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Competencies Needed for Vocational Education Graduates in Logistic Industry: A Systematic Review

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Abstract: Logistics is one of the industries that constantly follows developments, changes, and shifts. At this time, the competence of vocational education graduates, especially in logistics, has not adjusted the demands and needs of the industry. Vocational education certainly must prioritize the competence of suitable graduates, have high qualifications is appropriate for the logistics industry. This research aims to find the competence of vocational education graduates in the logistics field that are by industry demands and needed. This study used the Systematic Literature Review (SLR) method using data sources from previous studies that have been published in indexed international and national journals for the year published between 2010-2020. The findings of this study indicate the need for vocational education graduates to be equipped with hands-on skills, soft skills that are relevant to the industry with massive changes, shifts, and challenges, and competence to predict future challenges. Vocational education graduates should have a good competency to fulfill logistics industry needed.

Keywords: Industry demand, logistics competence, vocational education

1. Introduction

Community life continues to develop and change with the times, including the demands for competencies needed by the industry will continue to change (Abele et al., 2015; Jones et al., 2017; Moldovan, 2020). The sustainable growth of world trade depends on efficiency in global and support structures such as logistics services (Gani, 2017). Logistic is one of the fields in the industry that continues to move with the times with all its demands (Winkelhaus & Grosse, 2020). In the world of logistics, various abilities and competencies of workers are demanded to orient work effectiveness and efficiency because it will have an impact on various sectors, related to logistics having roles in various industrial fields (Fugate & Mentzer, 2010).

Ideally, vocational education should be able to answer industry challenges through collaborative vocational education with industry (Reeve, 2016). So that the needs of the industrial world become a priority for vocational education in determining the competence of graduates (Raihan, 2014). Vocational education needs to be oriented towards the various competency demands required by the industry (Albashiry et al., 2015; Mouzakitis, 2010). The field of logistics requires a skilled workforce with competencies suitable with industry demands and more various challenges of the times that continue to shift and change massively (Ahmed et al., 2020). Besides, previous research has mentioned that more than 107 experts in the field of logistics agree that Logistics Performance Index (LPI) standard is relevant to industry logistics needed (Rezaei et al., 2018). Because what needs to be considered is how the relationship between individual competencies in industrial sustainability is one of the challenges that every worker needs to prepare for entering the industrial world (Lorincz & Eriksson, 2020).

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Prospective workers many skills have which include communication skills, problem-solving skills, conflict resolution, teamwork with others, and ensuring customer satisfaction (Bekri et al., 2015; Khaled et al., 2014). Industry requires employees who have adequate technical skills but also have soft skills (Uckat & Woodruff, 2019). Information regarding the perceptions required for soft skills in the workplace is still limited (Munim & Schramm, 2018; Wu et al., 2016). This research seeks to close the literature gap regarding the perceptions of Vocational Education institutions and job providers such as industry regarding the skills that prospective workers must-have in the logistics sector (Dubrova, 2019). Given that the logistics industry and industry, in general, do not only require cognitive abilities (Håkanson et al., 2020), it is the responsibility of vocational education as an official institution to be able to compile an adaptive learning curriculum with a variety of rapid and massive changes in the industry (Boateng, 2012).

2. Method

This study using the Systematic Literature Review (SLR) method. The stages carried out in this study started from searching for indexed scientific journals/articles with a time limit of the last 11 years (2010-2020) and only used articles in English. After searching, the researcher enters the stage of sorting the articles that are relevant to the research, then the researcher carries out the analysis stage on the articles that have gone through the sorting stage. Furthermore, the researchers wrote the results of the analysis sourced from scientific articles/journals used from ERIC, SAGE PUB, ELSEVIER, EMERALD, and national journals. In the searching stage, the researcher used keywords such as described in Figure e stages carried out by researchers can be seen in the following figure.

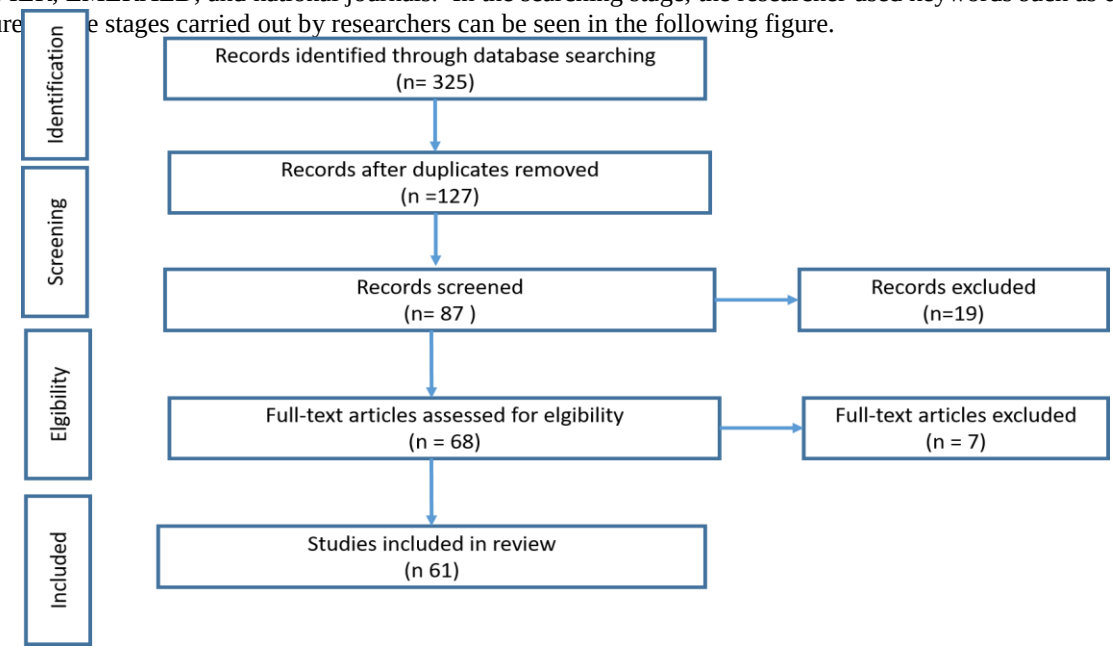

Fig. 1 - SLR stages using the PRISMA method

The steps carried out in Figure 1 have been compiled by researchers based on search, collection, and sorting based on keywords. Researchers used several keywords to get references that could support the SLR conducted by the researcher, includes: logistics curriculum, TVET curriculum, TVET learning, TVET skills, soft skills, technical skills, administration skills, managerial skills, professional skills, communication skills, technology skills, skills worker, logistics performance, and industrial 4.0. They are keywords in this study used to find out what is vocational graduate competency that can fulfill logistics industry needed.

3. Result

Articles related to educational competencies in the field of logistics were identified from several related keywords. Several keywords have been reviewed in one article. The identification result of selected articles is shown in Table 1. It can be seen that as many as 28 articles related to skills, followed by 15 articles related to logistics performance, 11 articles related to the curriculum, 5 articles related to learning, and 2 articles related to industry 4.0. The distribution of articles selected based on the publication period for the last 11 years (2010-2020) is shown in Figure 2. Based on this distribution, the highest number of articles was published in 2020 (20%). At the second-highest ranking, the number of articles published in 2016 (16%).

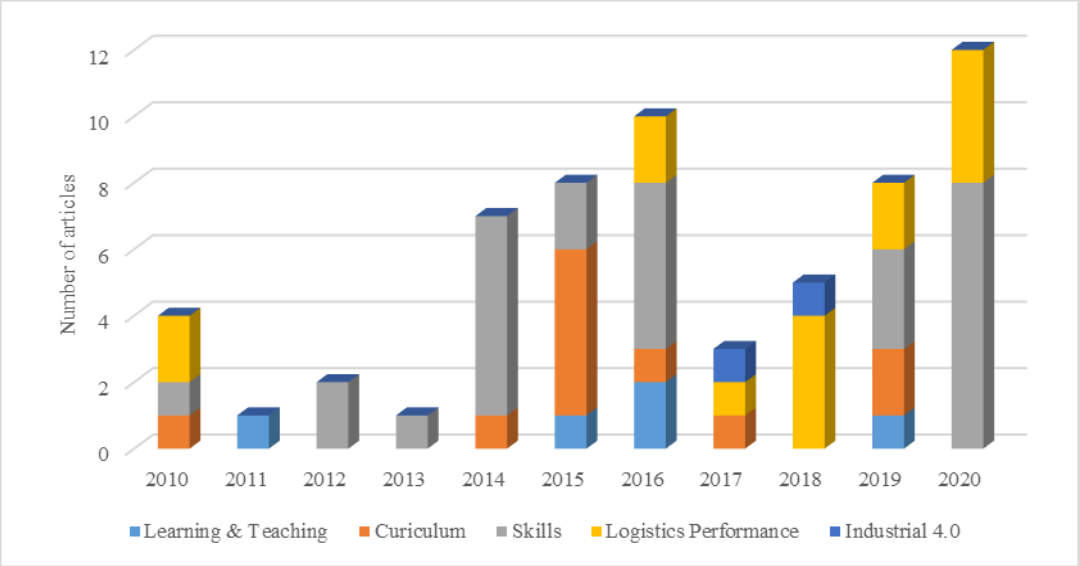

Fig. 2 - Distribution of articles in the last 11 years

Based on Figure 2 distribution of articles in the last 11 years, it got from identification, screening, eligibility, and included that show as in Fig.1. In this study, to find what is logistics industry needed for vocational education graduates will show a spreading resume of those articles on Table 1 List of keywords and articles used in the study.

Table 1 - List of keywords and articles used in the study

No	Keywords	Description	Related articles
1	Learning & Teaching	This keyword includes articles on learning and teaching in logistics in vocational education	Chen (2016), Ozment(2016), Uckat, H., & Woodruff, C. (2019), Abele, E., Metternich, J., Tisch, M., Chryssolouris, G., Sihn, W., ElMaraghy, H., Hummel, V., & Ranz, F. (2011), Bekri, R. M., Ruhizan, M. Y., Norazah, M. N., Norman, H., Nur, Y. F. A., & Ashikin, H. T. (2015)
2	Curriculum	This keyword includes articles on curricula in logistics and curricula in vocational education	Tarvo Niine and Ott Koppel (2015)[1], Marin Marinov and Anna Fraszczyk (2014), Zbigniew J. Pasek and Pawel Pawlewski (2019), Tarvo Niine and Ott Koppel (2015)[2], Mouzakitis, G. S. (2010), Albashiry, N. M., Voogt, J. M., & Pieters, J. M. (2015), Dubrova, Y. E. (2019), Reeve (2016), Chinyere Shirley et al., (2015); Engelbrecht et al., (2017); Paryono (2015)
3	Skills	These keywords include articles that discuss technical and vocational skills, including TVET skills, worker skills, soft skills, technical skills, administration skills, managerial skills, professional skills, communication skills, and technology-related skills.	Reeve, E. M (2016), Raihan, M. A. (2014), Boateng, C. (2012), Khaled, A., Gulikers, J., Biemans, H., van der Wel, M., & Mulder, M. (2014), Yen-Chun Jim Wu (2013), Lorincz, L., & Eriksson, R. (2020), Ahmed, S., Islam, H., Hoque, I., & Hossain, M.(2020), Håkanson, C., Lindqvist, E., & Vlachos, J. (2020), Al-Minhas, Usman Ndubisi, Nelson Oly, Mariah, Siti Sugandi, Machmud Barrane, Fatima Zahra (2020), Mariah, Siti Sugandi, Machmud (2020) , Uckat, Hannah Woodruff, Christopher (2019), Alipour (2019), Geng, B. B. & X. (2014), Khaled, A., Gulikers, J., Biemans, H., van der Wel, M., & Mulder, M. (2014), van der Bijl, A., & Taylor, V. (2016), Niine (2015), Wong (2014), Thai (2012), Wu, L., Yue, X., Jin, A., & Yen, D. C. (2016), Polater, Abdüssamet (2020), Marinove (2014), Chen

No	Keywords	Description	Related articles
			(2016), Long (2010), Brink, Kyle E. Costigan, Robert D. (2015), Lu (2016), Karia (2019), Ravikumar, Kushal Jalige Manjunath, Tarun (2020), Liviu Moldovan (2020)
4	Logistics Performance	This keyword includes articles that discuss logistics performance	Winkelhaus, S., & Grosse, E. H. (2020), Rezaei, J., van Roekel, W. S., & Tavasszy, L(2018), Fugate, B. S., & Mentzer, J. T (2010), Munim, Z. H., & Schramm, H.-J. (2018), Bag, Surajit Gupta, Shivam Luo, Zongwei (2020), Munim, Ziaul Haque Schramm, Hans-Joachim (2020), Fugate, Brian S Mentzer, John T (2010), Rezaei, Jafar van Roekel, Wilco S. Tavasszy, Lori (2020),Önsel Ekici, Şule Kabak, Özgür Ülengin, Füsun (2019), Aharonovitz, Miriam Catarina Soares Vieira, José Geraldo Vidal Suyama, Suzi Sanae (2018), Liu, Jie Yuan, Chunhui Hafeez, Muhammad Yuan, Qiuyan (2018), Lu, Qing Goh, Mark De Souza, Robert (2016), Martí, Luisa Martín, Juan Carlos Puertas, Rosa (2017), Lu (2016), Karia (2019)
5	Industrial 4.0	This keyword includes articles that discuss industry 4.0	Jones, C., Pimdee, P., (2017), Ghufron (2018)

4. Discussion

Based on the results of the identification of the papers that have been discussed in the results section, an analysis was carried out related to the following educational competencies in logistics. In this section, we create a research framework to simplify understanding research objectives and how to achieve them.

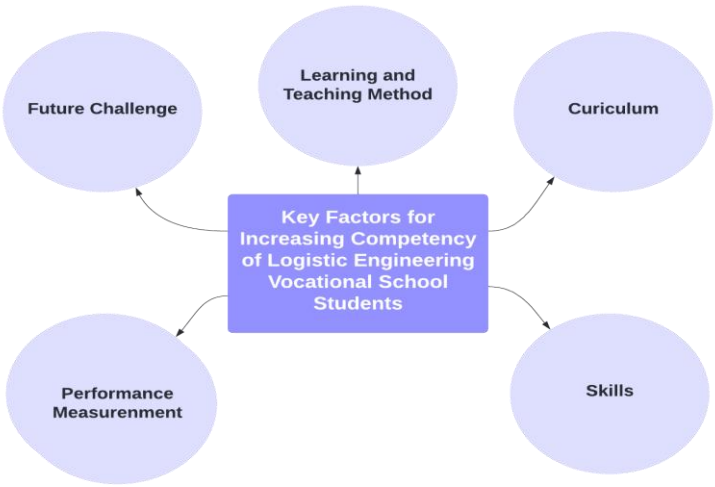

Fig. 3 - Framework of key factors for increasing competency of logistic engineering vocational school students

Based on fig-3 we can understand that there are five key factors which must be focused for vocational school if they want to increase the competency of their graduate students. After creating a framework, we breakdown those factors into specific competencies which can simplify explain educational institutions how should they do to improve their educational service for increasing the competency of their graduate students. This increasing competence affects to decrease gap competence between vocational school competency and industrial competence, especially in the logistic field. The final step of this research, we give our recommendation strategy to Educational Institution in Indonesia on how to do for increasing the competence of logistic Engineering Vocational School Students.

4.1 Future of Logistics Learning and Teaching

Logistics Engineering as professional engineering discipline responsible for integration support considerations in the design and development, test and evaluation, production, construction, operation, maintenance, and ultimate disposal/recycling o systems and equipment as safe of The Council of Logistics Engineering Professionals (CELP). On their hand, logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption to meet customer's requirements (Taylor 2008). Logistics, especially in the field of education, is currently not accommodating the needs of industry, this is shown from the results of previous research in the United States (Ozment & Keller, 2011). It moves towards an as competitive global economy, there will be increasing demands such as the demand of most hight qualified workers to create an efficient managerial of a logistic industrial system (Bekri et al., 2015).

Educational and training methods that are widely practiced in companies are the basic ways of reforming and developing vocational education (Chen & Li, 2016). Relying on the industry, vocational education, and industries to determine how the cooperation mechanism between schools and companies is beneficial and adapting the current mode of teaching of these mechanisms is the key to breakthroughs and vocational education reform (Bekri et al., 2015). In practice, however, the deep operating mechanism of the logistics cooperation between schools and professional companies is still imperfect, the status quo does not satisfy the cooperation between schools and companies; often the uncertainty of business logistics and changes in market and logistics demand between professional education program conflicts, as well as work and study, school-company cooperation, short-term behavior disruption and causing conflict, it is difficult to form a combination of work with learning, school-company cooperation, long length planned, directed and measured (Chen & Li, 2016).

It must be considered in vocational education in the logistics sector in the future is how to become hard skills as a way of assessing and promoting soft skills for each individual (Uckat & Woodruff, 2019). The implementation that must be done is the collaboration between industry and educational institutions, as has been done in Europe since 2014 and has proven to provide good feedback in increasing the value of graduates as prospective workers in the logistics industry, especially in manufacturing (Abele et al., 2015).

4.2 Logistics Curriculum in Vocational Education

Education in the field of Logistics is an interdisciplinary field of study and is quite colorful (Niine et al., 2015). For example in the European curriculum (Niine et al., 2015) has examined the typology of the logistics curriculum which is divided into four clusters, namely business administration and logistics, interdisciplinary logistics management, modern transportation management, and logistics engineering. The classification of the four clusters is based on an integrated model of logistics knowledge, namely: 1) business strategy, marketing and environment, accounting and financial management, organization, people and process management, 2) supply chain management core concepts, logistics management, and trade, purchasing and inventory management, 3) viewpoints on transport, 4) supporting functional areas (warehousing process and technologies, information and communication technologies, manufacturing process and technologies), 5) foundational topics (law and legal environment, basics of social sciences, basics of natural sciences). The logistics curriculum requires an integrated approach with systems, networks, physical technologies, ICT, product and process engineering (Niine et al., 2015). Niine et al. (2015) have also modeled the logistics curriculum structure which consists of 6 layers, namely: value creation layer, performance and process control layer, core logistics configurations, logistics technology layer, systems engineering, and generalized individual meta competences.

The development of a deep understanding of multidisciplinary concepts and orientation is necessary for a sustainable future (Marinov et al., 2014). It developed an integrated (hybrid) curriculum model that integrates subjects, teaching, and learning methods from four European Universities (Marinov et al., 2014). The identified subjects are grouped into six clusters, namely: Logistics (L); Technology and Management of Rail Transport (TMRT); Rail and Logistics Infrastructure (RLI); Management and Marketing in Rail Freight and Logistics (MMRFL); Safety, Security, and Risk Management (SSRM); and Transport Planning and Economics (TPE). The evolution of content and teaching practices needs to be continuously reviewed and modified to stay in line with teaching practices of design and entrepreneurship, progress simulation technologies, and student responses (Pasek et al., 2019). This contributed to the development and renewal of the logistics engineering curriculum. Pasek et al. (2019) examined that the Lean Startup Method using the Business Model Canvas has replaced business plans in teaching entrepreneurship.

Curriculum development plays an important role in maintaining and improving the quality and relevance of an educational program. In contextual and organizational barriers need to be considered in systematic curriculum development (Albashirya et al.,2015). A curriculum must also be able to support students to be ready to work after graduation. Relevances between curriculum and industry are needed to make qualifications for better applicability. Students must be provided with strong knowledge and skills to live and work in the 21st century (Engelbrecht et al. 2017; Reeve, EM., 2016). In 21st Century skills, including Science, Technology, Engineering, Mathematics (STEM); Problem-Solving; and the Four 4Cs: Critical Thinking, Communication, Collaboration, & Creativity (Reeve, EM., 2016). The

socio-economic growth and technological development of a nation can be encouraged through Technical Vocational Education and Training (TVET) (Chinyere et al., 2014).

4.3 Logistics Skills Worker

Some companies have difficulty recruiting employees with the skills required in logistics/supply chain management, it related with last research in Studies in countries such as China, India, United States, United Kingdom, Vietnam, and the Republic of Korea have reported that more employees are not fulfilled qualification in logistics skills working in the logistics industry (Mckinnon et al., 2018). Finding employees with appropriate competencies is a must. Competence includes knowledge, skills (soft skills and technical skills), and attitudes that are reflected in actions (Pasek, 2019). One of the things that prospective workers must have is soft skills which include communication skills, problem-solving skills, conflict resolution, working well with others, and ensuring customer satisfaction (Bekri et al., 2015; Khaled et al., 2014). Mastery of communication skills should start in the classroom and should be an essential component of the supply chain management curriculum (Long, 2010). Technical skills are knowledge and professional skills of workers, in this case specifically for logistics techniques, which are obtained not only through formal education, but through work experience, training, independent study, informal education, and internships. Technical skills are part of the development of a logistics engineering curriculum related to supply chain management and are required from a global logistics professional based on an objective evaluation of the industry (Pasek, 2019; Alipour, 2019; Yen-Chun Jim Wu, 2013; Geng, BB & X., 2014; Khaled et al., 2014; van der Bijl, A., & Taylor, V, 2016). Technical skills in supply chain management that many researchers mention are professional (Wong, 2014; Marinove, 2014; Chen, 2016; Alipour, 2019), managerial skills (Wong, 2014; Thai, 2012; Wu, L., et al., 2016; Polater, 2020), administrative skills (Niine, 2005), and technology-related skills (Lu, 2016; Karia, 2019; Alipour, 2019; Niine, 2015; Ravikumar et al., 2020).

It is a common opinion that to ensure good quality service, the availability of a highly-skilled workforce is required. The possibility of a highly skilled workforce is guaranteed by "highly skilled professionals" (Marinov, 2014). Based on a research of competency needs for logistics professionals and supply chain management conducted by Thai in 2012, management skills are seen as the most important component of logistics executives, with an emphasis on traditional managerial skills such as planning and organizational motivation. Modern logistics experts need to integrate business management and administrative skills with technology design, IT systems, and other engineering fields (Niine, 2015).

4.4 Logistics Performance Workers Needed

Procurement, warehousing, and transportation in the logistics sector affect performance but the impact on performance must be through the integration of halal logistics (Karia, 2019) and logistics in general. Therefore, it is necessary to have active collaboration from various sectors to be able to determine the performance standards needed by the logistics industry (Lu et al., 2016). This is based on previous research which found 26 assessment indicators for worker performance in the logistics industry (Lu et al., 2016). This needs to be considered because it is planning, implementation, and control of efficient and effective flow and storage of goods and services from the starting point of origin external to the company and from the company to the point of consumption to confirm customer needs (Winkelhaus & Grosse, 2020). The World Bank has paid attention to this with the occurrence of economic globalization and the logistics sector is in it, a Logistics Performance Indicator (LPI) has been created which has been used in various countries such as Turkey, Malaysia, and several other countries in Asia and Europe (Rezaei et al., 2018). Seeing this phenomenon, it is necessary to have a more standard. Previous research has found the existence of an LPI mechanism with a determination as illustrated in the following figure.

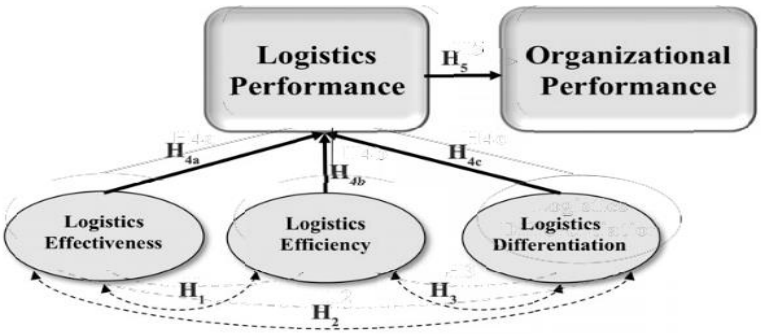

Fig. 4 - Model Logistics Performance
Source: (Fugate & Mentzer, 2010)

Figure 4 illustrates the relationship between logistics performance dimensions (H), as follows:

H_1: Logistics effectiveness and logistics efficiency are positively related;
H_2: Logistics effectiveness and logistics differentiation are positively related;
H_3: Logistics differentiation and logistics efficiency are positively related;
H_{4a-c}: Logistics performance is a second-order formative construct composed of three dimensions: (a) logistics effectiveness; (b) logistics efficiency; and (c) logistics differentiation;
H_5: High levels of logistics performance are positively associated with high levels of organizational performance.

One of the considerations for efficiency in determining efficient logistics performance is that there are more than 91 countries that have ports and there needs to be an in-depth review of the logistics sector that plays a role in this (Bag et al., 2018, 2020; Munim & Schramm, 2018).

4.5 Logistics Challenges in 4.0

The term industry 4.0 was introduced first 2011 at the Hannover Fair in Germany. Industry 4.0 was driven by the rapid development of technology and also by social and economic factors. Currently, logistics trends are also influenced by social and economic changes. The industrial revolution 4.0 is marked by the development of the Internet of Things followed by new technologies in data science, artificial intelligence, robotics, cloud, three-dimensional printing, and nanotechnology (Ghufron, 2018). Industry 4.0 and IoT continuation of UK's first revolution. Industrial revolution 4.0 is driven by digital data, connectivity, and cyber systems (McGregor, 2017). Planning, design, and operation of intra-corporate logistics processes were significantly influenced by the achievement of the 4.0 industrial revolution, enabling companies to track customer needs and procurement orders in real-time. Logistics development processes based on industrial technology 4.0, personal performance for carrying out logistics operations can be improved or replaced with automation and robotization. In the presence of Industry 4.0, vocational education is expected to improve its educational approaches and methods. Students need to learn basic knowledge about the latest technologies in industry 4.0 such as big data analysis, artificial intelligence, the internet of things, cloud computing, and other advances. The latest technology can support logistics-related work.

5. Conclusion

The industrial world that is changing rapidly and massively has an impact on various sectors. One of them in vocational education. In this case, vocational education must respond quickly to these changes and shifts. Various competencies keep changing and shifting as the shifts and changes that occur in the logistics industry. Existing performance standards still need to be standardized as global standards. Vocational education needs to respond and respond quickly and appropriately to the challenges and changes that occur in the logistics industry. Vocational education must respond by adaptive curriculum based on industry needed and prepare the graduate with certification skills in logistics competency for the logistics industry. Logistics industry competencies needed like the hand on competencies, soft skills, including skills workers need to be equipped for graduates of vocational education in the logistics industry.

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