile, the documents that will be observed from the regulator are related to the standardization of aviation human resources both on a national and international scale. Field observations were conducted in conjunction with in-depth interviews and Online FGDs.

The data that has been processed according to its categorization is then explained narratively as a finding. The first narrative is a description of the existing conditions of collaborative governance based on the perceptions of each cluster, academics, industry, and regulators in the aviation world in Indonesia. Furthermore, it is also explained about the development of aviation technology and how each cluster interprets it and prepares itself to face it.

Interpretation is carried out on the findings and given an explanation based on the

theory of collaborative governance from Ansell and Gash. Further described the implementation of the theory on the development of aviation human resources. So that the conclusion was reached that this theory allows it to be implemented in the development of aviation human resources to achieve link and match targets, especially in facing the challenges of aviation technology development in the future.

RESULTS AND DISCUSSIONS

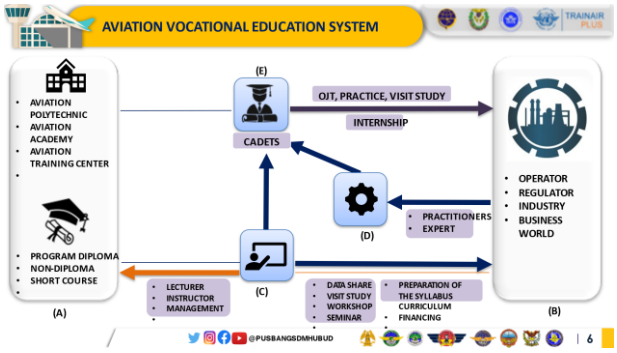

Figure 2. Aviation Vocational Education System

In the aviation education policy, PPSDMPU and all educational Implementation Units (UPT) under it can involve the aviation industry, which is a user of its graduates, as well as with the regulator from the Director General of Hubud as the standardizer of aviation personnel. This is done in line with the concept of link and match in the world of education in Indonesia which was initiated by the Minister of Education and Culture of the Soeharto era, namely Prof. Wardiman Joyonegoro (Kurnianto, 2019).

Academician Perspective

In the Focus Group Discussion (FGD) which presented businessmen and government, representatives of academics stated that the involvement of non-aviation education parties in this case the operators, regulators, industry, and the business world has been carried out as shown in **figure 2**. The first thing that is implemented by academician in involving businessmen and government is on the job training activities, practices, studies visits, and internships. All the activities mentioned are as part of education processed by students at the UPT Education PPSDMPU involving businessmen. In this activity, students are referred by the university to various types of aviation industries such as airports, Airnav Indonesia, aircraft workshops, and others. It should be done at least 6 months. It is conducted to directly practice all the material which is gained from their class, in the industrial world. In addition, they are also expected to advance experience working in the industry. Furthermore, they can know the world that they should join when they graduated.

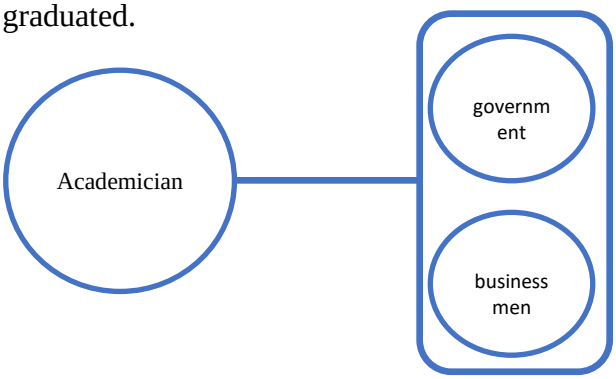

Figure 3. Academician perspective in the triple helix scheme

The next activity that is applied as an activity to involve the B and G that have been carried out by PPSDMPU and its universities under their coordination is the presence of practitioners and experts. they are plotted as a lecturer for students. They were given the opportunity to share their knowledge officially. It is determined based on a decree prepared by the leaders of the UPT Pendidikan PPSDMPU. Furthermore, if they are permitted by their head of organization, they can become permanent lecturers by being proposed to the Directorate of Higher Education. It could happen even though the level of education is only undergraduate. They should attend the process through past learning recognition (RPL). It can align their experience that they have with the level of master's education and even doctoral education.

The third thing is the involvement of non-educational parties from the aviation industry and regulators in the preparation of the curriculum. This activity is in the form of coordination meetings, seminars, workshops, data sharing, and studies visit. During the preparation of the curriculum and syllabus, the industry and regulators were allowed to submit input and suggestions on it that had been prepared by the PPSDMPU team. Moreover, there were several of curricula and syllabus

that B and G involvement since its drafting. The last thing that PPSDMPU organizes in involving the aviation industry is to prepare graduates who have the required competencies in recruitment activities organized by the industry.

The academician perspective when we compared with the triple helix scheme by Ranga and Etzkowitz in (Yoda & Kuwashima, 2020) has different model. We could draw as **figure 3**. It seems near to a laissez-faire configuration with there was different goal that linking businessmen with government. However, businessmen should follow the regulation from government regarding the standard human resources in aviation. They must assign the aviation officer who has licenses issued by G.

Businessmen Perspectives

Indonesia only has one company engaged in the industry in the field of aviation navigation, namely the Indonesian Aviation Navigation Service Provision Institute (LPPNPI) or better known as Airnav Indonesia. In the presentation delivered to respond to collaboration among triple helix scheme on the development of Aviation Human Resources, Airnav Indonesia focused on link and match. It is the synergy between demand and the provision of human resources from aviation universities. However, Airnav stated that based on the roadmap of aviation navigation services & their fulfillment program, the addition of aviation engineer was only to replace retired ones. Specifically for ATC, in addition to replacing those who retire, it is still necessary to add a total of 154 people within a period of 5 years and prioritize their fulfillment through transfer and mutation programs so that the recruitment of educational institution graduates is the last option.

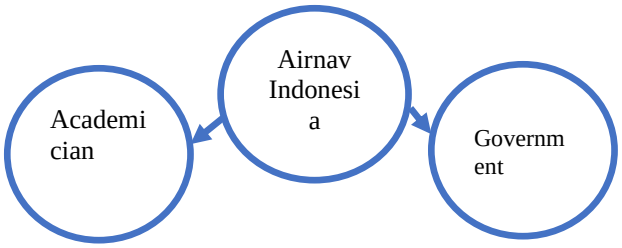

Figure 4. Airnav Indonesia's model of collaboration in aviation HR development

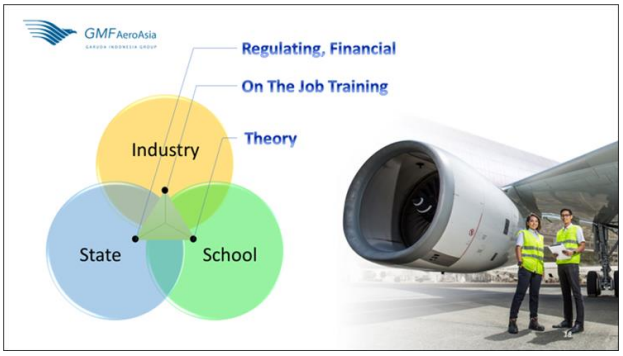

Figure 5. Collaboration on the perspective of businessmen (B)

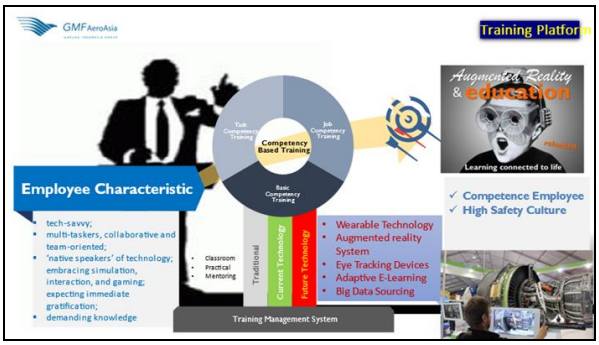

Figure 6. Characteristics of employees

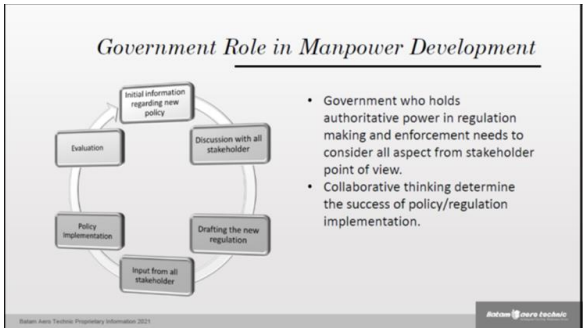

Figure 7. The role of the government in collaborative governance according to BAT

Meanwhile, the aircraft repair industry is represented by two Indonesian aircraft repair companies whose service range reaches outside Indonesia. First is PT. GMF Aero Asia (GMF), a company that is a subsidiary of the government-owned airline company, Garuda Indonesia. In his presentation, the informant gave a depiction of collaboration model as shown in **figure 5**. It seems exactly similar to the third configuration of Ranga and Etzkowitz in (Yoda & Kuwashima, 2020). On the other hand, the informant said that the criteria for employees at GMF must meet the required employee characteristics and must be met by graduates of the UPT Pendidikan PPSDMPU as illustrated in **figure 6.**

The second company that participated in the FGD was a subsidiary of the private airline Lion Air, namely PT. Batam Aero Engineering (BAT). In his presentation, the informant conveyed the HR criteria needed by BAT and must be prepared by the UPT Pendidikan PPSDMPU which consists of three specific parts of knowledge, attitude, and skills. The informant also gave his point of view on the role of regulators in collaboration scheme as illustrated in **figure 7**. However, BAT has different point of view with GMF according to the information in figure 7. It showed that BAT follows the first configuration by Ranga and Etzkowitz in (Yoda & Kuwashima, 2020) where the government is the main roles in manpower development.

The informant from BAT also gave his point of view regarding the role of regulators in the collaboration of aviation HR development as illustrated in figure 4, namely first providing preliminary information related to the policies issued. Then starting discussions with parties in the aviation industry. Furthermore, prepare a preliminary draft which will later be given input from interested parties. After that, the policy is implemented for a certain period and then an evaluation is carried out regarding the effectiveness of its implementation.

Government Perspectives

Similar to the industry that attended the FGD, the invited regulatory representatives were from the relevant directorates, namely the Directorate of Air Navigation (DNP) and the Directorate of Airworthiness and Aircraft Operations (DKUPPU). In his presentation, the informant conveyed about the duties and functions of the regulator in the field of aviation navigation, namely the regulation, control, and supervision of flight navigation personnel. In addition to conveying the job description and its functions, the informant also conveyed the position of the regulator in the collaboration model, namely in the process of preparing aviation HR regulations, the initial concept was initiated by the regulator. Furthermore, before the issuance of the regulation, it was discussed together with interested parties in the aviation industry, namely operators, training institutions, and legal parties. The form of activities carried out in the form of meetings, discussions, or picking tests.

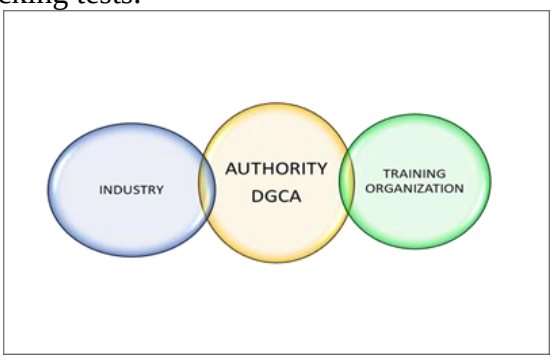

Figure 8. DKUPPU's collaboration model on HR development

The second party of the regulators present at the FGD invitation was from the DKUPPU. In his presentation, the informant gave an overview of the main duties and functions of the DKUPPU in terms of aircraft maintenance, namely regulation, control, and supervision. The informant also elaborated on the position of the regulator in the collaboration scheme, the first is as a reviewer of the chair and OJT program organized by the training institute. Furthermore, the regulator reviews the quality of graduates of educational institutions and encourages synergy between the industry and training institutions. DKUPPU also carries out personnel qualification mapping activities in the aviation industry. Finally, the position of the regulator, in this case, DKUPPU, improves education programs for students by gaining fieldwork experience in the industrial environment. The interesting thing is the collaboration model initiated by DKUPPU as shown in **figure 8**. It is seemed similar to the statist configuration in Ranga and Etzkowitz in (Yoda & Kuwashima, 2020). The government work as a leader in the collaboration model which connects and regulates both academician and businessmen in term of HR development in aviation.

Academician, Businessmen, and Government Perspectives on Future Aviation Technology Development

The future aviation world, especially in the field of aviation navigation, is projected to use technology based on artificial intelligence or referred to as the "new state of the art technology" based onboard avionics (Pais-

Montes, Freire-Seoane, & López-Bermúdez, 2019). The European country has prepared a project called SESAR in its air traffic management (SESAR, 2012) and (Motyka & Njoya, 2020). On the other hand, the Federal Aviation Administration (FAA) has implemented a project called "the NextGen System" which is the latest technology and procedure that makes the aircraft capable of moving directly and precisely when directed (Erzberger, 2004) and (Federal Aviation Administration, 2016). Both airspaces have designed new airspaces that make satellite-based technology key to making air traffic management more procedural, safe, efficient and effective (Pais-Montes et al., 2019).

On the other hand, the aircraft workshop field will also experience significant changes in the use of technology in the future. This change is due to robotic and automation technologies, 3D Printing (Joshi & Sheikh, 2015), (Chen, Choi, Moon, & Wang, 2019) and new aircraft manufacturing techniques (Chen et al., 2019), virtual and augmented reality (Ceruti, Marzocca, Liverani, & Bil, 2019), new aircraft designs (Chen et al., 2019) and the internet of things (IATA, 2018). The future technology that needs to be taken into account is also the use of unmanned aircraft technology that will enter a new chapter in the transportation industry including the world of aviation (Finn & Donovan, 2016), (Pagallo & Bassi, 2020) and (Shirvani, 2019).

Figure 9. Aviation Industry 4.0

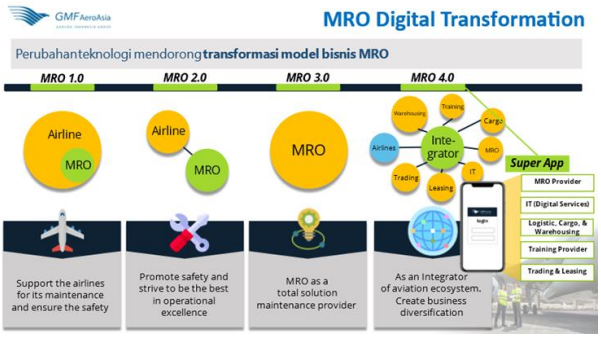

Figure 10. MRO Digital Transformation.

The aviation navigation industry in Indonesia, in this case, Airnav Indonesia, has anticipated the challenges of the aviation world in the future, in the presentation at the FGD, the informant said that human resources will be projected to be experts in the fields of satellite-based procedure design, Communication Technology, Navigation and Surveillance (CNS), and Information Management and Avionics. Meanwhile, informants from the aircraft workshop industry from both GMF and BAT also expressed their opinions on future technological changes in the aircraft workshop industry. The informant from BAT said that it is necessary to prepare human resources who have competence in the aviation industry 4.0 as shown in **figure 9**. Furthermore, informants from GMF conveyed the roadmap for the development of MRO technology from 1.0 to 4.0 according to to **figure 10**.

The regulator, namely, DNP also gave its opinion regarding aviation technology in the future. The informant said that the development of Aviation Navigation Human Resources today and in the future is anticipatory and adaptive to organizational changes, technological developments, and market needs. It has an impact on the number of HR needs and the type of expertise possessed to contest the link and match criteria. DKUPPU as a regulator in the field of aircraft repairs has issued regulations related to the use of drones. It is one of the technological disruptions in the aviation industry and requires standardization not only of its products but also of humans who control unmanned aircraft. The regulation is CASR 107 amendment 0 of 2015.

Based on the presentation from the deputy director of PPIC, it was conveyed that

academics had also anticipated future technological changes in the aviation world, namely by preparing a special study program in the field of aviation navigation, namely the Master of Applied Aviation Navigation System Engineering and Operation in the field of aviation navigation industry and Diploma IV aerospace System Engineering Technology (specialization in unmanned aircraft) in the aircraft workshop industry. The opening of this new study program is expected to be following the profile of graduates and the needs of the aviation industry in the future.

CONCLUSION

The development of aviation technology requires industries, regulators, and educational institutions to prepare reliable human resources. Collaboration according to the academic perspective is in the form of a model that describes the aviation vocational education system. The model seems near to a laissez-faire configuration with there was a different goal that links businessmen with the government. On the other perspective, the industry offers different models among them. Airnav Indonesia's perspectives if compared with the triple helix scheme could be part of a laissez-faire configuration. GMF model seems exactly similar to the third configuration. Another businessman, BAT follows the first configuration. The government perspective offers a DGCA's collaboration model. It seemed similar to the statist configuration. The government work as a leader in the collaboration model which connects and regulates both academician and businessmen in term of HR development in aviation

On the other hand, Academician, businessmen, and Government in the triple helix scheme have similar preparation to facing aviation technology development in the future. They anticipated the challenge by preparing the human resources competencies. Academicians establish the new major to accommodate the needs of graduates with the new competencies. The businessmen recruit new expert who complies with the technology development. Last but not least, the government anticipates proposing new regulations for personnel licensing.

REFERENCES

Ceruti, A., Marzocca, P., Liverani, A., & Bil, C. (2019). Maintenance in aeronautics in an Industry 4.0 context: The role of Augmented Reality and Additive Manufacturing. *Journal of Computational Design and Engineering*, *6*(4), 516–526. https://doi.org/10.1016/j.jcde.2019.02.001

Chen, T. C. T., Choi, S. K., Moon, S. K., & Wang, Y. C. (2019). Advanced aircraft manufacturing and maintenance using three-dimensional printing. *International Journal of Advanced Manufacturing Technology*, *105*(10), 4055–4057. https://doi.org/10.1007/s00170-019-04604-2

Creswell, J. W., & Báez, J. C. (2021). 30 ESSENTIAL SKILLS FOR THE QUALITATIVE RESEARCHER Second Edition. In *Gastronomía ecuatoriana y turismo local.* (Vol. 1).

Ergun, H. S., & Peksatici, O. (2019). The barriers against effective university industry collaboration - A study in Turkish aviation industry. *Pressacademia*, *6*(1), 35–43. https://doi.org/10.17261/pressacademia.2019.1032

Erzberger, H. (2004). Transforming the NAS : The Next Generation Air Traffic Control System. *October*, (October).

Federal Aviation Administration. (2016). *NextGen Implimentation Plan 2016*.

Finn, R., & Donovan, A. (2016). *Big Data, Drone Data: Privacy and Ethical Impacts of the Intersection Between Big Data and Civil Drone Deployments*. 47–67. https://doi.org/10.1007/978-94-6265-132-6_3

IATA. (2018). Future of the Airline Indrusty 2035. *Services Marketing Quarterly*, *6*(3), 57.

Ivanova, I. A., & Leydesdorff, L. (2014). Rotational symmetry and the

transformation of innovation systems in a Triple Helix of university-industry-government relations. *Technological Forecasting and Social Change*, *86*, 143–156. https://doi.org/10.1016/j.techfore.2013.08.022

Joshi, S. C., & Sheikh, A. A. (2015). 3D printing in aerospace and its long-term sustainability. *Virtual and Physical Prototyping*, *10*(4), 175–185. https://doi.org/10.1080/17452759.2015.1111519

Kurnianto, B. (2019). Dinamika Pendidikan Tinggi Vokasi. *Jurnal Analisis Sistem Pendidikan Tinggi*, *3*, 81–88.

Lai, E. R. (2011). Collaboration : A Literature Review Research Report. *Research Reports*, (April), 41.

Leydesdorff, L., Park, H. W., & Lengyel, B. (2014). A routine for measuring synergy in university-industry-government relations: Mutual information as a Triple-Helix and Quadruple-Helix indicator. *Scientometrics*, *99*(1), 27–35. https://doi.org/10.1007/s11192-013-1079-4

Lutte, R. K., & Mills, R. W. (2019). Collaborating to train the next generation of pilots: Exploring partnerships between higher education and the airline industry. *Industry and Higher Education*, *33*(6), 448–458. https://doi.org/10.1177/0950422219876472

Motyka, A., & Njoya, E. T. (2020). Single European sky: The progress so far. *Journal of Aerospace Technology and Management*, *12*(1), 1–20. https://doi.org/10.5028/jatm.v12.1175

Pagallo, U., & Bassi, E. (2020). The Governance of Unmanned Aircraft Systems (UAS): Aviation Law, Human Rights, and the Free Movement of Data in the EU. *Minds and Machines*, *30*(3), 439–455. https://doi.org/10.1007/s11023-020-09541-8

Pais-Montes, C., Freire-Seoane, M. J., & López-Bermúdez, B. (2019). Employability traits for engineers: A competencies-based approach. *Industry and Higher Education*, *33*(5), 308–326. https://doi.org/10.1177/0950422219854616

Septiani, V., Amalia, D., & Cahyono, D. (2020). Implementation of Inspector Training System Certification Learning Based On E-Learning in Palembang Aviation Polytechnic. *International Journal of Progressive Sciences and Technologies*, *23*(1), 342–346. https://doi.org/10.52155/ijpsat.v23.1.2271

SESAR. (2012). Sesar Magazine. *Director*, (March).

Shirvani, T. (2019). Disruptive technology and innovation in transport. *Policy Paper on Sustainable Infrastructure*, (August), 80.

Ye, F. Y., Yu, S. S., & Leydesdorff, L. (2013). The Triple Helix of university-industry-government relations at the country level and its dynamic evolution under the pressures of globalization. *Journal of the American Society for Information Science and Technology*, *64*(11), 2317–2325. https://doi.org/10.1002/asi.22931

Yoda, N., & Kuwashima, K. (2020). Triple Helix of University–Industry–Government Relations in Japan: Transitions of Collaborations and Interactions. *Journal of the Knowledge Economy*, *11*(3), 1120–1144. https://doi.org/10.1007/s13132-019-00595-3