

Big Data for National Defense in the Urge of Nation Threat amidst Fourth Industrial Revolution

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ABSTRACT: *Abstract—The technological advancement of the fourth industrial revolution, which globally impacts countries encourages every nation to adapt the use of sophisticated technology, including Indonesia. The unpredictable of nations threats in strategic environment also drives national defense to adapt technological use. This technology includes big data. Through literature review, the author argues that both technologies are useful for national defense which effectively for minimizing and anticipating every form of national threat. Regarding to the current national threat situation in nonmilitary realm such as pandemic, the usage of big data is applicable to military and nonmilitary aspects. The usage of advance technology in Indonesia for national defense shows how Indonesia readiness to face every kind of threat in the era of the fourth industrial revolution.*

KEYWORDS-Big Data, cloud computing, national defense, national threat, industry 4.0 revolution.

I. BACKGROUND

The development of human civilization has been improving which is marked by human usage of technology. The improvement of technology to human daily basis activity is shown in the fourth industrial revolution era. Smart manufacturing and data interchange, such as high-level factory automation and Internet of Things applications are key components of the fourth industrial revolution [1]. The fourth industrial revolution is the future of global manufacturing, combining existing ideas into a new value chain that is critical to transforming entire value chains of the life cycle of goods while developing innovative services and products in the manufacturing industry [2]. The presence of technology in this revolution adds value to the efficiency of the work environment, for example in terms of time management to production costs. The fourth industrial revolution can be a bridge for digital connectivity with the real world that collects field data in real time through advanced technology [3].

The era of the fourth industrial revolution has made extensive digital disruption not only in the economic sector, but also in the defense sector. The revolution which evolves around the global realm also expands the dimensions of the nation threat which do not only consist of land, sea, and air dimensions but also into the dimensions of space and cyberspace [4]. As a nation that occupies a huge territorial in land, sea, and air areas, Indonesia needs an adequate defense and security system that implements the usage of fourth revolution industry technology [5]. The Ministry of Defense (MoD) adapts the national defense system by increasing the capability of cyber human resources in facing the existing challenges amidst digital disruption era. The effectiveness of national defense implementation to protect the nation is not only determined by the capabilities of the defense industry, but also the use of technology in every defense resource. The availability of technology innovation in the fourth industrial revolution can maximize the support of the Government's 2020-2024 Nation Defense vision, namely

the realization of an advanced Indonesia that is sovereign, independent, and has a personality based on cooperation through the mission of providing protection to all Indonesian people to feel safe [4].

The presence of the fourth industrial revolution as a form of cyber technology collaboration and automation technology can support the readiness of national defense in facing the challenges of nation threats. The form of nation threat includes military and nonmilitary threats. The use of defense technology by the Indonesian National Armed Forces in dealing with various forms of threats is the utilization and the usage of available big data in the existence of social media and the internet. The big data compose of information which is considered as a fruitful commodity and has a huge influence in determining decisive key in a military operation [5].

Indonesia is not only facing a traditional military threat, but also a current nonmilitary threat such as the COVID-19 pandemic [6]. The COVID-19 pandemic is an outbreak of an infectious disease caused by the Corona virus and spread throughout the world [7]. It has an impact on all sectors of life, not only the economy and health sector, but also the nation defense and security sectors [8]. The pandemic has forced the government to make a policy of not having physical contact to break the chain of the spread of COVID-19. One of the technological developments in the fourth industrial revolution that can help deal with various nation threats is big data and cloud computing systems.

Big data can be used widely in government institutions, including defense sector. Several opportunities for using big data in the public sector include getting feedback and public responses from government service, information systems, and social media, as a basis for policy making and improving public services; find solutions to existing problems based on data, for example by analyzing weather information and soil fertility levels, the government can determine or recommend the types of plant varieties planted by farmers in certain areas and at certain times; as well as assisting in the management and supervision of state finances. Regarding the pandemic, digitalization of processed big data can reduce physical contact to minimize the spread of COVID-19 and can be a form of effectiveness and the basis for decision or policy making. The technologies have several implementations to provide nation security regarding the nation defense.

II. RESEARCH METHODOLOGY

This work was written by utilizing the literature review or literature review approach. Literature review is a research method that entails reviewing previous references, including books and other research findings, to develop a theoretical foundation for the research subject. This paper also conducting a review of the literature which is a part of the literature review [9].

III. LITERATURE REVIEW

A. Big Data

Although the phrase of big data has spread widely, the studies on big data and national security are still not comprehensive, so it is necessary to borrow definitions from other disciplines, such as computer science, computer engineering, and information science. Based on the writings of De Mauro and her colleagues, big data is the information assets characterized by such a high volume, velocity, and variety to require specific technology and analytical methods for its transformation into value [10].

Big data is a trend that covers a wide area in the world of business and technology. Big data refers to technologies and initiatives that involve data that is so diverse, rapidly changing, or so large that it is too difficult for conventional technology, expertise, or infrastructure to handle effectively. Big data has a volume, velocity, or variety that is too extreme to be managed by conventional techniques. The term big data applies to information that cannot be processed or analyzed using traditional processes or tools [11].

The term big data itself was coined by Doug Laney in the early 2000s which includes three concepts that has mentioned on the passage above, such as volume: the type and detail of data being collected, velocity: the speed at which data are collected, variety: the types of data being collected, and veracity: how much "noise" is in the data. To deal with large and fast data sets, researchers have developed predictive analytics to manage

big data. Often, this involves analyzing trends in historical and transactional data to make new discoveries or predictions about future or other unknown events [11].

Big data is data that exceeds the processing capacity of conventional database systems. Big data technology can handle a wide variety of data. In general, there are two groups of data that must be managed, namely structured data: a data group that has a defined data type, format, and structure. The data sources can be transactional data, OLAP (online analytical processing) data, traditional RDBMS (relational database management system), CSV (comma separated values) files, and spreadsheets. The latter, unstructured data, is textual data groups with erratic formats which does not have an inherent structure. This data is generated by internet applications, such as URL log data, social media, e-mail, blogs, video, and audio [12].

B. Big Data in National Defense

The use of big data in government regarding national defense is suitable for intelligence agencies. These agencies rely on gathering raw information to be processed into data and becomes an input for making national defense decisions. The concrete implementation shows at US intelligence groups which have institutionalized big data through the design of the analysis of civilian population units and military agencies. The groups contain Intelligence Advanced Research Project Activities (IARPA), the Defense Advanced Research Project Agency (DARPA) and the Central Intelligence Agency's technology incubator In-Q-Tel. The data analysis in these agencies is fulfill the demand of valid intelligence products in dealing with a complex security environment. To some extent, several activities carried out by intelligence agencies in making the national security decision-making process are requirements, collection, collation, analysis, dissemination, and security. In general, the usage of big data expands and improve core intelligence capabilities[10].

In the requirements process, the use of big data analytics to discern general trends and anomalies in very large datasets can help to identify potential intelligence targets, thus driving intelligence requirements. This is demonstrated using bulk data collection and data analytics to identify phenomena or targets of interest in multiple large datasets and refine its collection effort. One of the example of its use is the detection of warplanes in Baghdad by DARPA which requires 100,000 times more data than the detection of bombs in the Reagan National Airport area[10].

In the field of collections, the intelligence explores data and information to fill knowledge gaps indicated by large amounts of diverse data. Big data can facilitate the collection of massive amounts of data through indexing mechanisms and data summarization algorithms which automatically identify, summarize, and store relevant data. One of the methods used is opensource intelligence which is based on data available in the public domain, a space where much information is easily accessible. Data collection tools automatically trawling through vast amounts of diverse data stored on the servers at the basis of the internet. For instance preventing disinformation by using screening algorithm to countering hoax news[10].

In the processing section, raw data is converted into a useable information. An example of its application is data collected by surveillance drones such as the MQ-1 Predator which is transmitter, processed and exploited (translated) at core sites of the US Army Distributed Common Ground System. Another example is the usage of drones that fly and their sensors are able to capture multiple types of data so that they can identify a threat, for instance, an insurgent. Integrated data from various sources is collected, then analysed to look for patterns and identify changes and enter the processed data into the drive collection. Analysis of this mapping data can detect trends in multiple large datasets that could point to growing instability in a specific region of the world, thereby improving situational awareness[10]. Big data's potential for managing considerably larger datasets, unstructured data, and later combining data into a structured database was recognized by the analytics teams [13].

Big data programs can create structures from unstructured data on websites, for example in creating datasets through natural language processing (NLP). The NLP application, for example, is used in the analysis of social media in a specific region of the world which indicates a stability regime in specific countries. One thing to note is access to traffic data on social media itself which allows analyst to identify a location within a specific time-frame and get direct access to users in specific area [10].

The analysis component of the intelligence process depicts the use of knowledge, reasoning, and procedures to turn raw data and information collected from many sources into informational outputs suitable for decision-making. Big data can assist analysts in identifying trends and things of interest in vast datasets by allowing them to determine long-term development, establish intelligent hypotheses, and add contradicting evidence. Anomaly detection, association, and link analysis are data analytics tools that can be used to predict dangers, such as identifying potential radicalization targets. Data-mining tools can also detect broad patterns of activity among target groups, as well as more particular patterns that indicate to risks or events of interest, in real time. Big data technologies, in general, can assist analysts in describing, sometimes even identifying, and forecasting scenarios based on a variety of data sources. [10].

Big data as a technology can assist distribute intelligence from producers to consumers, as demonstrated by the dissemination process. Analysts can use data analytics technologies to communicate information more effectively and quickly. There are other visualization techniques in big data that can assist people in comprehending complex situations. An interactive map that shows the developing front lines of the present conflict in Syria is one example of its application. It uses open source data processed by Palantir software, which is widely utilized in the US intelligence establishment. This demonstrates how a big data application may display a complex reality in a way that is both understandable and engaging. Visualization tools can also help people understand complex events by displaying recognized patterns and trends in large networks, such as in terrorism by focusing on the networks of terrorist groups and individuals [10].

The detection of harmful domains and malicious codes (malware) in cyberspace is one of the security applications of big data analytics, specifically with NLP capabilities. Network-based intrusion detection systems examine internet traffic for certain signatures or codes that depart from the usual or have already been identified as malware in the field of cyber security. Analysts can use these technologies to detect advanced persistent threats and automatically block cyber attacks [14].

C. Big Data for National Defense of Indonesia

The availability of data is one of the challenges in implementing big data in government. Permissions and permits are required to access non-public data because data access is so vital. Every sector that has access to big data should reduce their ego to make scattered data collected easier. Data sharing and open data can be used particularly in the sphere of public sector information through the creation of main data website [14].

According to Indonesian laws and regulations, such as the Law on Information and Electronic Transactions and the Law on Public Information Openness, open data stored by ministries and agencies must be standardized and protect the privacy. Another issue is the ability of human resources, such as requirements of data scientists, to manage large amounts of data. Infrastructure allowances are also necessary for using big data techniques like big data analysis with Natural Language Processing (NLP), which can handle Indonesian digital interactions [14].

National defense guarantees the integrity of the Unitary State of the Republic of Indonesia based on Pancasila and the 1945 Constitution. The National Defense of the Republic of Indonesia is universal and upholds the formation of a sense of security from various threats to the Indonesian nation through public and individual security. Given the increasingly complex state threats, ranging from military to non-military threats, there needs to be a national strategy to minimize these threats [6]. The changes of the global security situation increase external threats drive countries to be concerned about their security. The fourth industrial revolution which is based on digital technology determines interconnects and interdependencies between various sectors of social life. Information technology is used in the day-to-day operations of government institutions and other sectors [15]. The national strategy that can support the realization of national security in the era of the fourth industrial revolution is the implementation of policies through maximizing the use and adaptation of technology, specifically big data technology.

In a modern warfare, information superiority is a decisive factor in winning battles. Utilization of a satellite-based computer network in a modern and safe Combat Management System to process big data so that combat troops in the operational field can seize informational superiority over opponents and identification. Meanwhile, big data on Command, Control, Communications, Computers, Intelligence, Surveillance and

Reconnaissance (C4ISR) technology is collected through military satellite systems and communication systems obtained from various data sources in trimatra joint military operation (land, sea, air) so that the combatant commander can monitor and control military campaigns in the operational field at any time. Meanwhile, big data for tactical data link system (TDL) where TDL technology is a superior military technology that allows a variety of Trimatra defense equipment (submarines, aircraft carriers, tanks, helicopters, tanks, fighter aircraft, and reconnaissance aircraft to coordinate with the command headquarters) from the manufacturer/type different networks can be connected and secure to send or exchange big data [16].

The technology of big data and cloud systems as a part of the era of the fourth industrial revolution could be combined to flatten the curve of COVID-19 as a national threat. The amount of data that can be collected in big data encourages cloud computing which stores information permanently on a server that can be accessed via the internet and other devices. Big data and its analytics lead to massive amounts of information produced and obtained daily. The convergence of information media that encourages the presence of big data in this era of the fourth industrial revolution can encourage the presence of a data center that can accommodate and provide data to ensure access and is able to provide security guarantees for data access [17]

Deputy Minister of Defense (MoD) Lieutenant General TNI M. Herindra explained the potential military threat from the fourth industrial revolution in national stability and Indonesian sovereignty. The challenges of the massive development of digital technology require the Indonesian National Army to take important steps for cyber defense in the sector and suggest that office holders have assertive law enforcement related to the ITE Law. Cyber threat trends include threats to software, hardware, and brainware such as malware, eavesdropping, and hate speech. The development of cyber security in Indonesia is shown by the support of the virtual police alert program, Cyber TV, a website to contain data in web patrolling, and socialization in social media. This effort shows how big data is applicable to maintain Indonesia cyber security developments, especially regarding to data collection and data analysis. From the law enforcement, the government's ability, especially in the defense sector, the use reliable weapons is supported by Presidential Regulation No. 8 of 2021 regarding the expansion of the dimensions of combat and increasingly sophisticated military weapons technology. Some actions that manifest digital transformation for national security in defense industry is the development of C5ISR by PT Len Industri (Persero) [18].

To overcome nonmilitary threats such as COVID-19, the government can minimize the transmission of COVID-19 by stopping the use of physical goods. For example, when registering for vaccines, data from individuals should be available at the government data center so there is no need to fill in manually which requires physical contact. In addition, the use of the internet and data stored in big data such as population data can be used to determine the best policy, for example in determining daily quotas for vaccines and classifying data from workers to aid, especially to essential workers who are forced to be unable to work from home. The stored data can also be used for defense in maintaining a tighter environment regarding people going in and out of an area so that it can trace anyone who might be spreading the virus. There needs to be special discipline and policies as well as a focus on developing state-of-the-art technology as part of the readiness of the fourth industry revolution as well as facing the nation's threats in the defense sector. The usage of big data can maximizes the effectiveness of minimizing nation threats.

IV. CONCLUSION

The development of the fourth industrial revolution globally leads to the innovation of big data which covers a wide area in technology. Big data refers to technologies and initiatives that involve data that is so diverse, rapidly changing, that it is too difficult for conventional technology, expertise, or infrastructure to handle effectively but leads to massive amounts of information produced and obtained daily. The benefits of big data technology have been widely felt in various sectors including the defense sector. The fourth industrial revolutions also leads to several potential form of nation threats, therefore, every nation including Indonesia need a deterrence nation strategy to protect the country from the threat by using the advance technology. The usage of big data in defense sector, especially in traditional intelligence activities such as requirements,

collection, processing, analysis, dissemination, and counter-intelligence and security indicates that technological advancements have enabled security professionals to collect and process larger and more diverse amounts of data. The analyzed data is fruitful for decision making of nation strategy of defense. The big data usage in the military also showed as satellite-based computer networks in a modern and safe combat management system that processes big data and widely used for facing nation threats such as the pandemic. Therefore, big data can be used as tools that make national defense effective in minimizing forms of national threat. A greater understanding of the role of big data in fundamental national security services like intelligence is required to fulfill a whole national defense.

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