International Journal on Advanced Science Engineering Information Technology

Vol.12 (2022) No. 4
ISSN: 2088-5334

Strengthening of Defense Human Resources through Information Technology in The Era of Industrial Revolution 4.0: (A Case Study: Indonesian Naval Academy Surabaya)

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***Abstract*— In the era of the Industrial Revolution 4.0, the defense sector must anticipate the development of digital technology, which has a major impact on the cybersecurity system and defense technology itself through strengthening defense resources. This study examines the strengthening of defense human resources through information technology at the Surabaya Navy Academy (AAL). Data collected through observation, interviews, documentation, and competency tests. The results show that strengthening is supported by human resources who have adequate competence, carefully arranged financing, complete teaching materials, use of two-way methods as needed, supported by complete facilities and infrastructure. The strengthening process supported by careful planning, implementation not only on the campus of the Naval Academy but also at other representative institutions. The implementation is monitored via CCTV and supervised by a lesson supervision officer who reports directly to the Governor of the Naval Academy. Evaluations are always carried out to get input to improve existing and ongoing activities. The output of strengthening, cadets of the Naval Academy can master information technology competencies with good values as expected. The conclusion is that the strengthening of AAL cadets through information technology has carried out following the objectives and has achieved the target of increasing the competence of Naval Academy cadets in the information technology field. Therefore, this program can be continued in the future by increasing the quality of its implementation.**

***Keywords*— Defense human resources; information technology; industry 4.0; navy academy.**

Manuscript received 15 Feb. 2021; revised 30 May 2021; accepted 5 Aug. 2021. Date of publication 31 Aug. 2022.

I. INTRODUCTION

Currently, the world is entering a new era known as the industrial revolution 4.0. An industrial revolution era that integrated networks to integrated to follow, exchange, process, store and send messages automatically [1], [2]. Today's technological systems have been developed with artificial intelligence (AI), Internet of Things (IoT), Unmanned Vehicles (UMV), Mobile Technology (5G), Workspaces, study classes, and public roads equipped with CCTV for surveillance, control, learning environments equipped with Smart Classrooms, Robotics, and Bio-Technology [3]–[6].

Perceived changes such as skin touch or face-to-face touch screen (screen to screen). In other words, technological advances in the Industrial Revolution 4.0 have been able to change the pattern of human relations in all aspects of life, be it social, economic, legal, political, cultural, defense, and security [7]. The other side, the presence of this era is believed to have a positive impact on human life and a threat to unqualified human resources (HR). Therefore, the government must immediately be aware of this by improving the quality of human resources. Improving the quality of human resources to face increasingly fierce competition is a priority for all nations, including Indonesia. According to the 2019 Global Competitiveness Index (GCI) report released by the World Economic Forum, Indonesia's competitiveness ranking fell five places to position 50 out of 141 countries surveyed. Likewise, Indonesia's competitiveness score in 2019 fell 0.3 points to the level of 64.6 points on a scale of 0-100 [8]. Thus, the quality of Indonesia's human resources still needs to improve to face global competition in all fields, including in the defense sector. This is important because the defense is one of the functions of state government to create a single national defense unit to achieve national goals. In industrial revolution 4.0, the role of defense in digital transformation is increasingly significant. Internet-based

systems will become attractive opportunities for cyber-attacks if the Internet of Things achieves greater growth [9]. The defense sector must anticipate the development of digital technology, which has a major impact on the cyber security system and defense technology itself, including the main weapon system, the defense industry, and intelligence technology [10]–[12]. Therefore, the use of modern detection system technology and defense equipment requires high academic competence and skills for soldiers who guard them. Military capabilities should be developed based on digital technology, big data, and artificial intelligence to face the opportunities and challenges of the 4.0 Industrial revolution era [13], [14].

Terms "the man behind the gun" is a very familiar term when talking about the relationship between human resources and their ability to use technology. Minister of Justice and Human Rights Indonesia revealed that an organization with its systems and management would not run properly as long as the human resources (HR) who operate it do not have integrity [15]. This means that human resources in the era of the industrial revolution 4.0 are very dependent on the good and bad development of human resources.

To face the demands of advances in information technology and improve the quality of the Indonesian Navy's professionalism, educational institutions play a very decisive role in forming the initial foundation for developing the Indonesian Navy's human resources organization. For this reason, the Navy needs to continuously develop and strengthen educational institutions in their environment that has an important role in shaping the character and professionalism of soldiers in accordance with the demands of advances in information technology in the Industrial era 4.0, including the Naval Academy.

The Naval Academy or abbreviated as AAL is an educational school for the Indonesian Navy (AL) which organizationally, AAL is in the Indonesian National Army Navy (TNI AL) organizational structure under the guidance of the TNI AL Academy. Students in naval academic called Cadets. Cadets are a graduate from senior high school who continued his study at Naval Academy for four years of education. After graduating, the AAL's cadets stated as first officers with the rank of second lieutenant and a bachelor of defense engineering degree.

The AAL's cadets strengthening program through information technology is designed to get more professional quality in the field of information technology. In addition, it is also to anticipate the destructive progress of information technology in the era of industrial revolution 4.0. Strengthening program cadets through information technology is to narrow limitations in the defense of human resources in the field of information technology [16]. This is interesting to study further about strengthening human defense resources through information technology in the era of the industrial revolution 4.0.

II. Materials and Methods

In this study, the researcher acts as a full observer, namely, an observer who is not directly involved with the research subject in carrying out the research process. It has been done to maintain the objectivity of the research results.

Under the research approach used, this research method is descriptive qualitative. The qualitative descriptive method is a research procedure that produces descriptive data in written words, pictures, and not numbers, obtained from people and observable behavior [17]. With this qualitative descriptive method, the researchers hope to obtain data about the research object because of the direct relationship with the respondents or the object of the study. As mentioned above, this research uses qualitative methods, so data collection through observation, interviews, and tests on subjects and objects. Table 1 shows the subjects and objects in this research.

TABLE I
SUBJECTS AND OBJECTS OF RESEARCH

No	Subject	Component	Object	Component
1	Indonesian Naval Academy Surabaya	Governor of the Naval Academy (AAL)	Input	Human resources (man), money, material, method, facilities (computers, WIFI, LAN, Smart classroom)
2		Lecturer	Process	Plan, organizing. implementation, surveillance, and evaluation
3		naval academy cadets (level 3)	Output (Strengthening)	The competency of cadets in information technology

III. Results and Discussion

To see an increase in human resources, defense through Information Technology at AAL Surabaya can see regarding (1) input of strengthening; (2) process of strengthening; and (3) the output of strengthening. For more details, see the following figure 1.

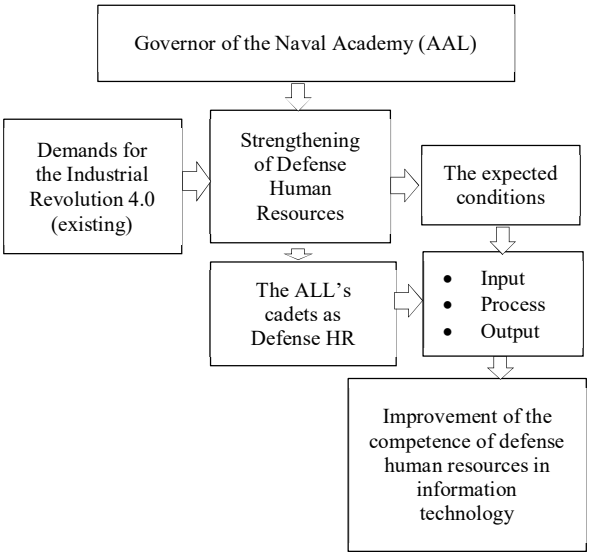

Fig. 1 Conceptual Framework

A. Input of Strengthening

1) Human resources: The AAL's cadets have implemented a computer-based learning process. They have practiced information technology computer-based and participated in the learning process activities with various sources obtained from the internet. They can exchange information and search data online, send data to instructors (lecturers) online. The enthusiasm of the cadets of AAL for strengthening information technology is very high. They realized that Information technology is very needed in the present and the future. Cadets can practice the computer-based learning process. This opinion supports Notoadmojo [18] that there are two aspects seen in human resources: quantity and quality. This shows that the element of quality human resources strongly supports strengthening AAL cadets through information technology in the era of the industrial revolution 4.0.

2) Cost: The Director of Planning and Development (Dirjenbang) and the Director of Education (Dirdik) carefully designed the cost elements required for the strengthening of AAL cadets through Information technology for Naval Academic (AAL). Facilities and infrastructure to support activities in class such as Wi-Fi, LAN, and computers and two smart class have been designed as best as possible to strengthen AAL cadets towards Information Technology.

3) Teaching-learning materials: Teaching materials for Strengthening Information Technology is not only books but also videos, the internet, electronic books, and references from other universities. As well as the availability of LAN, Wi-Fi in the learning environment makes it easier for cadets to find teaching-learning materials according to their needs.

4) Method: The instructors have used the Strengthening information technology method. It can see from the implementation of learning activities using smart class facilities. Methods of strengthening information technology are not only one-way but also two-way. Naval Academy cadets can also access data or information needed by using the e-learning method.

5) Facilities and infrastructure: Strengthening the cadets of the naval academy through Information Technology has been support by the existence of smart classes, smart boards, and information technology laboratories that support the learning process.

Fig. 2 Computer Lab

Fig. 3 CBT Lab

Fig. 4 Smart Class

Facilities and infrastructure for strengthening cadets through information technology are sufficient because Wi-Fi and LAN support them. Nadeak [19] argues that the strengthening unit must have adequate and relevant facilities and infrastructure to support implementing its programs, managing, utilizing, and maintaining facilities and infrastructure efficiently and effectively. Provide buildings, lecture halls, laboratories, and spaces. The library provides computer facilities to support training programs, studies, and laboratory programs in the testing room and the field and ensure the sustainability of procurement, maintenance, and proper utilization of facilities and infrastructure.

B. Process of Strengthening

1) Plant: The objectives of the planning for strengthening cadets of naval academies through Information Technology are as follows: (a) systematically knowing the stages of strengthening activities to be carried out; (b) know which aspects or elements of strengthening are the focus; (c) knowing the model used; (d) preparing the materials and methods used. Planning in the framework of designing the naval academy cadets' program through Information Technology is the initial activity in preparation for the implementation of strengthening. There are three important things to consider in the Planning to Strengthen AAL Cadets through Information Technology, i.e., purpose (what to achieve), Method (how to achieve the goal), and Format (determining the design you want to achieve). The preparation of the AAL's cadets strengthening plan involving the use of Information Technology being carried out through the following procedures:

- Formulate clear, explicit, and specific assumptions about strengthening AAL's cadets through information technology.
- Identify competencies.
- Formulate goals descriptively.
- Determine the criteria and type of assessment.
- Group and prepare cadet goals.
- Design a strategy to strengthen AAL's cadets.
- Organize a class management system.
- Implement a trial plan to strengthen cadets.
- Provide an assessment of the design of the strengthening of naval cadets.
- Revise the plan for strengthening cadets.

2) Organizing: The implementation of strengthening AAL cadets through information technology needs to be structured in an organization/committee structure and clear job descriptions. The organization is formed by considering the aspects of efficiency and cooperation. The activities of strengthening AAL's cadets through information technology are divided into four macro components, as shown in table 2.

TABLE II
COMPONENTS OF STRENGTHENING IN ORGANIZING

	Components		
Strengthening	**Participants**	**Policy**	**Environment**
– Module/teaching materials	information technology knowledge	Regulation	Security
– Facility	Information technology skills	Responsibility	Condition
– Information technology Instructor	Attitude	Supporting facilities	Attitude
– Method	-	-	-
– Time	-	-	-
– Evaluation	-	-	-
– Ambiance	-	-	-

These components are linked or integrated with organizational activities to go hand in hand to achieve the objectives of the naval academic cadets strengthening activities through information technology implemented.

The success of organizing for the strengthening of AAL's cadets through information technology can be seen in the strengthening process's progress, namely the atmosphere of the strengthening activities. This is reasonable because the purpose of organizing is to assist coordination, namely assigning work tasks to work units in a coordinative manner, so that goals can be strengthened easily and effectively. To streamline supervision, need to place competent personnel in each unit of strengthening implementation, increasing specialization with the concentration of activities. So that it can help a person become more skilled in certain jobs, cost savings by organizing, there will be considerations related to efficiency, a harmony of interpersonal relations with organizing so that each personnel between works units can work complementary to each other, reduce boredom, foster a sense of mutual need, and eliminate materialistic approaches. The success of an organizing activity cannot only be seen from the results of the AAL's cadets strengthening activity through Information Technology but also in the ongoing activities.

3) Implementation: After everything about strengthening AAL cadets through information technology has been planned, the next stage is implementation. This activity describes the implementation of the AAL's cadets strengthening activity through Information Technology, its implementation elements, methods, and teaching. This implementation stage is divided into three steps: the preparatory step (administrative and educational preparation), the implementation step, and the reporting step. Figure 4-5 shows the implementation of strengthening activities.

Fig. 5 E-learning Training

Strengthening naval academy cadets (AAL) (figure 4) through Information Technology, including E-learning training. Improving the user's ability to participate in educational learning systems that display information through information technology devices is important. The training was guided by a Naval Information and Data Processing Department.

Fig. 6 Strengthening Through Automotive and Electronics Training

Strengthening AAL cadets through information technology is not limited to the naval academy, but also collaborates with the Center for Development and Empowerment of Educators and Education Personnel in the Automotive and Electronics Sector (PPPPTK BOE) / Vocational Education and Development Center (VEDC) Malang, East Java. The activities of strengthening AAL's cadets have done well and continuously. The existing information related to activities can receive quickly by implementing elements. Every

strengthening AAL's cadets is recorded, and every progress can be seen clearly.

After the training process, an assessment will give to the extent to which the training participants can apply their knowledge and abilities in carrying out job tasks in the position they hold.

1) Supervision: Strengthening implementation activities for AAL's cadets through information technology carry out and monitoring through CCTV (Closed-circuit television). This activity is directly monitored by the Lesson Supervisor Officer and reported to the Navy Academy Governor. CCTV as a monitoring medium is considered effective because it can carry out online so that the surveillance carried out no longer has a distance limit [20]. Initially, CCTV worked with a simple passive surveillance system, but now it can be integrated with all platforms and devices. This surveillance aims to guarantee provisions for the implementation of activities following the plan. Robbins supports this idea, and Coutler [21] concluded that supervision is the same as control as the process of monitoring activities to ensure that the activities are completed as planned and correcting any significant deviations. Supervision of strengthening AAL's cadets carries out centrally under the unit of work.

2) Evaluation: After strengthening AAL's cadets through information technology is complete and then evaluated. An evaluation is usually conducted after the implementation phase to improve Cadets strengthening activities through information technology that already exists and has been running so far. Evaluation at the end of the strengthening of AAL's cadets through information technology becomes an integral part of the cycle to play a keys role in quality control by providing feedback; recommended goals set by instructors and participants; effectiveness and the approaches and methods used; The initial needs identified at each level, organizational and individual have been met. This is supported by the thoughts of Nuraini and Suwandi [22], that every strengthening activity ends with an evaluation. The purpose of an evaluation is to determine the extent to which strengthening activities have achieved their goals [23]. Evaluation targets include participant elements, teaching programs, individual, organizing organizations, lecturers/instructors, facilities and infrastructure, costs, community participation, and post-strengthening. Without evaluation, the program strengthening does not know it is successful or not. This is reasonable because the level of achieving the effectiveness and efficiency of a strengthening program can see from the results of the evaluation, which can be used as input and material for consideration in strengthening control as well as materials for improving the strengthening of AAL's cadets through information technology in the future.

C. Output of Strengthening

After the steps of input and process, a test or competence test will be done to see the result of these strengthening activities. Competence tests are theory tests and practical tests related to the training of strengthening activities [24], which has given to cadets. 28 total cadets from third and fourth level follow the test. The result can see at table 3-4.

TABLE III
RESULTS OF THE LEVEL III CADETS COMPETENCY TEST

No	Cadets Identity Number	Score
1	2017239	85
2	2017244	90
3	2017246	90
4	2017249	80
5	2017254	80
6	2017256	80
7	2017258	90
8	2017271	80
9	2017279	80
10	2017282	85
11	2017286	80
12	2017288	85
13	2017295	85
14	2017305	80
15	2017307	80
16	2017316	90
17	2017318	80
18	2017324	85
	Total	1.505
	Average	83,6

The result of the competence test of third years AAL's cadets at strengthening activities for AAL's cadets through information technology show that the highest score is 90 and the lowest score is 80. Four of 18 cadets get score 90, 5 cadets get score 85 and the others 9 cadets get 80. No cadets score under 80 with an average score of 83.6, which means that most of AAL's cadets have good competence.

TABLE IV
RESULTS OF THE LEVEL IV CADETS COMPETENCY TEST

No	Cadets Identity Number	Score
1	2015350	85
2	2016254	90
3	2016257	80
4	2016263	85
5	2016271	85
6	2016277	80
7	2016285	80
8	2016288	80
9	2016292	85
10	2016294	80
11	2016297	80
12	2016308	90
13	2016317	90
14	2016318	85
15	2016319	80
16	2016320	80
17	2016321	90
18	2016341/W	90
19	2016346/W	85
20	2016349/W	85
	Total	1.685
	Average	84,25

The Level IV AAL's Cadets competency test results on the strengthening of AAL's cadets through information technology show that the highest score is 90 and the lowest score is 80.

From 20 cadets; 5 (25%) people scored 90; 7 (35%) people scored 85; and the remaining 8 (40%) people scored 80. None of the AAL cadets scored below 80. The average score was 84.25. This means that 25% of AAL cadets have very good competencies, and 75% of AAL cadets have good competencies. Thus, most of the cadets of AAL have good information technology competencies. This means that by participating in strengthening AAL cadets and cadets through information technology, the level IV cadets of AAL can master information technology competencies under the objectives of strengthening human defense resources through information technology.

Thus, through the test of strengthening AAL's cadet through the information technology, the cadets can hold the competence of information technology as expected. Because of the target of strengthening designed to shape, increase and change knowledge of human resource so can give the impact on attitude, behavior, and skills to reach the expected standard.

A similar opinion was conveyed by Basri and Rusdiana [25] that the general objectives of strengthening as human resource development, among others ; develop expertise and skills so that work can be completed more quickly and more effectively; develop knowledge so that work can be completed rationally; and develop attitudes that lead to cooperation with colleagues and the leadership. This is reasonable because the strengthening of AAL's cadets through information technology aims to improve work effectiveness by increasing cadets' knowledge, skills, and attitudes towards their duties or their responsibilities to the corps to achieve the expected goals.

Strengthening AAL's cadets through information technology is also intended to provide a basis for increasing competence in the field of communication technology and careers for AAL's cadets so that the professionalism of their work in achieving goals can be realized effectively and efficiently. Thus, strengthening AAL's cadets through information technology provides benefits for AAL's cadets, namely: improving the performance of AAL's cadets according to their current position; develop the skills of cadets to anticipate reformative tasks; motivating the personal growth of cadets for creating individual job satisfaction, and helping AAL's cadets make better decisions.

Thus, strengthening AAL's cadets through the information technology gives an advantage to AAL's cadets to improve cadets' performance, develop the skills to anticipate the reformative task, motivate self-growth of cadets to create individual satisfaction help them to make a better decision.

IV. Conclusion

Based on the research, the input of strengthening of AAL's cadets through the information technology needs support by the instructor who has a good competence, financial arranged carefully, comprehensive of strengthening teaching materials, using two-way strengthening method by needs support under full facilities and infrastructure. Strengthening cadets supported by right activity planning and implementation of strengthening activities is important to implement at the other representative institution. Using information technology such as CCTV is the right choice to control cadets strengthening activities. CCTV's procedure is easy to control by the controller and director because it is online. To create an effective AAL's cadet strengthening program it is necessary to get input and suggestions for improving AAL's cadets strengthening activities.

Acknowledgment

The researchers thank the Rector of the Defense University of Republic Indonesia as the support to this research. We are obliged to the Governor of the Indonesian Naval Academy for his permission and time to carry out research safely and comfortably.

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