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The Analysis of Technical Competency towards the Automotive Manufacturing Expertise in the Industrial Context 4.0

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***Abstract*—This research aims to examine the literature and analyzes the views/perceptions of the industry regarding what competencies are needed in automotive manufacturing within the framework of industry 4.0. The last few years around the world, policy makers are concerned about the competence of vocational education graduates towards the labor market needs of the automotive manufacturing industry. Skill competencies that are not in sync with the needs of the automotive industry's labor market can obstruct someone to gain profit. On the other side, the company will not get any skillful laborers based on the needs. Literature review and deep interview of industry practitioners are used as a tool in data collection, the results are based on the literature review and industry's perceptions, industrial 4.0 technical competencies is needed in the manufacturing industry such as operating CNC machines, and using software design in the initial recruitment process. However, in the early recruitment process, technical competence is not used as the special requirement towards the applicants because it affects the numbers of the applicants and the threshold to pass the test.**

Keywords—competence, technical, automotive

I. INTRODUCTION

In recent years around the world, policy makers have been concerned about the competence of vocational education graduates to the labor market needs of the automotive manufacturing industry [1]. Competence from the skill aspect is an important asset as a person's provision in finding a job. Skills are a person's investment to get a higher wage [2,3]. The mismatch of skills with the labor market needs of the automotive manufacturing industry can hinder a person from earning income, the disadvantage of the other side is that the company does not get input of skilled workers according to needs [4]. Impacts that can occur include fading or loss of productivity growth and innovation from workers, so companies must train worker skills that should be taught in schools [5,6].

The labor market needs of the automotive manufacturing industry that do not match may occur because the information conveyed is asymmetrical with the provider of prospective workers [7]. The output of vocational education that does not match the needs of the labor market is reflected in the fact that vocational education graduates take a longer time to find suitable jobs, while job seekers who do not have educational qualifications or who only have basic education take a shorter time to find a suitable job. find a job [8,9]. Data on the Open Unemployment Rate (TPT) issued by the Central Statistics Agency [10] in the last three years shows that SMK graduates are always in first place as the highest contributor to unemployment in Indonesia. The latest data in February 2020 shows that 8.49% of SMK graduates do not have a job.

Given this serious situation, it is necessary to conduct research to determine the labor market needs of industry 4.0 automotive manufacturing by calculating and investigating the factors in meeting the needs of workers according to their competencies. The impact of competency discrepancies is also a concern in the research. After doing research with several data collection techniques, conclusions are drawn and policy recommendations are made at the end.

II. METHODS

Research is a scientific way to understand and solve problems in order to obtain the truth that is scientific truth. In this literature review process, the author adopts the method used by Durst & Edvardsson in the research of Indriartiningtias R [11]., including:

- Determining the area to be discussed and literature search.
- Determine inclusion and exclusion criteria.
- Triangulation by interviewing industry practitioners
- Analysis
- Conclusion

A. Determining the Area to be Discussed and Searching the Literature

The first step, the researcher determines the research question and some keywords. This study aims to determine the research area in the field of technical competency analysis in the automotive manufacturing expertise field in the context of industry 4.0. The research questions to be answered include:

1) What technical competencies are needed in the automotive manufacturing sector within the framework of industry 4.0 based on a literature review?
2) What technical competencies are needed in the automotive manufacturing sector within the framework of industry 4.0 according to industry perceptions?

Based on these areas, the researcher uses keywords, among others, Competence, Skill demands, and Industry 4.0 to search for relevant articles. The articles searched for are articles published in 2010-2021 using the publish or perish 7 Application. This application is used because it makes it easier for researchers to search for data that matches keywords, and the majority is indexed by Scopus. The data that appears is then opened one by one and recorded. The data that has been captured is then considered according to the inclusion criteria.

B. Determine Inclusion and Exclusion Criteria

The criteria for articles that can be included in the literature review in this article include:

1) Scientific articles that discuss the Technical Competence of Automotive Manufacturing Expertise in the Context of Industry 4.0.
2) Articles in English and published in indexed journals.
3) Articles with the year published between 2010-2021.
4) Selected several articles as representatives

III. RESULTS AND DISCUSSION

The results of a literature review search using the publish or perish 7 Application are 97 articles from the 2010-2021 timeframe. Articles entered in the search based on keywords, then processed. Articles that fall into the inclusion criteria are taken and used as research material. Other articles that fall into the exclusion criteria are not included in the literature review discussion in this article. Based on the predetermined criteria, 50 articles were found that discuss the technical competence of the automotive manufacturing expertise field in the context of industry 4.0.

The articles that have been included in the recap are then summarized in the form of a logbook table containing the author's name, year of publication, research objectives, research methods, and research results. The summary results can be seen in table 1.

TABLE I. THE RESULTS OF THE RESEARCH ON COMPETENCY ANALYSIS IN THE TECHNICAL FIELD OF AUTOMOTIVE MANUFACTURING EXPERTISE IN THE CONTEXT OF INDUSTRY 4.0.

No	Competency Criteria	Number of Articles	Times
1	Atittude	2	2010-2021
2	Skill	11	
3	Attitude, and Skill	35	
4	Work Culture, and Skill	1	
5	Atittude, Work Culture, and skill	1	

Then from the results of the identification of research on technical competency analysis in the field of automotive manufacturing expertise in the context of industry 4.0. several articles were selected as representatives of the competency criteria needed by the industry which can be seen in table 2.

TABLE II. CRITERIA FOR TECHNICAL COMPETENCE IN THE FIELD OF AUTOMOTIVE MANUFACTURING EXPERTISE IN THE CONTEXT OF INDUSTRY 4.0.

No	**Competency Criteria**	**Authors**	**Year**	**Research Purposes**	**Methods**	**Research result**
1	*Atittude*	Duong, M. T. H., Nguyen, D. V., & Nguyen, P. T. [12]	2020	The research objective is to present a fuzzy logic approach to rank seven skill deficiencies in the Vietnam Labor Market, namely lifelong learning, adaptive capacity, information technology capacity, creativity and innovation capacity, problem solving capacity, foreign language competence, and organizing and management competence.	The research method used is a quantitative approach with a questionnaire method to companies that provide jobs to graduates in Vietnam	The results showed that problem-solving skills with good attitude and communication were a very prioritized need, but in fact there was a gap between the needs of the company and employees.

Table 2 cont.

2	*Skill*	Whysall, Z., Owtram, M., [13]	2019	The transformational changes of the business environment brought about by the fourth industrial revolution created the perfect storm for strategic human resource management, prompting the need to explore the implications of that context for talent management theory and practice. This paper aims to discuss these issues.	In-depth interviews were conducted with HR directors and senior leaders in engineering-led organizations to explore the current challenges experienced at each stage of the talent channel: attraction and recruitment, training and development, career development, talent mobility and succession planning.	The pace of technological change brought about by Industry 4.0 has created a significant gap between the capabilities of today's employees and the rapidly evolving requirements of their roles, prompting the need to consider new and more effective approaches to talent development.
3	*Attitude, and Skill*	Weaver, A., & Osterman, P. [14]	2013	The purpose of the study is to present and analyze employers with surveys in American manufacturing companies about the competencies referred to by companies	The detailed interview technique was conducted by the researcher to the manager of the manufacturing company that provided the job regarding skills, experience, and recruitment	The results of the study are that the factors that complicate the interaction of supply and demand are better communicated and coordinated by the employer to the agency providing workers, such as the skills of prospective workers, rather than focusing on an inadequate supply of labor. Preferably basic in arithmetic, able to read and good attitude.
4	*Work Culture, and Skill*	Kazancoglu, Y., & Ozkan-Ozen, Y. D. [15]	2018	The aims of this paper are threefold: first, to present a structural competency model; second, mentioning the new criteria for personnel selection in Industry 4.0; and third, contribute to the operations management literature by focusing on the recruitment process in the Industry 4.0 environment and supporting human resource activities with criteria related to Industry 4.0 and pointing out new research areas in Industry 4.0.	Design/methodology/approach Fuzzy DEMATEL has been used in its implementation. The study was conducted at a high-tech company, which has begun to modify its processes according to Industry 4.0, and introduced a new dedicated department responsible for this transformation. In total, 11 personnel selection criteria were presented and then assessed by experts through a fuzzy linguistic scale. The order of importance and causal relationships between the criteria are presented at the end of the study.	Findings based on the results, the most important criteria in the selected companies are the ability to face complexity and problem solving, think in overlapping processes, and flexibility to adapt to new roles and work environments. While the cause group includes criteria such as knowledge of IT and production technology, awareness of IT security and data protection, and error and error recovery capabilities, the effect group includes flexibility to adapt to

						new roles and work environments, understanding of organizations and processes, and ability to interact with modern interface.
5	*Atittude, Work Culture, and skill*	Maisiri, W., Darwish, H., & Van Dyk, L. [16]	2019	The aim of the study was to investigate the development of a skills development framework that seeks to bridge the gap between Industry 4.0 skills requirements and development in South Africa.	The research method used is a literature review of engineers.	The results of the research are that non-technical competencies are as important as technical competencies, the existence of technology that continues to develop, is not intended to replace humans to increase productivity, but to collaborate with each other.

TABLE III. AUTOMOTIVE MANUFACTURING INDUSTRY

No	Name of Industry	City
1	PT. Toyota Motors Manufacturing Indonesia	Kab. Karawang
2	PT. PAKOAKUINA	
3	PT. GISMA CIPTA SUKSES	
4	PT. ASTRA DAIHATSU	
5	PT. TRI JAYA TEKNIK KARAWANG	

Field interviews with practitioners of the automotive manufacturing industry were conducted to clarify the need for technical competence in the field of automotive manufacturing expertise in the context of industry 4.0. in table 3 is the automotive manufacturing industry data interviewed.

The results of the literature review data processing are then synchronized with the results of interviews from practitioners of the automotive manufacturing industry. The results of the data processing are then used as a reference in drawing conclusions in this study.

IV. CONCLUSIONS

The data from the literature review and interviews with practitioners of the automotive manufacturing industry are processed to produce descriptive conclusions, namely:

The needs of the automotive manufacturing industry in the context of industry 4.0. These include attitude, work culture, and skills. From this initial requirement data, the skill competency criteria is one of the competency requirements for the automotive manufacturing industry. Another result of attitude is the competency requirement criteria that are prioritized by the automotive manufacturing industry because it makes it easier to process workers/employees at work. The skill needs of the automotive manufacturing industry in the context of industry 4.0 are not like in previous years. The need for manual and conventional work skills has begun to be abandoned and has shifted to programming skills in the digital era in the 4.0 industrial revolution, such as working side by side with robots. The skills taught in schools must also be transformed and standardized to the needs of the industry.

REFERENCES

[1] A. Melnic, N. Trandafir, and C. Dumitrescu, “The Evaluation of Training Programs in Qualifications for the Automobile Industry in Romania,” Procedia - Soc. Behav. Sci., vol. 221, pp. 236–245, 2016.

[2] L. Büth et al., “Bridging the Qualification Gap between Academia and Industry in India,” Procedia Manuf., vol. 9, pp. 275–282, 2017.

[3] D. Jackson and E. Chapman, “Empirically derived competency profiles for Australian business graduates and their implications for industry and business schools,” Int. J. Manag. Educ., vol. 10, no. 2, pp. 112–128, 2012.

[4] T. Agrawal, “Vocational education and training programs (VET): An Asian perspective,” Asia-Pacific J. Coop. Educ., vol. 14, no. 1, pp. 15–26, 2013.

[5] A. Azevedo, G. Apfelthaler, and D. Hurst, “Competency development in business graduates: An industry-driven approach for examining the alignment of undergraduate business education with industry requirements,” Int. J. Manag. Educ., vol. 10, no. 1, pp. 12–28, 2012.

[6] J. Schweri, A. Eymann, and M. Aepli, “Horizontal mismatch and vocational education,” Appl. Econ., vol. 52, no. 32, pp. 3464–3478, 2020.

[7] C. Béduwé and J. F. Giret, “Mismatch of vocational graduates: What penalty on French labour market?,” J. Vocat. Behav., vol. 78, no. 1, pp. 68–79, 2011.

[8] Suharno, N. A. Pambudi, and B. Harjanto, “Vocational education in Indonesia: History, development, opportunities, and challenges,” Child. Youth Serv. Rev., vol. 115, no. May, p. 105092, 2020.

[9] A. Weaver and P. Osterman, “Skill demands and mismatch in U.S. Manufacturing,” Ind. Labor Relations Rev., vol. 70, no. 2, pp. 275–307, 2017.

[10] Badan Pusat Statistik, “Keadaan Ketenagakerjaan Indonesia Februari 2020,” Ber. Resmi Stat., no. 40, p. 5, 2020.

[11] R. Indriartiningtias, S. Subagyo, and B. Hartono, "Knowledge Creation pada Industri Kecil dan Menengah : Dalam Tinjauan Kajian Pustaka secara Sistematis," J. Ilm. Tek. Ind., vol. 16, no. 2, p. 142, 2017.

[12] M. T. H. Duong, D. V. Nguyen, and P. T. Nguyen, "Using Fuzzy Approach to Model Skill Shortage in Vietnam's Labor Market in the Context of Industry 4.0," Eng. Technol. Appl. Sci. Res., vol. 10, no. 3, pp. 5864–5868, 2020.

[13] Z. Whysall, M. Owtram, and S. Brittain, "The new talent management challenges of Industry 4.0," J. Manag. Dev., vol. 38, no. 2, pp. 118–129, 2019.

[14] A. Weaver and P. Osterman, "Manufacturing, Mismatch, Skill Gaps, Skill Demands, Structural Causes, Cyclical Causes," 2013.

[15] Y. Kazancoglu and Y. D. Ozkan-Ozen, "Analyzing Workforce 4.0 in the Fourth Industrial Revolution and proposing a road map from operations management perspective with fuzzy DEMATEL," J. Enterp. Inf. Manag., vol. 31, no. 6, pp. 891–907, 2018.

[16] B. Di Pierro, M. P. Fanti, M. Roccotelli, and V. Sangiorgio, "Industry 4.0: Roadmap for Applying Technologies in Shipbuilding and Manufacturing Sectors," 7th Int. Conf. Control. Decis. Inf. Technol. CoDIT 2020, pp. 819–824, 2020.