Graduate competencies based on the aspect of organizational activity in industry 4.0

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Article Info

ABSTRACT

Industrial revolution 4.0 has an impact, namely the demand for the labor market has changed, where the automation revolution replaces work that is usually capable of being done by humans and poses the risk of termination of employment. The purpose of this study is to identify the competencies that must be possessed by graduates based on aspects of organizational activity according to the needs of the industry. The data in this study are in the form of literacy studies, data from direct interviews with the industry and questionnaires to a number of respondents. Testing the validity of the questionnaire using the product moment correlation formula, followed by reliability testing using the Cronbach alpha. Meanwhile, to determine the sample size in this study using the purposive sampling technique with a total of 75 respondents consisting of practitioners and graduates of the Faculty of Engineering, Universitas Negeri Jakarta (FT-UNJ), Indonesia. The research method is carried out with a qualitative descriptive method which is intended to obtain results that describe in detail the competencies that must be possessed by graduates based on aspects of organizational activity according to the needs of the industry. The results of the research related to the competence of graduates needed by industry 4.0 based on aspects of organizational activity, namely open minded, decision making abilities, emotional intelligence, cognitive flexibility, service orientation, coordinating with others, leadership skills, critical thinking and creativity skills, skills in technology, and complex problem solving.

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1. INTRODUCTION

Acceleration of economic performance is supported by domestic demand that continues to increase, especially household consumption, and export performance that remains high. The improvement in the national economy is also reflected in the increase in the growth of the majority of business fields in all regions. Indonesia's economic recovery is predicted to continue, supported by increased mobility, sources of financing and business activities. Economic growth is one form of economic development and national

income [1], especially in the face of the industrial revolution 4.0; currently identified as the beginning of the industrial revolution 4.0. The industrial revolution 4.0 is initialized and intensified, like other industrial revolutions with increased competitiveness [2]. The industrial revolution 4.0 is characterized by a high degree of automation by automated control machines (cyber physical systems) as well as the high use of cloud, big data and intelligent production technologies [3]. In addition, revolution 4.0 considers the massive use of smart network systems with new product, procedure and service innovations.

In the era of the industrial revolution 4.0 in the next five years, it is estimated that 35% of jobs will be wiped out, even in the next 10 years it will continue to increase to 75% of types of work. This happens because the work played by humans is gradually being replaced by program digitization technology. As a result, the production process becomes faster and easier to distribute in bulk while minimizing human involvement [4]. The industrial revolution 4.0 not only provides opportunities, but also challenges for millennials. The progress of science and technology as a trigger for the industrial revolution is also followed by other implications such as unemployment [5]. Unemployment is one of the big problems faced by Indonesian people from year to year [6]. One of the triggers for the increasing number of unemployed in Indonesia is the low level of public education and inadequate human resources, making people unable to find work. Based on data from the Central Bureau of Statistics, the number of unemployed in Indonesia in February 2022 was still high as shown in Figure 1.
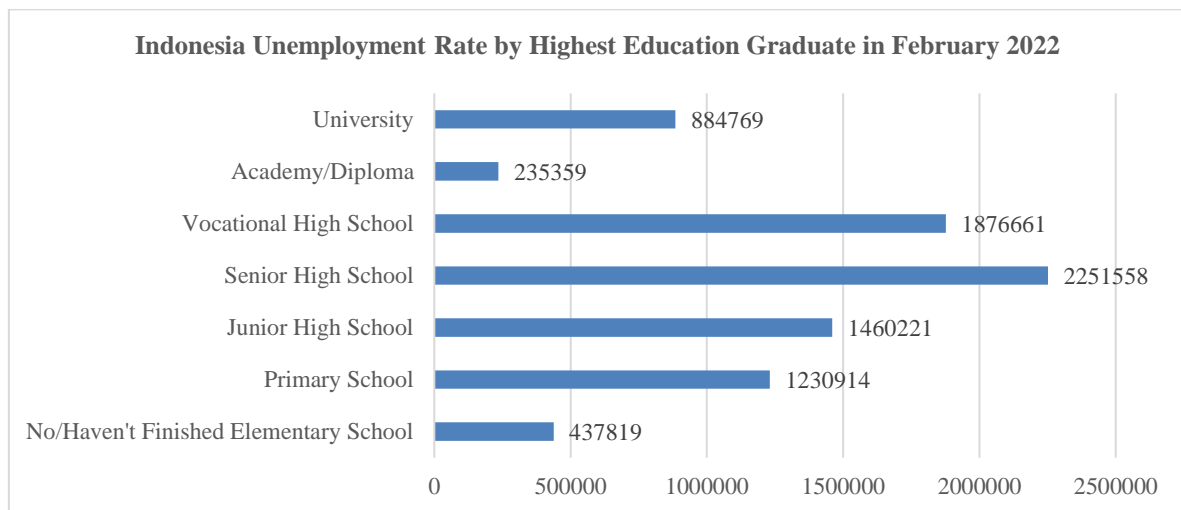

Figure 1. Indonesia's unemployment rate by highest education completed February 2022

Unemployment becomes a problem in the economy because with unemployment, people's productivity and income will decrease so that it can cause poverty and other social problems [7]. The economy of a country will be more productive if the proportion of workers increases because it can be carried out more efficiently and think critically in completing their tasks [8]. So that it indirectly affects the need for automated and digital workforce in the future through education that is very responsive to develop the industrial 4.0 workforce in the future through the involvement of partnerships with industry so that it is hoped that the workforce will be ready to enter the industrial 4.0 context [9]. In this case education means providing the effect of equipping humans with knowledge, predispositions, positions, and skills. Education will affect economic improvement or it can be said that any economic condition will affect the education process [10]. In other words, the contribution of education to the economy is complex where education is an influential force in shaping the economy of each country through the profile of the workforce [11].

The workforce profile in the industrial revolution 4.0 has new competency demands both in terms of knowledge and emerging skills, including technical competence, methodological competence, social competence, and personal. On the other hand, industry requires a workforce with professional skills that enhance the competitiveness of young specialists in the labor market which is reflected in several aspects, including readiness to plan and organize activities; readiness to use innovation and modern information technology in activities; readiness for creativity, as well as innovation in professional activities; as well as communication skills (negotiation skills) [12]. For universities, the industrial revolution 4.0 has an impact, namely the demand for the labor market has changed, where the automation revolution replaces jobs that are normally capable of being done by humans and creates a risk of termination of employment. The Faculty of

Engineering, Universitas Negeri Jakarta (FT-UNJ), one of the educational institutions that follows the development of the industrial revolution 4.0. Based on the tracer results of the 2022 Faculty of Engineering, Universitas Negeri Jakarta, it can be seen that 74% of graduates of the Faculty of Engineering work in multilateral institutions/organizations as seen in Figure 2.

Absorption of Engineering Faculty Graduates in 2022

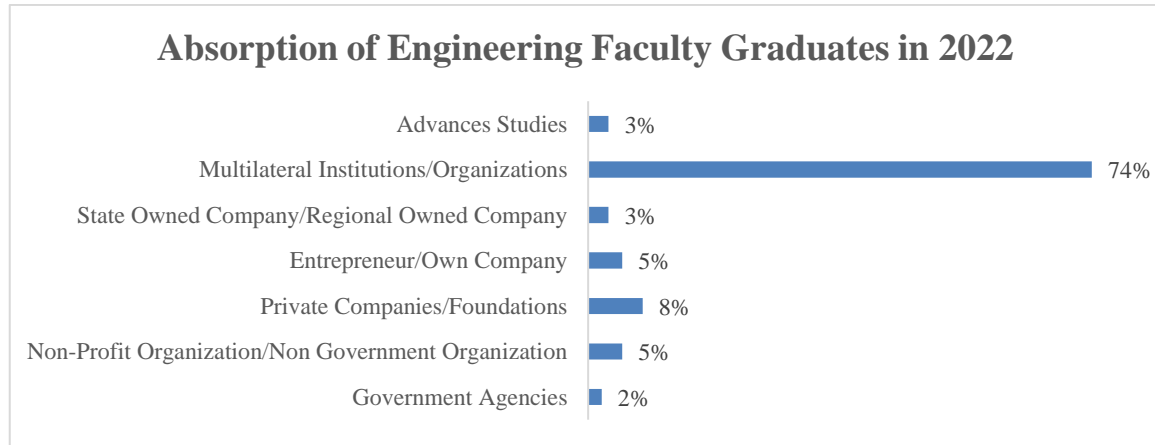|	
Advances Studies	3%
Multilateral Institutions/Organizations	74%
State Owned Company/Regional Owned Company	3%
Entrepreneur/Own Company	5%
Private Companies/Foundations	8%
Non-Profit Organization/Non Government Organization	5%
Government Agencies	2%

Figure 2. Absorption of engineering faculty graduates in 2022

Therefore, the Faculty of Engineering, which is part of the Universitas Negeri Jakarta, needs to produce graduates who are quick to adapt to change [13]. The activeness of students in organizing is one of the efforts made by universities in following the development of the industrial revolution [14]. Activeness in organizing helps students in forming themselves into individuals who understand the factors, conditions, principles of communicative activities (as a component of the principles of activity), as well as signs of opportunities in creating conditions for the development of many areas of student personality [15].

The FT-UNJ is one of the educational institutions that follows the development of the industrial revolution 4.0. The FT-UNJ has 12 student organizations (*opmawa*) and 14 student clubs. This organization and club are a forum prepared by FT-UNJ to help students achieve achievements that can be used as portfolios in entering the world of work, both in the fields of education, industry and entrepreneurship. Based on initial observation data to the industry that collaborates with the FT-UNJ it was found that 75.4% of the graduates received were graduates who were active in organizations [16]. Therefore, it is necessary to study the needs of industry 4.0 on the competence of graduates based on aspects of organizational activity within the FT-UNJ.

2. RESEARCH METHOD

The purpose of this study is to identify the competencies that must be possessed by graduates based on aspects of organizational activity according to the needs of the industry. This research was conducted in the Faculty of Engineering, Universitas Negeri Jakarta, Indonesia. Data collection was carried out from March to May 2022. The data in this study were in the form of literacy studies, data from direct interviews with industry parties and questionnaires to a number of respondents. Testing the validity of the questionnaire using the product moment correlation formula, followed by reliability testing using the Cronbach Alpha formula. Meanwhile, to determine the sample size in this study using the purposive sampling technique with a total of 75 respondents consisting of practitioners and graduates of the FT-UNJ.

The research method is carried out with a qualitative descriptive method which is intended to obtain results that describe in detail the competencies that must be possessed by graduates based on aspects of organizational activity according to the needs of the industry. This research begins by formulating indicators of interviews with industry parties related to the competencies needed by industry based on aspects of organizational activity that are aligned with literacy studies. The results of interviews and literacy studies are then used as indicators for the preparation of questionnaires for respondents who are graduates of the FT-UNJ who are currently working in the industry. After all the necessary data has been collected, the researcher analyzes the data and determines which competencies are dominantly needed by the industry in the 4.0 era. After all the data is analyzed and the results are obtained. The research design can be seen in Figure 3.
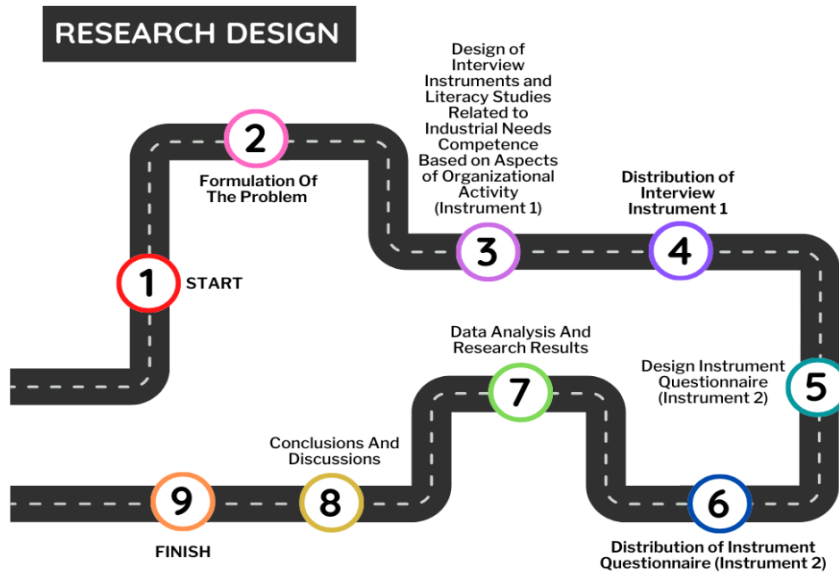
Figure 3. Research design

3. RESULTS AND DISCUSSION

The industrial revolution 4.0 greatly affects the pattern of human life activities, including in the field of education. One of them is higher education which plays a role in preparing graduates to be ready to work, both working independently (self-working) and also filling job vacancies in the world of work [17]. The industrial revolution 4.0 also has an impact on the market workforce and the skills needed by industry, so that some professions or jobs are lost [18]. Organizational activity refers to the impact of the skills and qualifications of the workforce that will be the key to the success of an innovative workforce [19]. Aspects of organizational activity are implemented in seven indicators: i) complex problem solving; ii) open minded; iii) coordinating with others; iv) service orientation; v) decision-making ability; vi) emotional intelligence; and vii) cognitive flexibility. Meanwhile, the competencies obtained as individual characteristics in the organization are reflected in the indicators: i) critical thinking and creativity skills; ii) leadership skills; and iii) skills in technology.

This is in accordance with the results of interviews with industry practitioners related to the competencies needed in the era of the industrial revolution 4.0 based on aspects of organizational activity. The results of interviews and literacy studies related to the needs of industry 4.0 on graduate competencies based on aspects of organizational activity, were then used as variables in the preparation of research questionnaires. The research questionnaire consists of statements relating to the needs of industry 4.0 on graduate competencies based on aspects of organizational activity using a Likert rating scale. The results of respondents' answers to the competency variables needed by the industry in the 4.0 era are presented in the Table 1. From the respondents' alternative answers contained in the Likert scale model in Table 1, it is necessary to interpret the scores as displayed in Table 2 [20].

Table 1. Respondents' answers regarding the competencies needed in industry 4.0

| Competency | Rating | | | | | | | | | | Total | % |
| | Score 1 | | Score 2 | | Score 3 | | Score 4 | | Score 5 | | | |
	f	%	f	%	f	%	f	%	f	%		
Open minded	1.00	1.00	2.00	3.00	7.00	9.00	38.00	51.00	27.00	36.00	313.00	83.47
Decision making abilities	2.00	3.00	6.00	8.00	2.00	3.00	30.00	40.00	35.00	47.00	315.00	84.00
Emotional intelligence	1.00	1.00	3.00	4.00	7.00	9.00	24.00	32.00	40.00	53.00	324.00	86.40
Cognitive flexibility	1.00	1.00	1.00	1.00	5.00	7.00	34.00	45.00	34.00	45.00	324.00	86.40
Service orientation	1.00	1.00	1.00	1.00	6.00	8.00	20.00	27.00	47.00	63.00	336.00	89.60
Coordinating with others	0.00	0.00	0.00	0.00	3.00	4.00	30.00	40.00	42.00	56.00	339.00	90.40
Leadership skills	0.00	0.00	0.00	0.00	2.00	3.00	31.00	41.00	42.00	56.00	340.00	90.67
Critical thinking and creativity skills	0.00	0.00	0.00	0.00	4.00	5.00	26.00	35.00	45.00	60.00	341.00	90.93
Skills in technology	0.00	0.00	1.00	1.00	1.00	1.00	29.00	39.00	44.00	59.00	341.00	90.93
Complex problem solving	0.00	0.00	0.00	0.00	1.00	1.00	31.00	41.00	43.00	57.00	342.00	91.20

Table 2. Score interpretation criteria

Percentage (%)	Score interpretation criteria
0-20	Very weak
21-40	Weak
41-60	Enough
61-80	Strong
81-100	Very strong

Open-mindedness is mostly related to negotiation, conflict, resolution, and knowledge generation in work teams [21]. Within the organization itself there are norms in the process of open-mindedness, where every member has the right to have beliefs based on his point of view and knowledge and has the right to express and be recognized as new knowledge for other members. Open-mindedness can be said as seeking and sharing information that leads to new knowledge [22]. An active open-minded person has a tendency to value new evidence that contradicts existing beliefs and carefully considers it in making organizational decisions [23]. So that it can be said that open-mindedness is a very strong competency or possessed by graduates based on aspects of organizational activity according to the needs of the industry with a percentage of 83.47%.

In the decision-making process, it is necessary to have the ability to analyze and understand data about the relationship of the relevant variables [24]. Good decision making can help a company or industry to support its business goals [25]. Decision making is considered important for the industry because the decisions made are expected to have benefits in solving problems and in the long term [26]. In the decision-making process, four factors were identified, namely stakeholder views on decision-making, barriers to implementing the decisions that have been made, ways to improve the results of decision implementation, and the impact caused by the decision-making process [27]. Therefore, it is necessary to have the ability to build individual capacities, to understand, retain, use, and weigh relevant information presented in the decision-making process [28]. This is in accordance with the results of the questionnaire, that the decision-making ability variable had a percentage of 84% which was included in very strong competency criteria or possessed by graduates based on aspects of organizational activity according to the needs of the industry.

Based on the questionnaire, the cognitive flexibility and emotional intelligence variables had a percentage of 86.40% which was included in the very strong competency criteria or possessed by graduates based on aspects of organizational activity according to the needs of the industry. Cognitive flexibility is the ability to effectively adapt to changing task demands and/or changes in one's environment [29]. Cognitive flexibility can also be said as the ability to generate alternative solutions and exchange ideas [30]. Someone who has good cognitive flexibility can be seen from three indicators: i) the tendency to feel challenging situations in a controlled way; ii) the ability to understand alternative possibilities for situations and human behavior that occur in life; and iii) the skills to generate a number of solutions to solve problems, solve challenging situations [31]. In addition, individuals with strong cognitive flexibility have better learning abilities compared to people with poor abilities [32]. In the theory of "cognitive flexibility", the concept of "cognitive" means the retrieval from intact memory of pre-existing knowledge when information is acquired, and the concept of "flexibility" means the flexible use of the acquired knowledge in various fields. Cognitive flexibility to choose and use the right information in understanding situations so that they are able to make the right decisions if there are obstacles in their work [33].

Emotional intelligence plays an important role in improving performance and reducing burnout levels for workers working in industry [34]. Theoretically, emotional intelligence comes from two perspectives, namely the first as a form of pure intelligence in the form of cognitive abilities or as mixed intelligence, which consists of cognitive abilities and aspects of personality [35]. Emotional intelligence can be defined as the ability to understand, respond to, and manipulate emotional information without having to perceive feelings well or fully experience them [36]. People with high levels of emotional intelligence experience more career success, build stronger personal relationships, and are able to lead organizations more effectively than those with low levels of emotional intelligence [37]. In the world of work, emotional intelligence greatly affects various kinds of work attitudes and behaviors, where emotional intelligence affects a person's ability to successfully cope with environmental demands and pressures, thereby managing stressful working conditions [38].

One of the characteristics of the organization is service orientation, where the organization plans and engages proactively both in terms of practices, processes, and procedures; so that service excellence is a strategic priority in an organization [39]. This is what the industry needs in era 4.0. In this era, the industry faces an increasing number of competitive threats so that each industry offers services in various ways to create a sustainable competitive advantage [40]. Many industries have stopped operating due to the indifferent attitude of employees towards consumers [41]. Service orientation in the organization, instilled as

values and norms that emphasize the importance of creating and delivering satisfaction value to customers [42]. Service orientation refers to the involvement of members of the entire organization in the activity of creating and using knowledge to increase competitiveness which refers to the development of new knowledge or insights within the organization as a potential influence on company behavior [43]. So that it can be said that service orientation becomes a very strong competency or is owned by graduates based on aspects of organizational activity according to the needs of the industry with a percentage of 89.60%.

The word coordinating with others is never loose in the organization [44]. An individual can learn many things based on the experience or beliefs of others in dealing with something through coordination so as to optimize the performance of the organization's system as a whole [45]. Coordination is important in work in industry both on a small scale and on a larger and complex scale [46]. Coordination between the main key teams of an industry to be able to survive longer in industry 4.0 competition [47]. Coordination is based on the application of professionally oriented tasks so that each team member or workforce is required to show their contribution to the development of the industry [48]. This is in accordance with the results of the questionnaire, that the coordinating variable with others has a percentage of 90.40% which is included in the criteria of very strong competence or possessed by graduates based on aspects of organizational activity according to the needs of the industry.

In organizations, leadership plays an important role, especially in the era of industry 4.0 which causes changes in production modes that require strategic decisions at all levels of the organization [49]. Education is a place that is able to mobilize and foster students so that they can form a leadership spirit and become fully human through existing organizational activities [50]. Today's industry is not only looking for graduates who have good academic values but also have a good leadership spirit to increase the success of the industry itself [51]. Leadership skills can be identified from six aspects, namely being able to form a vision to focus and challenge the team; able to translate the vision into a clear strategy on what actions to take and what not to; able to recruit, develop and reward team members; focusing on measurable results; able to innovate and learn to sustain a team or organization; and lead yourself [52]. Therefore, leadership skills are very much considered in one of the soft skills that are considered by the industry to accept its workforce [53]. This is in accordance with the results of the questionnaire, it is found that the leadership skills variable has a percentage of 90.67% which is included in the very strong competency criteria or possessed by graduates based on aspects of organizational activity according to the needs of the industry.

Critical thinking and creativity skills are one of the main skills needed in the industrial workforce 4.0 [54]. Critical thinking can be seen from the individual's ability to understand the information he has and be able to draw conclusions based on the available evidence, be able to evaluate existing information, be able to think logically in expressing his opinion, and finally be able to distinguish between valid and invalid arguments [55]. While creativity is related to the production of new and useful ideas about products, services, or processes that are a must for an organization or industry, it can be long-term in success [56]. Through critical thinking and creativity skills, it is hoped that students will be able to become workers who are able to construct knowledge, so that they can increase their motivation in facing the realities of the world of work [57]. This is in accordance with the results of the questionnaire, that the critical thinking and creativity skills variable had a percentage of 90.93% which was included in the very strong competency criteria or possessed by graduates based on aspects of organizational activity according to the needs of the industry.

In the industry, competitiveness is the basis for a company's sustainable and stable competitive advantage [58]. The market competitiveness of an industry is closely correlated with the support of high-tech core technology [59]. Therefore, the industry tends to choose workers who have technological capabilities in the form of a complementary set of skills and knowledge that can be used in product development, production, and services that can be a competitive advantage for the industry [60]. In organizations, technology support is also very much needed in building and improving the organization's internal documentation as well as helping to identify mechanisms that apply in various situations and contexts [61]. This is in accordance with the results of the questionnaire, it was found that the skills in technology variable had a percentage of 90.93% which was included in the very strong competency criteria or possessed by graduates based on aspects of organizational activity according to the needs of the industry.

Complex problem solving is considered to be the most complex level of cognitive activity operating at the same time, where all the intellectual parts of an individual including memory, perception, reasoning, conceptualization, language, emotions, motivation, self-confidence, and the ability to control situations to find solutions or solutions. achieve hard-to-reach goals [62]. Complex problems require high knowledge and collaboration with many people [63]. Complex problem solving skills consist of the ability to identify and control a dynamic problem environment [64]. Where are the characteristics of a dynamic problem environment, among others: i) the complexity of the problem situation represented by the many variables involved; ii) connectivity and mutual dependence between the variables involved; iii) the dynamics of the situation, reflecting the role of time and development in a problem; iv) non-transparency regarding the variables involved; and v) conflicting objectives that occur at various levels of analysis [65].

This complex problem solving ability is referred to as an important work ability in the industry [66]. This is in accordance with the results of the questionnaire, it was found that the complex problem solving variable had a percentage of 91.20% which was included in the very strong competency criteria or possessed by graduates based on aspects of organizational activity according to the needs of the industry. Some of the abilities that need to be possessed based on hierarchy are complex problem solving, skills in technology, critical thinking and creative thinking, leadership skills, coordination, service orientation, cognitive flexibility, emotional intelligence, decision making, open minded as seen in Figure 4.
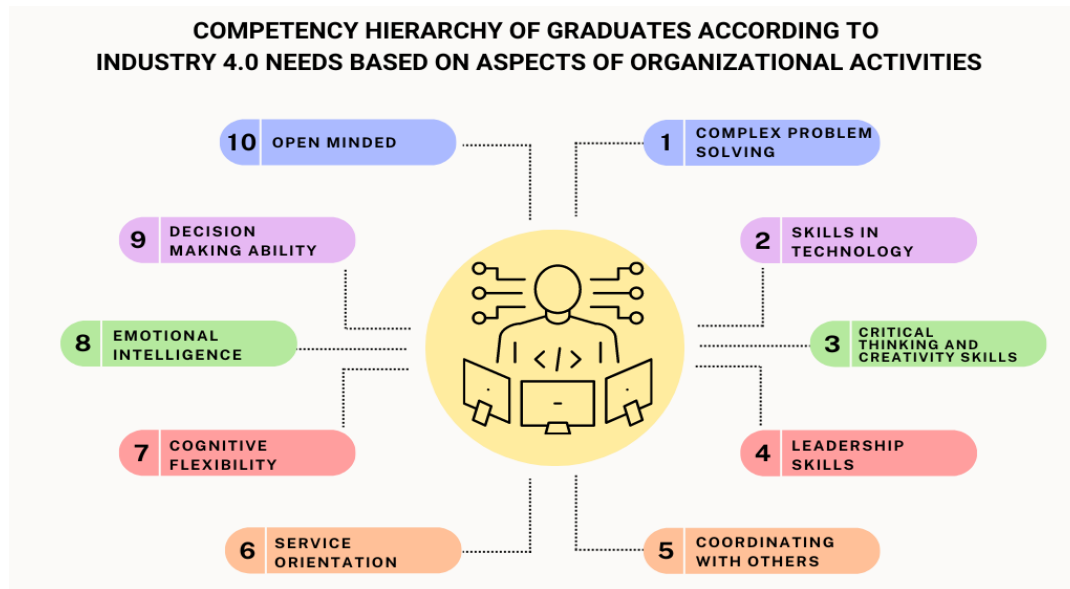
Figure 4. Competency hierarchy of graduates according to industry 4.0 needs based on aspects of organizational activities

Competence of the workforce will facilitate the industry to achieve their performance and business goals strategically. Therefore, when the business strategy changes or develops, the human resource strategy will also change [67]. Based on the percentage of competencies possessed by graduates based on aspects of organizational activity according to the needs of the industry as a whole, it shows that complex problem solving is the main competency that is needed by industry 4.0 with a percentage of 10.32%; skills in technology with a percentage of 10.29%; critical thinking and creativity skills, with a percentage of 10.29%; leadership skills, with a percentage of 10.26%; coordinating with others, with a percentage of 10.23%; service orientation, with a percentage of 10.14%; cognitive flexibility, and emotional intelligence with a percentage of 9.77%; decision making ability with a percentage of 9.50%; and the last one is open minded with a percentage of 9.44%. Based on this, the FT-UNJ continues to strive to improve the performance of each existing organization.

Every organization within the Faculty of Engineering, Universitas Negeri Jakarta carries out various social service activities, disaster management, community training, participating in competitions, and many more. In organizations, students will meet many people who have different habits, backgrounds and mindsets. In addition, through organizations, students learn to be able to make proposals, manage budgets, find sponsors or donors, and more. So that through active student organizations can improve work performance, increase job satisfaction, promote innovation, and encourage leadership in students can play a role as a driver of change for the better. Soft skills are critical to human resource development and workforce success these qualities rival academic or technical skills in their ability to predict employment and income, among other outcomes [68]. Therefore, the competence of graduates must be in accordance with the needs of the industry. Organizations can become learning media in the form of industrial transformation so that graduates will be able to adapt to an environment that changes quickly, unexpectedly, and become competitive human resources and win global competitions [69].

4.   CONCLUSION

The results of the research related to the competency of graduates needed by industry 4.0 based on aspects of organizational activity, namely open minded, decision making abilities, emotional intelligence, cognitive flexibility, service orientation, coordinating with others, leadership skills, critical thinking and creativity skills, skills in technology, and complex problem solving. To obtain these competencies, it is hoped that the Faculty of Engineering, Universitas Negeri Jakarta will continue to improve the performance of each organization through various social service activities, disaster management, community training, participating in competitions, and many more. So that active student organizations can play a role as a driver of change for the better.

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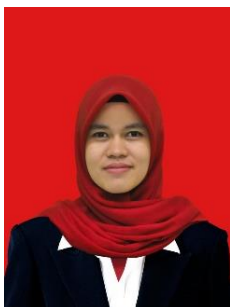
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