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Conceptual Framework for Cyber Competence of Military Institution Personnel in the Digital Age: A Literature Review

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Abstract

Digital transformation has a disruptive effect on organizations with the most standard format, namely military organizations. The TNI AD must master the latest technology, including information technology and war equipment, as a response to digital transformation. The war that occurs is no longer related to physical war but the war caused by the flow of technology and information. This article discusses a conceptual framework that can be adapted to understand cyber competence, the factors that influence cyber competence, and strategies for strengthening cyber competence that can be adapted to support the role of the Indonesian Army in maintaining network and infrastructure security from cyber attacks. A qualitative approach using a literature study is applied in this case. The results show that in carrying out the cyber job role, the personnel responsible for the position must have the knowledge, skills, aspects of self-image, social motives, traits, mindset (thought pattern), frame of mind, ways of thinking, feeling, and acting (way of thinking, feeling, and acting) related to the cyber job role description. Personnel's cyber competence will be influenced by education, training, personal characteristics, and environment. To improve the cyber competence of personnel, strategies that can be carried out are in the form of needs analysis, development of core competencies, and changes to innovative work designs.

Keywords
Competence; cyber; determinant; strategy; reinforcement

I. Introduction

The digital industry has experienced a very fast development in the last decade. Digitalization transforms the service industry, logistics, information industry, and consumer culture and further changes the mass media and social media, intimately tied to people's daily life. Therefore, in recent years, organizations in practically all industries have started many initiatives to research and employ emerging digital technologies such as artificial intelligence, blockchain, big data, and the internet of things (Crittenden, Biel, & Lovely, 2019). (Crittenden, Biel, & Lovely, 2019). The notion of digital transformation, which refers to organizational changes generated by digital technology that leads to the reinterpretation of existing corporate capabilities, processes, and connections, is becoming popular today. As a result, digital transformation has revolutionized the way organizations relate to organizational stakeholders, how organizations run administrative operations, how organizations understand organizational business models, and how organizations manage themselves (Trittin-Ulbrich et al., 2021). Today, the integration of digital technology into the business processes of organizations is becoming very important for the survival and competitive advantage of contemporary organizations.

In its development, digital transformation has a disruptive effect on organizations with the most standard format, namely military organizations. Digital transformation encourages the creation of dynamics in the strategic security environment, which promotes

the state to improve its military technology (Ali, Legionosuko, & Nuraini, 2020). Military organizations are also constantly trying to find innovative digital-based solutions. The utilization of information and communication technology (ICT) is a way to support the functions and services of military organizations (Arias & Macada, 2018). An essential part of the military organization in Indonesia is the National Army (TNI AD). The TNI AD must master the latest technology, including information technology and war equipment, as a response to digital transformation. The war that occurs is no longer related to physical war but the war caused by the flow of technology and information.

The internet in today's era has increased in the community. The internet provides many benefits for searching for news and communicating remotely. The internet has positive benefits and has a negative impact, namely the emergence of crime in cyberspace known as "cyber crime." Cybercrime is a crime that occurs due to irregularities or misuse of technology in people's lives. Cybercrimes have many types, including Data Theft, Cyber Terrorism, Hacking, Carding, Defacing, Cybersquatting, Cyber Typosquatting, Advanced Persistent Threats Attacks, Denial of Service, and Distributed denial of service, Phishing Attacks, Cyber Infiltration, Spreading Illegal Content, and Malware.

In 2021, the number of internet users in Indonesia will reach 202,6 million, according to estimates from Detik.com. From January 2020, this number climbed by 15.5%, or 27 million people. Indonesia's current overall population is at 274.9 million (Central Bureau of Statistics, 2022). With 274.9 million Indonesians, internet users have reached 202.6 million. Indonesian people are not only active in one internet account, but one person can activate more than one account, either from cellphones, cellphones, or other devices. With many internet users in Indonesia, cybercrimes can occur in Indonesia.

The importance of competence in the digital transformation era is due to ongoing technological developments creating new tasks and roles for the organization's human resources and motivating human resources to develop technology-based solid competencies. Mazurchenko and Marsikova (2019) explain the evolution of human resource competencies from traditional technical competencies and skills to digital ones that must also occur in TNI AD personnel. TNI AD personnel are not only required to have traditional competencies such as relationship management (consultation), work ethic, business acumen, knowledge of human resource expertise, critical thinking, workforce planning and change management, diversity management and cultural awareness, but also must have additional competencies related to digital contexts such as digital literacy, digital communication, data analysis, and cloud technology, multitasking, working in an agile/creative way, learning to continuously improve skills and digital-based solutions that can solve organizational problems (Mazurchenko & Marsikova, 2019).

The important of adjusting the competencies that TNI AD personnel need to have with digital transformation will be able to anticipate the rapidly increasing volume of data which has the potential to cause more crimes to be committed in it, and if this is not immediately expected, many websites and infrastructure will be compromised can be hacked, information and data that can be stolen and misused which leads to state losses. Therefore, to be able to maintain cyber security in the Indonesian government sector, especially cyber security within the Indonesian Army, it is necessary to have the role of the TNI AD in maintaining network and infrastructure security from cyberattacks, especially cyber competence for TNI AD intelligence staff officers, so that information and the data held by the Indonesian Army is kept safe.

This article discusses a conceptual framework that can be adapted to understand cyber competence, the factors that influence cyber competence, and strategies for strengthening cyber competence that can be adapted to support the role of the Indonesian Army in maintaining network and infrastructure security from cyber attacks.

II. Research Method

This article uses a qualitative approach. The method used is a literature review. Data were collected from various credible journals and books, which were then analyzed to answer the purpose of writing this article in the form of a conceptual framework for cyber competence, factors that influence cyber competence, and strategies for strengthening cyber competence that can be adapted to support the role of the Indonesian Army in maintaining network security. and infrastructure from cyber-attacks.

III. Result and Discussion

3.1 Cyber Competence

This shift in human resource development places human capabilities at the forefront. A human attribute called competence was first recognized by White (1959). McClelland (1973) presented an alternative to the traditional IQ test for predicting competence. A person's motivation and self-image are two factors that McClelland (1973) argues distinguish successful implementations from those that fail, and this may be seen in a variety of settings, including the workplace. Heavily regarded as the originator of the term competence, McClelland (1973) characterizes it as the trait that supports a person's ability to perform well. Competency has been defined and improved by a variety of authors, including critical thinkers and industry executives, over time.

Table 1. Definition of Competence According to Several Experts

Expert	Definition of Competence
McClelland (1973)	An ability that adds visible economic worth to one's efforts at work is a quality or collection of behaviors that contributes to a more effective or superior job performance.
Klemp (1980)	A person's underlying characteristics result in ineffective and superior performance at work.
Boyatzis (1982, 2007)	An individual's underlying traits are associated with higher job performance. He identified 19 generic skills that top performers typically possess. He separated the 19 generic management competencies into five categories: goal and action management, leadership, human resource management, subordinate supervision, and a focus on others.
Hornby and Thomas (1989)	Ability to effectively perform management-related functions in work situations
Jacobs (1989)	Observable skills or abilities to complete managerial tasks successfully.
Hogg B (1989)	Ineffective performance in a particular area of work is the outcome of manager characteristics that lead to the display of talents and abilities. Additionally, competence includes the ability to transfer talents from one field to another.
Spencer and Spencer (1993)	Skills and abilities you can do - acquire through work experience, life experience, study, or training.
Page and Wilson (1994)	The skills, abilities, and personal characteristics required by an effective or good manager. This definition needs to consider the inclusion of competencies that can be observed and tested directly, such as knowledge and skills, and competencies that cannot be assessed related to personal characteristics or personal competencies.
Gilbert (1996)	The state of competence refers to the ability to consistently create the outcomes (decent behavioral outcomes) necessary for the efficient and effective attainment of larger organizational goals.
Dubois (1998)	Characteristics in knowledge, skills, mindset, frame of mind, and the like, result in successful performance when used either singly or in various combinations.
Evarts (1998)	The underlying characteristics of a manager are causally related to his superior

	performance on the job.
Woodall and Winstanley (1998)	Abilities, knowledge and comprehension, skills and attributes, values, beliefs, and attitudes contribute to an effective managerial performance in a specific environment, circumstance, or function.
Rice (2006)	Competency-based leadership development is not aimless; rather, it purposefully focuses on achieving specific professional goals. In the meanwhile, he underlined that a systematic approach to career development would enhance the effectiveness of the organization.
Lucian Cernusca and Cristina Dima (2007)	This expert explains the concept of competence and how competence is related to one's performance and career development. The author also looks at several competency mapping models and assessment tools for performance management. A business may have highly qualified human resources, but human resources may not work in a suitable position for these human resources. This is where competency mapping and assessment tools help H.R. experts choose who should work in what situations.
Rothwell et al. (2004)	Competency-based strategies are receiving a growing amount of focus. Professional training and development use competency models to define organizational-specific competencies in order to improve human performance and integrate individual competencies with the organization's core competencies.
Gaspar (2012)	The competency-based selection technique is reliable, organized, and exhaustive. The evaluation of candidates is based on the required competencies for placement within the firm. Performance management and competence systems assist H.R. executives in assisting employees with decisions such as promotions and transfers by diagnosing their future training and development needs.

Source: Chouhan & Srivastava (2014)

Over the past decade, various definitions of the term competency have been improved. Competence is most usually defined as the set of success characteristics required to produce substantial successes in a certain job or role inside a specific business. The success factor is a mix of knowledge, skills, and talents (historically referred to as "KSAs") articulated in specific behaviors and exhibited by individuals who perform exceptionally well in a given work or job function.

According to the numerous definitions of competence, knowledge and skills must be included in the competence employed by employees to produce the desired output or results. Bowles (2013) concluded that competence is a combination of skill and knowledge. However, task-related skills and knowledge are simply one component of overall organizational success.

According to the preceding explanation, the competence of persons within an organization is related to the features of skills required to support the work. According to table 2, the work in question is at least explained in the cyber environment by Newhouse et al. (2016). This refers to Carlton and Levy's (2017) definition of cyber security as an action or process, competency, or condition in which information and communication systems and the data they contain are protected or defended against damage, unauthorized use or modification, or exploitation.

Table 2. Cyber Job Role Category

Job Role Category	**Description**
Security Provision	Conceptualize, design, and build secure information technology (I.T.) systems, responsible for strategy and network development.
Operate and Maintain	Provide the essential support, administration, and maintenance for information technology (IT) systems to maintain their effective and efficient operation and security.
Oversee and Govern	Provide leadership, management, direction, or development and advocacy so that organizations can effectively carry out cybersecurity

	work.
Protect and Defend	Identify, analyze, and mitigate threats to internal information technology (I.T.) systems and networks.
Analyze	Conduct highly specialized reviews and evaluations of incoming cybersecurity information to determine its usefulness for intelligence.
Collect and Operate	Provides specialist deception and deception operations, as well as the collection of information on cybersecurity that can be utilized to generate intelligence.
Investigate	Investigate cybersecurity incidents or crimes related to information technology (I.T.) systems, networks, and digital evidence.

Source: Newhouse et., (2016)

Cyberspace is a combination of multiple disciplines, including computer science, mathematics, economics, law, and psychology. This includes the internet networking of devices as well as how humans interact with and are affected by these technologies. Cyberspace affects every aspect of modern life, from the electricity that powers millions of homes to the transportation networks that carry millions of people daily. As the number of connected devices and their use increases, the cyberinfrastructure's complexity and the number of vulnerable devices increase rapidly. This infrastructure and network are supported and maintained by the cybersecurity personnel.

3.2. Factors Affecting Cyber Competence

Improving the learning environment in companies is critical for employee employability and well-being, as well as productivity and innovation inside enterprises (Bohlinger et al., 2015; Jacobs & Park, 2009; Kyndt et al., 2014; Tynjala, 2013). Furthermore, a widely held belief in the academic literature holds that a company's ability to remain viable and competitive depends on its employees' ability to learn on the job in both quality and quantity (Noe et al., 2014). Despite the fact that learning is typically spontaneous and natural, organizations can create learning-friendly settings (Skule, 2004) and engage in a variety of programs aimed at developing employee competencies (Jeong et al, 2018). (Ellstrom & Kock, 2008; van Buuren & Edelbrock, 2013). Formal learning activities must be included into the daily work of employees in order to keep their skills fresh and relevant in the face of ever-changing situations (Ellstrom, 2001).

Many companies spend a lot of money on formal education, such as classes and workshops (Aguinis & Kraiger, 2009; Ellstrom & Kock, 2008; Grossman & Salas, 2011). There is some evidence to suggest that the investment of time and money in the development of human capital is not well understood by many business leaders. The relationship between competency development initiatives and their work outcomes has not been investigated by all experts (Aragón-Sánchez et al., 2003). Competency development initiatives are rarely subjected to rigorous evaluations; consequently, the relationship between competency development initiatives and their work outcomes has not been investigated by all experts. It is difficult to demonstrate the enterprise's worth when there is a dearth of data on the outcomes of competency development programs. While there appears to be general agreement in the literature that training benefits organizations, Ford et al. (2018) conclude that individual training initiatives' effectiveness in terms of the amount of knowledge they typically transfer to the workplace is far less agreed upon, in line with this perspective (Amalou-Dopke & Süß, 2014).

Imagine that top-level managers are unwilling or unable to endorse the idea of human resource management accountability. This can impede the professional efforts of Human Resources to assess competency development outcomes (Kennedy et al., 2014). One possible explanation for the lack of commitment and support from upper management

is their ignorance of existing assessment methodologies and instruments. Tootel et al. (2009) found that participants' lack of understanding of HR methodology and tools inhibited the adoption of new measurement procedures. As Ho et al. (2016) observed when interviewing executives, several managers were unaware of the numerous methods and instruments for tying education and training to business outcomes. Training evaluation has also been questioned by certain supervisors.

Second, training. The second factor that needs to be considered to understand individual competence is prior training, where a number of studies have demonstrated a favorable effect on personal competency (Mclaughlin & Talbert, 2001). In addition, on-the-job training demonstrates that training does contribute to an individual's competency (Sconeville, 2001). Unlike education, which has been linked to work since the 1960s, activity and job performance have just lately been linked. Similar to education, research indicates that training has a positive or neutral influence on an individual's competency (Emad & Roth, 2008). The practice of relating movement to industry/business models by tying desired outcomes to individual behavioral objectives dates back to the 1920s (Burke, 1989). Several nations have, in fact, included competency-based training into their national education systems (Lewarn, 2002).

Training provides skills. A person's ability to execute a job is contingent on his or her abilities, which include previous training and on-the-job training. Similar to schooling, one could argue that training is "knowledge processing" (Firestone & McElroy, 2004). In the context of the cyber area, it demonstrates that the training that military institution personnel undergo before and during extensive cyber-related activity will considerably impact their cyber competence.

Personal traits come in third. Individuals choose to selectively communicate their information based on a personal agenda (Akgün et al., 2005; Coulson-Thomas, 2009; van der Vegt et al., 2009). In addition, it is asserted that individuals lack commitment to their jobs for a variety of reasons, such as impending job departures or job insecurity. Consequently, it is crucial to focus on the individual intents, beliefs, and commitments underlying personal perspectives. Human conduct is rooted in intents, ideas, and commitments that motivate individuals to act as they do. Organizational knowledge is shared, developed, created, and created by individuals. Theorists and practitioners will address challenges that restrict individuals from sharing and receiving knowledge once they have a deeper grasp of them.

If contextualized with the cyber field, then personal characteristics will affect the cyber competence of military institution personnel. When this personnel enters the cyber domain, the individual character of the previously existing personnel will be carried over to complete the implementation of their duties and responsibilities. In this case, it will be seen how the influence of personal characteristics on the competencies possessed by cyber personnel is seen. Suppose there are unique characteristics that can hinder organizational performance. In that case, the organization's task in charge of cyber is to direct its personnel to have a personal character following their duties and responsibilities in the cyber field.

Fourth is the environment. As a result, organizational administration is not a precise science, but rather a creative and political process. People, tribes, and families all have their own unique ways of doing things (Handy, 2009). In his theory of evolution, Eigen (1971) emphasized the significance of understanding ambient culture. He discussed that it is essential to obtain ecological information to better adapt to the evolutionary process. Therefore, environmental culture is defined differently. This definition represents the individual's previous culture before and during the work environment. Consequently, it can

be concluded that culture affects individuals depending on time and place, but culture differs from site to home, leading to different inner-individual cultures as created here.

Organizations need to understand that their personnel have and adhere to different cultures in the cyber context. Before joining the cyber field, the personnel concerned received a lot of cultural internalization that formed their competence. When entering into an organization dealing with cyber, it will be easier for the organization to empower it if the culture possessed by personnel before joining the organization is in line with the organizational culture in cyber. However, when the culture is different, it is the task of the organization to provide convenience for personnel to be able to adapt to the culture that exists in cyber organizations.

3.3. Cyber Competency Strengthening Strategy

The development of an organization's human resources includes a focus on cyber competency. Individual processes, teamwork, and organizational structures can all be improved through the development and transmission of specialized knowledge, according to Swanson and Holton (2009). Human resource development (HRD) is a concept that focuses on how employees can improve the integration of work and learning by acquiring personal and organizational skills, knowledge, and talents. Human resource development, according to Mankin (2009), is a collection of corporate activities that focus on education. A wide range of topics are covered: education and training; the workplace; careers; organizational knowledge and comprehension; and lifetime learning and development.

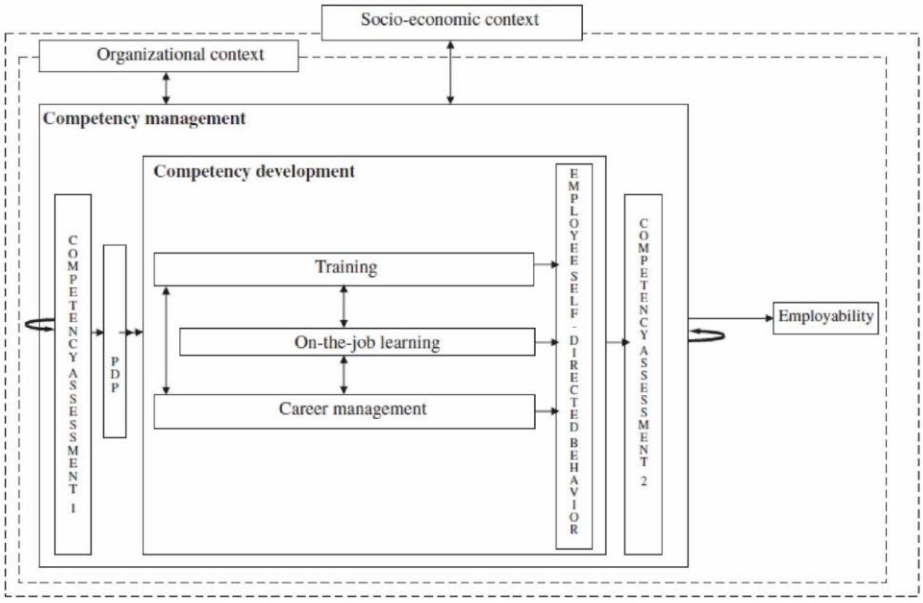
Some of the problems in determining the limits of human resource development have been pointed up by Hamlin and Stewart (2011). Individuals and groups learn in the context of the workplace and their careers through human resource development (HRD), according to Hamlin & Stewart's definition of HRD (2011), two of the most critical facets of human resource management are growth and development.

Development of competencies is a vital aspect of competency management (Campion et al., 2011; De Vos, De Hauw, & Willemse, 2015). Competency management is defined by Heinsman et al. (2006) as an effective method typically utilized by businesses to choose, classify, and evaluate employees, manage individual careers, develop individuals, and evaluate individual performance. According to Ellstrom and Kock (2008), creating skills for certain work areas or job positions inside an organization can bring numerous benefits to human resource management techniques in recruitment, promotion (e.g., career planning), and talent empowerment (both internal and external). Informal learning on the job is facilitated by talent education or training (e.g., participation in internal or external programs) and deliberate changes in task or work structure pertaining to various sorts of actions (e.g., job development, job rotation, team organization).

Using a ground-theory approach, De Vos, De Hauw, and Willemse (2015) construct an integrated model to illustrate the many stages of competency development in organizations (see Figure 1). The model describes the relationship between competency development and organizational, socioeconomic, and other human resource management techniques. In this methodology, competency development is an intrinsic aspect of the multi-step competency management process.

The personal development plan is a crucial component of the model since it serves as the foundation for the whole competency development procedure. In order to build these competencies, training, on-the-job training, and career management are required. Consequently, individual employability will grow. As organizational and socioeconomic circumstances are continually evolving, there is an ongoing need to uncover or define new

competencies through competence assessments. In other words, the competency development procedure is an endless tale (De Vos, De Hauw, & Willemse, 2015).



Source: De Vos, De Hauw, & Willemse, 2015
Figure 1. *Integrative Model of Competency Development*

Bowles (2013) describes strategies that can be done to strengthen competence, and this can be contextualized to cyber competence. The first thing to do from this strategy is conduct a needs analysis. Cyber organizations need to carry out this analysis which means identifying the competencies that exist in the organization and how these competencies relate to work. Cyber organizations' needs analysis will provide crucial strategic information for executive management. It will give an overview of the current cyber competency base within the organization and how it can be developed to drive process improvement. As a result, cyber organizations will obtain information regarding indications of significant competency gaps, and with that information, further development of cyber competencies can be made.

Furthermore, after a needs analysis has been carried out, the following strategy that can be done is to build core competencies. Improving cyber competence in organizations can lead to process improvements for existing personnel, and this will continue to be an essential part of HRD activities in cyber organizations. The arguments that have been pursued in this course are not about process improvement but about the radical changes in organizations that are taking place, the choice being between the development of workplace communities and network organizations. If the cyber organization wants to maintain control over knowledge and intellectual capital within the organization, then the H.R. department in the cyber organization needs to map the competence of personnel to the organization's key outcome areas. What is the contribution of personnel to the organization, and how can personnel expand the competence of the organization.

Overall, the executed plan is based on modifications to innovative work designs. The dynamic nature of organizations diminishes the significance of defining job functions and designing jobs. In comparison to expressing individual contributions to organizational performance, defining occupations in terms of functional functions that will change rapidly is less valuable. The development of cyber competences can replace job design as the defining activity for people actions within businesses. With this in mind, cyber

competences will be created around a flatter hierarchical structure and devolution of activity completion to teams whose particular competencies are precisely mixed. The definition of departments and functional areas in cyber companies is another facet of organizational design affected by competency development.

IV. Conclusion

Military personnel have cybered competence when they combine knowledge, skills, aspects of self-image, social motives, traits, thought patterns, frameworks of thinking, and ways of thinking, feeling, and acting in carrying out cyber work roles. However, it should be understood that the cyber competence of military institution personnel is influenced by education, training, personal characteristics, and the environment. Suppose it is necessary to increase the cyber competence of personnel. In that case, military institutions can carry out a cyber competence development strategy by analyzing needs (need analysis), building core competencies, and changing innovative work designs.

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