Developing Aviation Smart Campus Through Digital Transformation for Vocational Education: Case Study at Indonesia Aviation Polytechnic

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Abstract: The application of digital technology to business processes brings a new atmosphere in the era of technological disruption. The increasing number of transportation users makes all air transportation industry operators compete to provide services and facilities without neglecting safety. Personnel working in the aviation sector are keys to successful service delivery. Good quality education begins with the management of the aviation campus. The application of ICT or digital technology in aviation schools in the digital transformation era will bring a fresher atmosphere and innovation. This paper aims to make the concept of digital transformation on aviation campuses based on business processes. Based on the dimensions of digital transformation, which consists of 9 aspects, as well as the value chains of the five porters, a matrix for the concept of digital transformation for aviation campuses can be created. By paying attention to customer experience, processes and business models that make it possible to create new businesses; the implementation of Digital Transformation can be achieved. A simple concept of IT Architecture, this paper can provide a plan for making a smart aviation campus.

Keywords: aviation training, business process, higher education, IT architecture, digital transformation

INTRODUCTION

Digital transformation brings changes to the environment and industry by combining social, mobile, cloud and smart systems aspects that have an impact on opportunities and innovation (Holotiuk & Beimborn, 2017). Likewise, air transportation has experienced an increase in air transportation users by 4.4% per year (Chang et al., 2019; Lamb, 2018; Oster et al., 2013) and transformation by applying technology. In this regard, qualified aviation human resources are needed to support the achievement of safe, effective, and efficient flights. The implementation of education that is flexible, integrated and prioritizes the application of technology is expected to be able to produce graduates who have skills and can compete globally in the society 5.0 (Aramyan & Krivopuskov, 2021).

New digital technologies are the key drivers of digital transformation (Conducted et al., 2011), including the use of cloud, mobile, big data, social media, internet of things and connectivity technologies to improve customer experience, streamline operations and even create new business models. Apart from new digital technologies, improving customer experience is a concern for digital transformation. Ease of using technology and new methods for service to customers such as self-service technology reduce costs and free up workers from routine transactions. There is also a streamlined operation where companies use automation to make processes more efficient and reliable, such as in Enterprise Resource planning (ERP) and developing (Shehab et al., 2004). In addition, it requires publicity from a company to drive digital transformation through automating internal processes (Brown et al., 2012). Next is the new business models, namely by implementing new technology in which the company not only runs its main business but can open and have opportunities to open new businesses. In this context, digital transformation can use digital disruption as a framework that will create new innovations and create business opportunities (Niemi & Pekkola, 2019).

Indonesia Aviation Polytechnic (IAP), which is the first aviation school owned by the government of Indonesia and has graduated tens of thousands of aviation experts, currently is a BLU legal entity based on regulations from the Ministry of Finance. Therefore, IAP must be able to compete globally and have financial independence (Umum et al., 2018). In addition, based on the ICAO regarding the standards for implementing aviation education that must be met (International Civil Aviation Organization, 2018) and the aviation law in fulfilling aviation personnel (Benedí C. & Güemes J., 2009), there is a problem of how this aviation education

institution must have readiness due to the very large asset values, a large area of 87 Hectares, complete facilities and supporting facilities. This is a challenge to manage aviation campuses to be adaptive to the era of technological disruption. IAP is currently still organizing classical education and its business processes have not yet adapted to the era of digital transformation. This will make this institution slow to move. Thus, adaptation to challenges and regulations as well as the needs of aviation personnel can only run well by carrying out digital transformation that follows technological developments and global challenges.

Indonesia Aviation Polytechnic (IAP) provides aviation training, which currently has 10 study programs. At the end of the training, all students will have a license in accordance with their respective fields as a requirement to work in the aviation industry based on Civil Aviation Safety Regulation and Law No. 1 of 2009. IAP has huge assets of 3 trillion to support the educational activities. With the assets owned and the business it runs, IAP has great opportunities in skill development and campus management. Digital transformation has 3 key factors, namely customer experience, operational processes, and business model. From these 3 keys, it can be translated into 9 building blocks as shown in Figure 1.
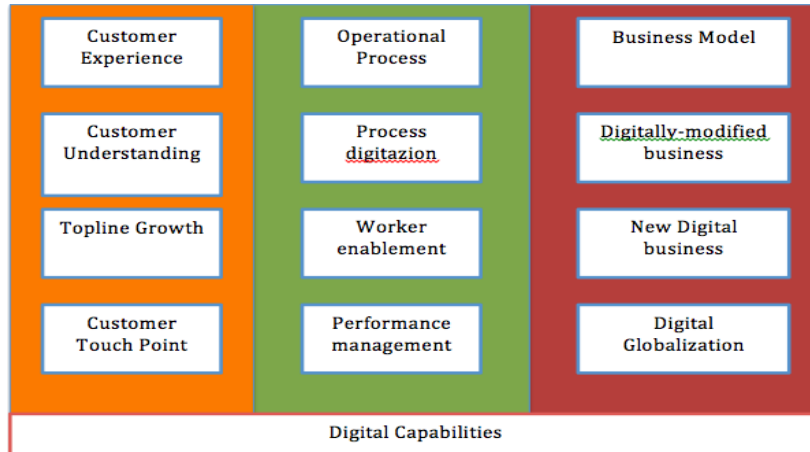
Figure 1. Digital transformation building block

Digital transformation aims to increase capabilities by involving the latest technology so as to have an impact on increasing innovation for the future (Limani et al., 2019). Digital transformation changes the main components of a business by knowing and utilizing the operating model and infrastructure, and minimizing costs (World Economic Forum, 2017). The IAP aviation campus has a business process, which is a collaboration of several stakeholders as seen at Figure 2.
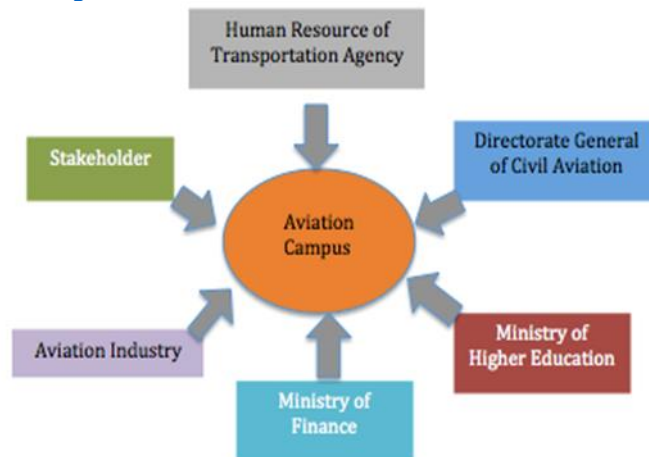
Figure 2. Aviation Campus Stakeholder

Digital transformation is also known as digitalization very popular with academics and industry. The role of technology and ICT in business processes makes evolution and innovation a problem. The application of the latest digital technology is the key to the success of digital transformation, although there is no consensus on the impact of business transformation except for statements from customers and improvements in company performance (Conducted et al., 2011). Digital transformation brings changes to increase customer experience, operations, and the formation of new businesses, so several things that are of concern are:

Usage of new technology, Acceleration in digital transformation requires cloud, mobile, big data, social

media and connectivity, the use of smart sensors and the Internet of Things (Prandi et al., 2020). Cloud computing makes it easy to share computer-processing resources on demand (Hassan, 2011). Mobile technology makes it easy to access applications, communications and data (Matt et al., 2015). Big data, high volume, high velocity, and variety of data, both structured and unstructured, make this data very useful for analyzing and making decisions. No less important is social media, which has a role as a liaison and interacts with the community. Improving Customer Experience, Customer experience has changed and shifted the old habits and models through digital self-service, such as self-service banking, self-service gasoline stations, self-service scanning and check-out lanes grocery, electronic voting, and self-check-in at airports (Castro et al., 2010). Technology that makes a habit of becoming self-service will reduce costs and labor (Reinders et al., 2008). Streamline operation, Companies use automation to make processes more efficient and reliable, even in the scope of enterprise resource planning (Shehab et al., 2004), research and development. Digital transformation with automation in internal processes will make companies work simpler and even create new businesses (Conducted et al., 2011; Cioslowski, 1989). New business concept, Efficiency and innovation by applying digital technology will seem to disrupt many elements of the old company pattern, but in fact digital disruption creates new business opportunities ("Journal of Forecasting 13 (7), 601-610," 1994).

The idea of smart campus is using technology for intelligence business in education, there are three groups can be identified: technology driven, the concept and adoption of smart city, business development (Wang et al., 2017), the architecture of smart campus there are four main components: sensor infrastructure, storage database management, data visualization interfaces and web server (Monti et al., 2018). Regarding revolution industry 4.0 in aviation industry, airport, aircraft maintenance and repair organization, airline, air navigation provider and another business in aviation are challenging for human factors, the technology changes but humans are not changing (Lamb, 2018), so as a provider human resources of aviation the aviation campus need to change the paradigm, the aim of this study is making a concept of digital transformation of Indonesia Aviation Polytechnic, the first aviation training in Indonesia which have a huge infrastructure, area and human resources for high performance digital organization and operating process in aviation training, regarding the framework of digital transformation process that have 5 pillars people, process, policy, stakeholder and infrastructure Indonesia Aviation Polytechnic should need a process of transforming to high-performance digital organization use digital technology and information system management (Rujira et al., 2020) that will increase the efficiency and competitiveness of the organization for excellence service and modern process through digital transformation (Rujira et al., 2021)

METHODS

In this study, primary data were obtained from interviews with the aviation school and secondary data were obtained from reviews of several articles and documents. The analytical tool uses the Digital Transformation framework (Conducted et al., 2011) and the business-modeling phase of Porter's value chain diagram (Eling & Lehmann, 2018).
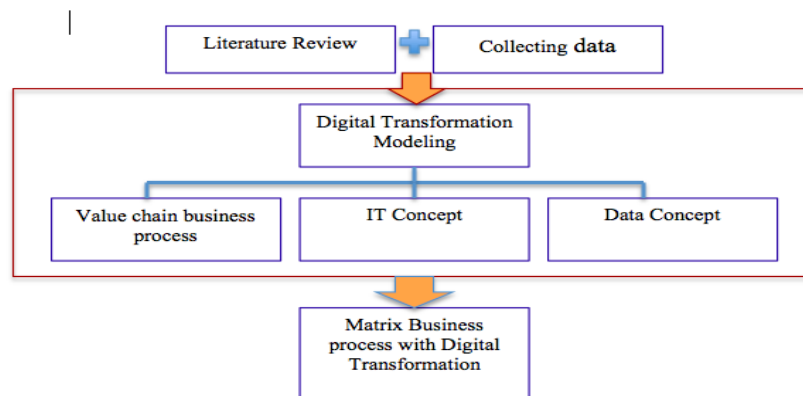

Figure 3. Research Framework

Value Chain Analysis

Identifying the main activities and supporting activities in the Indonesia Aviation Polytechnic as shown in Figure 4 carried out analysis of business processes using Five Porters Value Chain. Both activities support the vision and mission of the institution as shown in Figure 4. Based on the identification of data, the 2 activities of Indonesia Aviation Polytechnic, the main activities consist of Main activities consist of: Admission of New Cadets, Academic, Graduate, Research, and community service as well as coordinating with the Directorate General of Air Transportation and stakeholders. Supporting activities: Procurement of facilities and infrastructure, Human

Resource management, financial management and Quality Management Representative.

Furthermore, to identify the concept of digital transformation for aviation campuses, paying attention to 3 aspects of digital transformation and its dimensions, which are then described in the suitability matrix between the digital transformation concept and the value chain business model, carry it out.
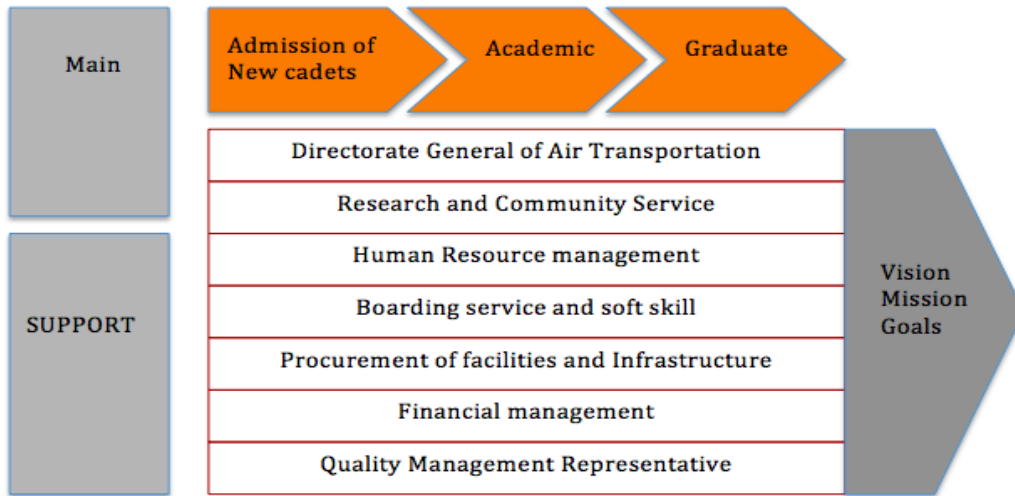
Figure 4. Value chain business model

RESULT AND DISCUSSION

The proposal of Digital Transformation of Indonesia Aviation Polytechnic for Aviation Smart Campus, value chain of aviation campus shown in Figure 4 above, the value chain of. The business process consists of the main and supporting activities, which are described in the following chart.
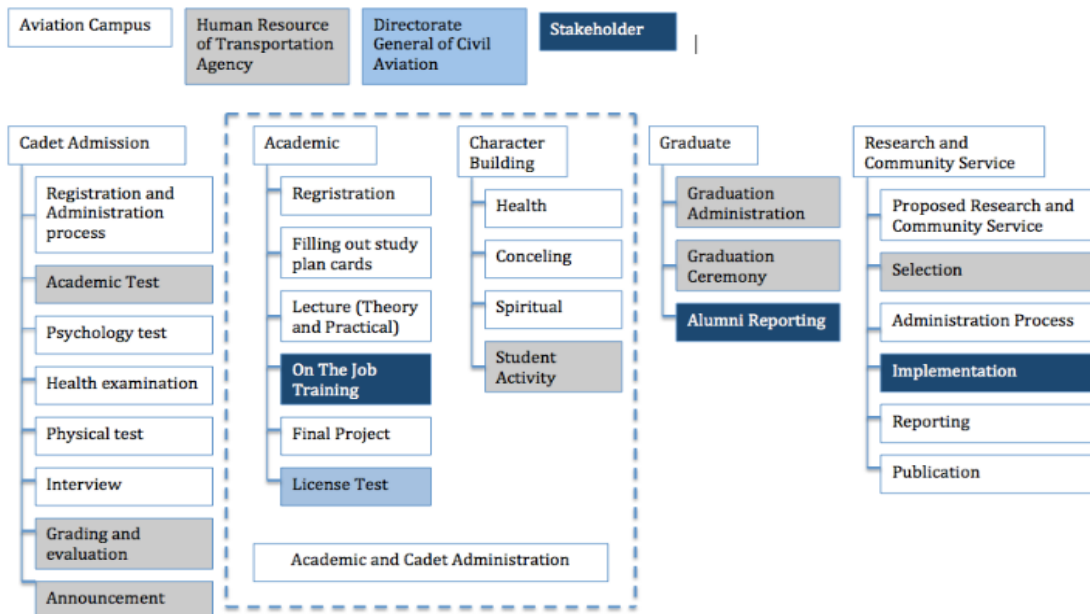
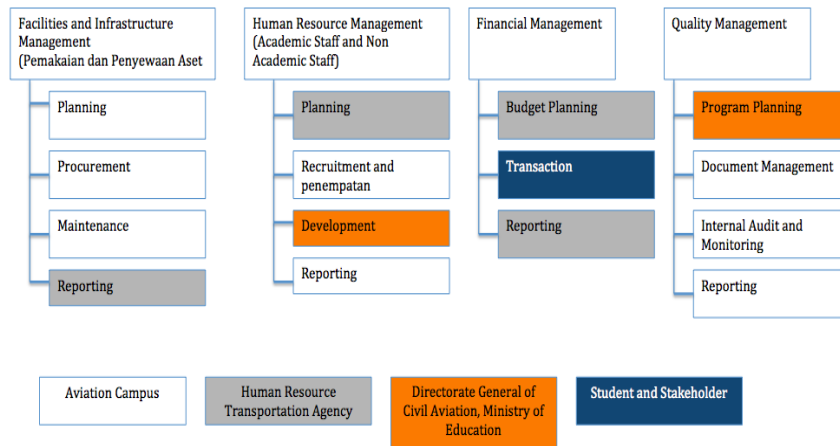**Figure 5.** Main Sub Business of Indonesia Aviation Polytechnic

Figure 6. Support Sub Process

For main sub process in Figure 5 there are 4 areas, cadet admission, academic, graduate, research and community service, this is main area at acidic field, also for character building is main concern to develop the attitude of cadet. The cadet admission as a collaborative function from stakeholder not only from IAP. At the academic field, the license as a student capability issued from directorate general of air civil aviation (DGCA), so IAP must coordination and collaboration with DGCA delivering a competencies training, this happened several areas regarding DGCA has several Directorate in different type of license. Graduate field, this is important for sustainability for IAP Campus, beside as a prestige about the alumni carrier and also for improve IAP Curriculum. There is another support for academic activity, as Figure 6 support sub process there is facilities and infrastructure, human resource management, financial management, quality management. IAP has a huge infrastructure such as Aircraft, simulator, laboratories, management building, class, dormitory, sport facilities and other facilities, the value about 3 billion Rupiah, there is a chance for increase the revenue for IAP from asset sector. Human resource management, this is how IAP prepare about the capability of staff to work in some areas which suitable license/ certificate like aircraft maintenance, lecturer, technician, laboratories, library etc. financial management this also the key factor for increase the good governance of institution, a good finance report has impact to the prestige for this campus. The integration data and the flow of finance necessary to improve the trust and motivation for the staff and stakeholder. The quality management as a quality control for all business process at IAP has a big portion to monitoring and reporting and gives some recommendation for improvement. Both main and support of main process must integrate and connect as well as to support the vision and mission of IAP.

The architecture for smart campus which also adoption from smart city concept, as mentioned above consists of 4 system: the sensor infrastructure, data visualization, database management and web server (Monti et al., 2018). This is the concept of the architecture:
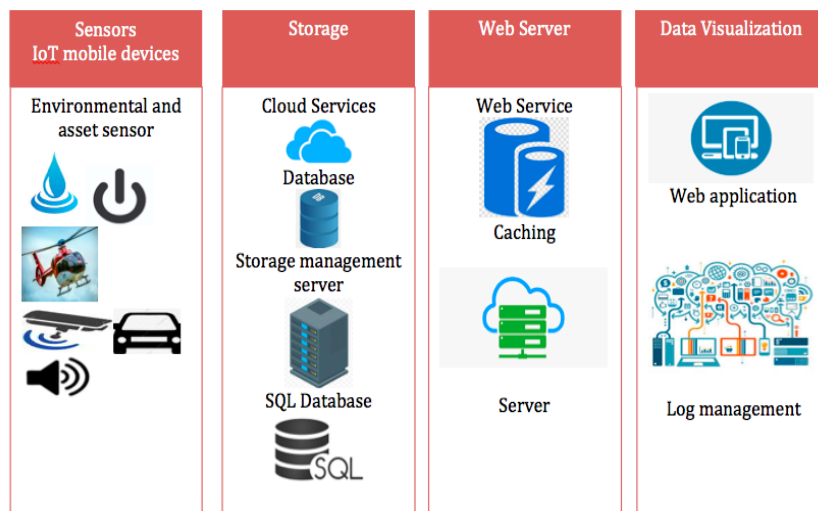

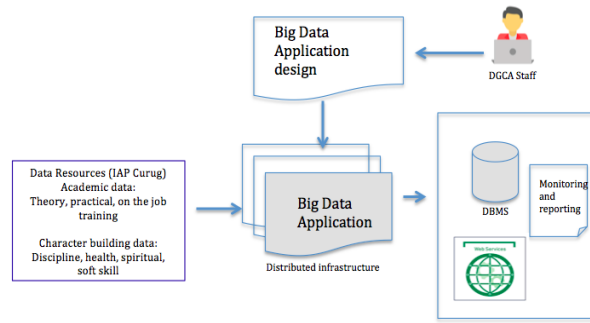**Figure 7.** Concept of architecture for aviation smart campus

Figure 8. Concept of architecture for aviation smart campus

The architecture as a key function for value chain business model, main and support sub process consist of 4 parts as Figure 7. The sensor as augmented infrastructure, develop with canarin II (Aguiari et al., 2018), this sensor also equipped with another sensor, the advantage of this sensor gaining environmental data such as air pressure, temperature, humidity which useful for check the condition about class, laboratory, aircraft and some simulator, the communication between the station and web server by using Wi-Fi/ Wi-Max related the area of IAP. Another sensor to control and monitoring the noise level, USB condenser microphone has a compact characteristic which has an omnidirectional pattern, a signal-to-noise ratio 85dB and has a frequency range between 100 Hz to 16.000Hz it can set up related aeronautical frequency (117- 137 MHz) (Wang et al., 2017).

The database layer, the data capture by sensor and send to database real-time, the data stored in MySQL database, and cloud service also use for effectiveness storage spent. The web server responsible to receive the client request querying the database layer and answer with calculation data. The data visualization allows to community interact with the data, the rich web base application using HTML5 and CSS3.

Regarding the process of certification of competencies for student after training, this process collaboration with DGCA, which has authority for personal licensing, the concept of big data can use for this process, the academic IAP data connected with DGCA data, this is important state of all academic business process. Figure 8 shows the concept of collaboration data between IAP and DGCA/ stakeholder, the source data from IAP and user / DGCA monitor the request and carrier of person who have license issued from DGCA and training in IAP. Using data base, web server and big data application it is connected this concept leveraging the learning process and experience and increase collection of large and diverse set of data (Khan et al., 2017).

Related to business process of IAP as shown at Figure 4 and the concept of digital transformation Figure 1, we make a matrix as in Table 1. There are 3 aspects of digital transformation and 3 items each aspect. We plot the possible plan to each building block of Digital Transformation aspect. Considering with IAP stakeholder and the posture of IAP becomes profit organization that's make this organization consider about asset management as support sub process at Value chain business process.

Table 1. Digital Transformation aspect

Customer Experience	Operational Process	Business Model
Customer Understanding	**Process Digitization**	**Digitally modified business**
Digital and self-service process since recruitment by making customer Apps Admission of new cadet: Single account to access all test phases **Academic** Candidate entity, Lecturer Entity, Parent Entity, Academic Advisor Lecturer Entity, Study Program Entities, cadet status Entity, curriculum, subject, study plan, On The job training, final project **Graduate:** - Data mining tracer study to enhance and improve curriculum and character-building method - Involving social media for socialization and the effectiveness of providing information	- Virtual digital classroom and seamless integration of physical and digital space - Research and Service Community Automation service and repository - Setting up an automated system to make the process more efficient and scalable, starting with creating an ERP for integration between resources, human resources, financial and supply chain processes - Employee Self-service system for lecturers, teaching staff, laboratory assistants, technician librarians and staff / support systems - Transparent access to information and functions	- The process of education and training as well as the use of assets that involve digital technology - Optimizing asset utilization

Inspirational education experience through student-centered and technology –rich way of learning

Topline Growth	Worker Enablement	New digital business
Prepare agents who have been trained and equipped with easy gadgets to provide information / data input, where this agent becomes an intermediary in services for changing to digital who can later provide analysis for Customer Relationship Management (CRM)	- Mobile devices will keep staff / employees connected to the office / campus and make it easier to coordinate and be responsive to problems that require a quick response - Seamless services with digital process - Human Resource management and training in accordance with employee recruitment, training demand planning, good training preparation and process, quality assurance, payroll and dismissal	Widen the market by preparing a business to go digital, such as: - Creating a platform for online learning and blended learning - Digital library with access rights - Global partnership with online collaboration - Asset utilization cooperation agreement - Leasing assets that are managed with a digital system Cooperation for seconded experts
Customer Touch Point	**Performance Management**	**Digital Globalization**
- By preparing Apps for self-service via digital tools, customers can access information and easily share it on social media - Self-service for academic and non-academic activities - Such as smart systems to monitor lectures, educational facilities, dormitories and services in dormitories - Real time student reporting	Information management system to monitor and inform a policy or order from the leadership Ease and well-ordered data circulation Management process includes target setting, monitoring, reporting of key performance indicators (KPI), incentives and leadership **Financial process:** - Integrated Invoicing	- Global flexibility, the ease of fulfilling requests from customers / service users and other stakeholders - Ease of simplifying bureaucracy and creating autonomous processes by utilizing a data center - Full digital support at all stages of the research process - Research information and management system Accessible high-performance computing

CONCLUSION

The conclusion obtained from the methodology and results explanation is that the IAP has great assets and plays an important role in supporting flight operations. This also gives an opportunity improve the business Digital transformation can be implemented for convenience in business processes, management, and the satisfaction of the community. As an organization that must observe the level of income to its operations, efficiency and technology application can be applied. Further research can measure the level of maturity, IT design and details of the business processes.

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