



## The Absorption of HRST From Technology-Based Companies of Indonesia

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### ABSTRACT

Technology-based changes increases the need for more efficient human resources in science and technology (HRST). This industry has two contradictory impacts where on the one hand it increases production efficiency with automation, but on the other hand, advanced technology causes dehumanization which contributes to not being fully absorbed of HRST. This paper mapped the absorption of the technology-based industry in Indonesia through data on job vacancies from five technology-based companies in Indonesia over a period of one year. The result showed that HRST are not absorbed in areas outside the big cities in Indonesia. On the other hand, some of the needs for HRST are distributed to the global market, especially in Singapore and Bengaluru, India, tendency to reach the demand of HRST in the global network, especially from regions that are the world's technological centers such as Bengaluru-India and Singapore. This study argues that these companies still created jobs. HRST still survived from dehumanization because the demand of some specific competencies is needed.

## I. INTRODUCTION

The development of science and technology, especially the integration of information technology systems that triggered the industrial revolution 4.0 and has changed the perspective and business processes of previous industries, resulting in increased efficiency and growth of company profits (Gilchrist, 2016). Efficiency in business processes aided by integrated technology has led to the

emergence of many technology-based companies in the world. In the Indonesian context, there are at least 992 startups of which 61% are under ten years of age (MIKTI & Teknopreneur, 2018). Moreover, numerous companies have reached a large valuation, where at least five companies have a value above 1 billion US dollars or often called 'unicorns' in early 2020.

However, the emergence of technology-based companies often has two opposing sides where on the one hand this industry creates new jobs that allow a wider range of employment opportunities (Aghion & Howitt, 1994; Peetz, 2019). On the

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other hand, the advancement of information technology has the problem of dehumanization which often arises from more efficient systems where many vulnerable jobs can be lost or replaced by computerization (Frey & Osborne, 2013; Ritzer, 2002; Schwab, 2016). While in Indonesia it is rare to find any discussion about the impact of technology-based companies on the absorption of human resources.

Several problems that arise in studies often relate to the impact of Indonesian technology-based companies in on informal workers and SMEs (Artaya & Purworusmiardi, 2019; Asmuni, 2019; Darsin, 2019). Research that examines issues regarding the impact of these companies in the context of science and technology-based formal employment is low. Therefore, this study will fill the gap by examining the impact of these companies in the absorption of HRST in Indonesia with the hypothesis that technology-based companies will absorb HRST. Furthermore, there are two questions that will be discussed. (1) How to map the supply and demand of science and technology human resources throughout Indonesia (2) How technology-based companies from Indonesia meet their needs for HRST.

Both answers will be delivered by the maps and linking of supply of Indonesian HRST from Indonesian University Graduates and the demand from the job vacancies from five of the biggest technology-based companies in Indonesia that has company value over 1 million USD: Gojek, Traveloka, Bukalapak, and OVO.

### **A. Technology-Based Companies Development in Indonesia**

Technology-based companies in Indonesia have grown in recent decades, especially starting in the late 1990s. One company Kaskus, was founded in 1999 by providing internet-based discussion services. In addition, Bhinneka, which started its online sales business in 1999, has become one of the first e-commerce companies in Indonesia. After 2000, the business models of technology-based companies in Indonesia began to develop: social media such as Koprol (2008); e-commerce with mobile platforms such as Tokopedia (2009), and Bukalapak (2010); Transportation providers

and ticket agencies such as Gojek (2010) and Traveloka (2012); Mobile Payment Portals such as OVO (2016), all of which have a capital value of over 1 billion USD. Lee (2013) called it a group of ‘unicorns’ because their appearance was included as an outlier.

The large capital value of the company comes from mainly foreign investors. Data from Cunchbase (2020) shows that Gojek has a total capital value of 4.4 billion USD with 30 investors who now make this company the largest technology company capital in Indonesia. This is similar to Tokopedia which has a capital value of 2.9 billion USD and a total of 11 investors and Traveloka which has a total capital of 1.2 billion USD with a total of 9 investors. This shows that the development of technology-based companies is currently supported by opportunities to find investors. As a result, abundant funds allow companies to develop business freely, including in the use of human resources.

## **II. ANALYTICAL FRAMEWORK**

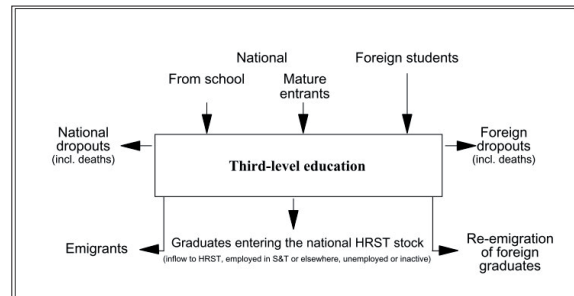
Human resources who are directly involved in the development of technology-based industries are often workers with educational backgrounds or experience in science and technology or commonly termed as Human Resource of Science and Technology (HRST). HRST can be defined based on the Canberra Manual can include human resources who have successfully completed third-level education studies, and also for those who did not complete the education but formally have a job in the field of science and technology-based on ISCO-88 level 1 (manager), level 2 (professional), and level 3 (technician) (Measurement of Scientific and Technological Activities, 1995). This definition shows that the science and technology human resources cover a broad range of HRST professions, from science and technology policymakers at the managerial level, to science and technology operators and technicians who do not produce or use science and technology directly.

In the Indonesian context, HRST are interpreted in a narrower scope. Act No.19 of 2019 defines science and technology human resources as researchers, engineers, lecturers, and

other science and technology human resources who work well as State Civil Servants (ASN), institutions, private companies, and individuals through the implementation of technology in the form of education, research, development, assessment, and application. Research is carried out to strengthen basic science; development is a follow-up to research to improve community welfare; assessment ensures science can answer development problems and produce value in the production process or product through engineering, technology clearing, technology audits, testing, technology development, design and operation; and application intended to encourage innovation through technology transfer, technology intermediation, science and technology diffusion, and technology commercialization.

From these two points of view, HRST emphasizes that HRST are those who have a job or education in science and technology who are directly involved in the implementation of technology. This study limits the concept of HRST which play a role in the implementation of technology. Meanwhile, human resources who play a supporting role, or in the Canberra Manual are referred to as Operators and Administration, will be positioned as supporting human resources for science and technology. HRST stock in a country is highly impacted by the supply and demand side. HRST supply is highly affected by the availability of HRST from third level graduates from university or other systems (Figure 1) that have the potential to become workers in the science and technology field (Paterson, 1999). OECD (1995) assessed that HRST contribute from sharing both students with science and technology backgrounds who have graduated or those who develop from experience to work in the science and technology field. This shows that the role of universities in providing science and technology learning is an important role in providing the embryo of the future readiness of science and technology human resources.

In the Indonesian context, HRST supply is affiliated with the HRST education capacity that is the maximum capacity that student able to enter universities (Achelia, Asmara, Akbar, & Tasrif, 2017) (Figure 2). This fact may create more universities in Science, Technology, Engineering,

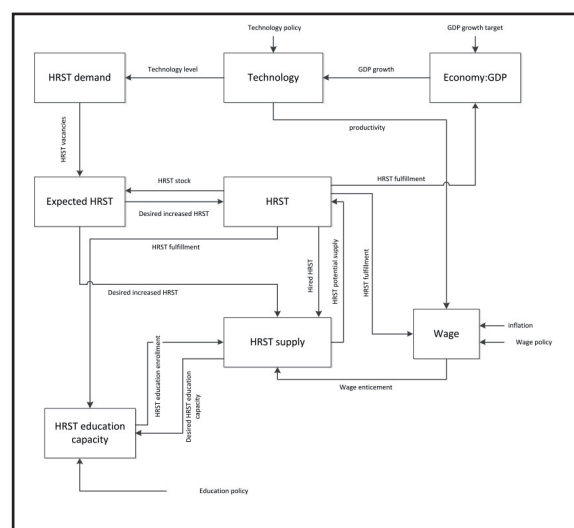


**Figure 1.** Major Flow HRST (Measurement of Scientific and Technological Activities, 1995)

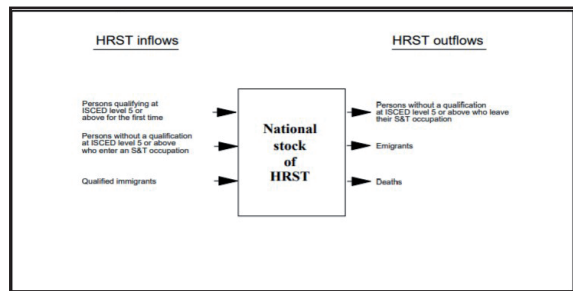
and Mathematics (STEM) in Indonesia, and cause an oversupply of HRST stock.

However, HRST demand is the number of human resources needed in science and technology activities at a certain level related to the occupational dimension (Mirela, 2011). The number of demands can be generated by the number of job vacancies (Achelia et al., 2017). HRST demand can be filled by the supply from both national and foreign education system.

In the process of its development, many HRST can now be replaced by the role of technology. HRST have professionals (level 2) who have a lower vulnerability than level 3 (technicians) to be replaced by technology (Peetz, 2019). This shows that technology can replace the roles of human resources supporting science and technology. The impact could be less labor absorption. In other words, unemployment could increase.



**Figure 2.** Indonesian HRST Model (Achelia et al., 2017)



**Figure 3** The national stock of HRST in a country level

The flows of HRST in a country level is depending on HRST inflow and outflows. OECD (1995). National HRST stocks is added by HRST inflows from worker who qualifying at ASCED level 5, worker who not qualified but enter S&T occupation, and the qualified immigrant workers. In addition, the national stock will decrease if qualified HRST left their S&T occupation, emigrants, and death (Figure 3).

To increase the demand of HRST to produce innovative products and more efficient business some companies use immigrant workers to fill the national HRST competency gap, or use outsourcing and establish overseas branch offices. the Globalization provides wider choice of location by companies to improve their business with their localization (Vernardakis (2016), a term used to show that some countries, such as in China and India, have intellectually developed.

### III. METHODOLOGY

This research uses job advertisement data from five technology-based companies in Indonesia: Gojek, Tokopedia, Bukalapak, Traveloka, and OVO from 31 January 2019 to 29 February 2020 on the respective company websites and job search portals. On that page, scrapping is carried out or the process of extracting website pages into a collection of words as raw data for processing (Glez-Peña, Lourenço, López-Fernández, Reboiro-Jato, & Fdez-Riverola, 2013). From this process, 1,080 job impressions were extracted during the one-year period. The next stage is cleaning data and content analysis for each job assignment (Figure 4). Content analysis is carried out to generate information about placement locations, skills, education, and other personal abilities to carry out analysis and draw valid conclusions from a collection of texts (Weber,

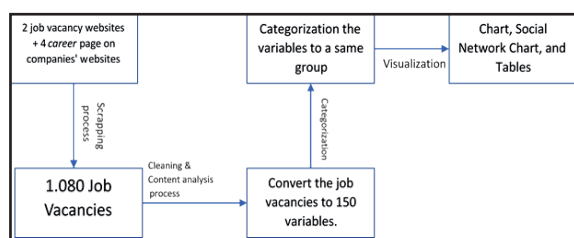
1990). Content analysis can be quantified through a systematic assessment of communication symbols that have been transformed into numerical values based on valid measurements to measure communication and describe its meaning (Riffe, Lacy, Watson, & Fico, 2019).

The results of content analysis in the form of 150 variables were converted and standardized to achieve the same understanding between each job vacancy. So that an understanding of the skills and abilities required by each job vacancy has a harmonious understanding. Finally the standardized categories were visualized through descriptive statistics in the form of tables, charts, and social network charts to illustrate the facts that will be discussed in this study.

The visualization data, especially to chart the relationship between Job Position by Company, Job Vacancies by Education, Job positions by recruitment location, data visualization is carried out using VOSviewer software version 1.6.16. Further job position data, company, education, education were described as interconnected social networks.

Meanwhile, other data and information included in this paper, such as the supply of science and technology human resources in Indonesia by field of study and area, were determined based on student data at database of higher student Ministry of Education and Culture of the Republic of Indonesia (<https://forlap.kemdikbud.go.id/>).

The usage of the companies as main research object was due to the same characteristics because the companies has been mainly operating in Indonesia, were established in Indonesia by Indonesian business persons. The companies also produced the digital products such as application mobile and web regardless of its business sector.



**Figure 4.** Analysis Process of the study



In addition, these companies have a valuation over 1 billion USD.

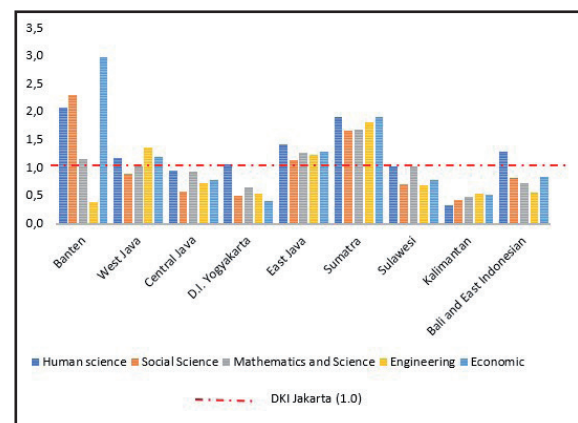
## IV. RESULTS AND DISCUSSION

### A. The Map of Supply and Demand HRST from technology-based companies in Indonesia.

The supply and demand for HRST based on the distribution of regions in Indonesia showed inequality. The main supply of HRST comes from universities throughout Indonesia. Although DKI Jakarta Province is one of the regions that produces the most HRST in Indonesia, it is not the best in terms of numbers. For example, the humanities, social and economic categories in Banten have more active students 2.1, 2.3, and 3.0 than DKI Jakarta; East Java has 1.3 more active Mathematics and Natural Sciences students than DKI Jakarta; West Java has 1.4 more engineering students than Jakarta (Figure 5). Moreover, the collective ratio between students in Jakarta and outside Jakarta has an unequal score where, on average, each category has 9.5 times more active students compared to DKI Jakarta. In short, the contribution of HRST production in Indonesia is mostly done by universities outside DKI Jakarta. However, companies that focus on the technology-based industry were spread unevenly in Indonesia. The BPS survey (2018) showed that 59% of web / digital platform companies are located in Jakarta. Other provinces such as West Java (15%), Central Java (12%), East Java (8%), and Banten (6%) are located in areas within the island of Java. This reflects that the technology-based industry was largely centralized in big cities on the island of Java, even though the number of HRST outside Java is at a high ratio. As a result, an abundant supply in an area cannot be absorbed if the industry in that area does not grow enough to provide a matching demand. Furthermore, the supply of human resources that comes from graduates from regional universities who tend to urbanize or has less potential job opportunities if they choose to stay in their area.

One of the assumptions that caused the technology-based industry to be centralized in one place was due to the efficiency of the

company as a result of the use of technology. In the analysis of job vacancies content (Figure 6), it appears that the linear lines below show two patterns of demand for HRST in the regions outside Jakarta, Jakarta, and abroad. The demand for HRST in the categories of Business Administration and Education, Sales, and Marketing is needed more in the regions outside Jakarta than in Jakarta or abroad. In contrast, in the Science & Research and Engineering category, there was less demand for Construction in the regions outside Jakarta. This information could explain that the technology-based industry in the regions absorbs more science and technology workers for operational needs. On the other hand, product development, especially HRST related to technology research and development, tends to be absorbed by companies located in Jakarta and abroad. The characteristics of job vacancies in each region also showed a different pattern. In general, regions need more requirements for a Grade Point Average (GPA), but less work experience than those in Jakarta and overseas. Meanwhile, overseas needs are more concerned with more experience, English language skills, and a few requirements that must be met based on the GPA. This can also be seen from the level of ability based on work experience where the more global the need for HRST, the longer the experience will be needed (Table 1).



**Figure 5.** Ratio of the Number of Students based on Field Groups of Each Province in Indonesia to the Province of DKI Jakarta

(Processed from Ministry of Research and Technology / National Agency for Research and Technology data (2020))

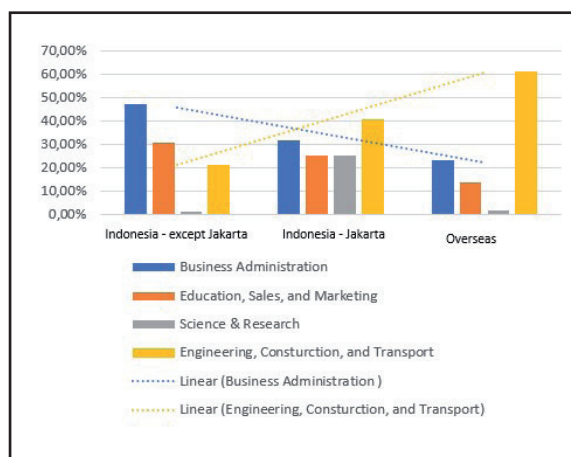
**Table 1.**

Job vacancy prerequisites

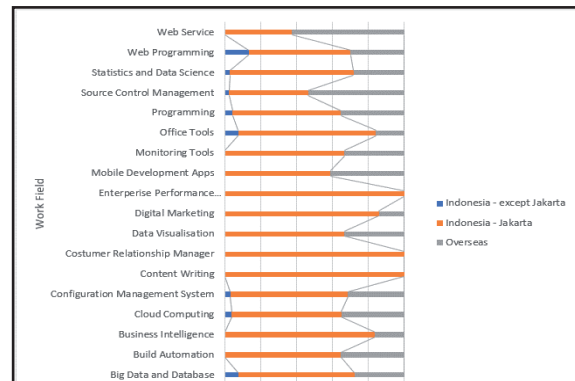
Characteristics	Regions Outside Jakarta	Jakarta	Abroad
GPA – <i>required</i> <i>above 3.0</i>	5.9%	5.3%	1.9%
Working Experi- ences	2.6 Years	2.7 Years	3.4 Years
Post Graduate Required	2.78%	1.6 %	4.67 %
Fluently English	28%	28%	66%

In more detail, the demand for HRST in engineering and managerial fields were dominated by the need for jobs located in the Jakarta and abroad (Figure 7). In general, the portion of labor in the field of work was more needed in Jakarta, except in the field of web services and source control management, which were more needed for jobs centered abroad. Several positions that do not have much IT skills, such as content writing, customer relationship managers, and enterprise performance management are all required at the head office in Jakarta.

Meanwhile, from a company point of view and the job position shows a network pattern that is evenly connected. During that time, Gojek became the company that published the most job vacancies with Traveloka. Meanwhile, Bukalapak is the company that publishes the least number of



Source: authors

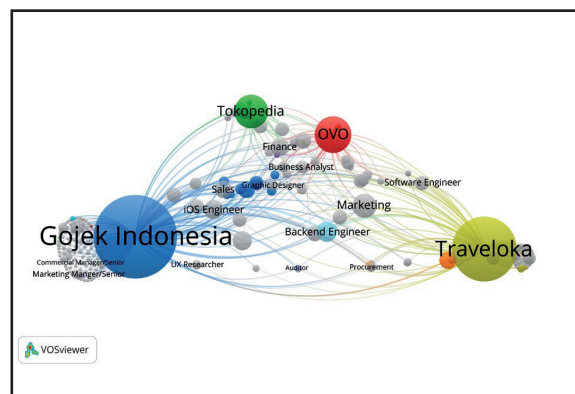
**Figure 6.** The job vacancies in three different categories

Source: authors

**Figure 7.** Proportion of HRST demand by occupation and region

job vacancies. Gojek itself has one network that is collected without any relationship (Figure 8). These networks show that the experts published by Gojek tend to be more unique and have no similarity in content during the analysis. Meanwhile, the dominant jobs that have relationships between these companies are Marketing, Sales, Finance, Business Analyst, Software Engineer, IOS Engineer, Graphic Designer, UX Researcher, Auditor, and Procurement.

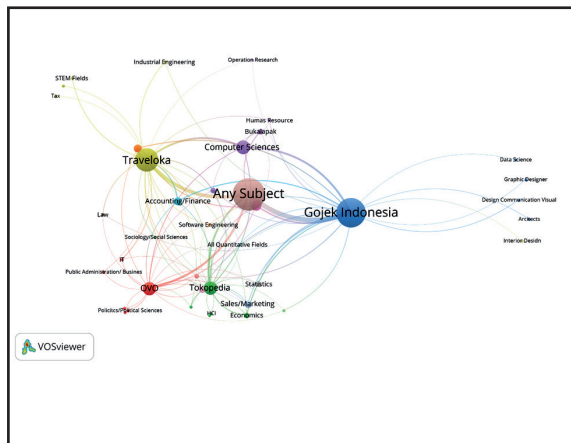
The demand for human resources based on the field of education shows a pattern where educational requirements based on the scientific field were not the main choice. Figure 8 shows that the category 'any subject' has the most general magnitude. The vacancies in this category emphasized the need for the ability to use software and mastery of technology (Figure 9). Meanwhile, the social science and quantitative science categories had a slightly different pattern. In social science,



Source: authors

**Figure 8.** Job Position by Company

a more rigid field of science was needed. Such as sociology, economics, human resource, and public administration. Meanwhile, in quantitative science midwives more generic human resources were needed, such as 'All quantitative fields' and 'Science, Technology, Engineering, and Mathematics (STEM) fields' also appeared to be one of the required field requirements. Although some fields of science were not as flexible as the social sciences, such as computer science and statistics.



Source: authors

**Figure 9.** Job Vacancies by Education

The ease of technology that causes globalization or what Ritzer (2002) calls McDonaldisation demands efficiency, especially business centralization made possible by technology and automation (McKinsey, 2019). The existence of development and research centers as places that require a lot of science and technology human resource needs can be concentrated in one strategic area. Unfortunately, this strategic place was not located in the regions of Indonesia. Thus, companies may no longer need workers in the regions, especially workers who can be replaced by technology and communication skills. Whereas the stock of science and technology human resources that emerge from universities is not only from the city center such as Jakarta, but also from regions that also contribute through the existence of universities. Furthermore, the need for higher quality human resources, especially in work experience with high technology capabilities was more needed at the head office in Jakarta and overseas branches. Consequently, the human resources required by the industry in the regions

placed an emphasize on new graduate HR based on scientific field indicators and GPA scores.

## B. How technology-based companies from Indonesia met their needs of HRST.

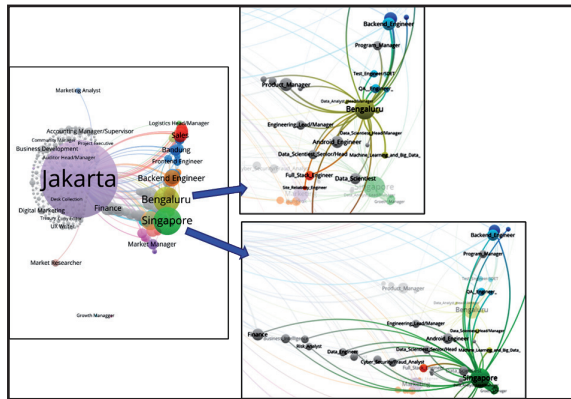
From a global network point of view, the three cities that were central to the demand of HRST in these companies are Jakarta, Bengaluru, and Singapore. Jakarta is the economic center in Indonesia where the five companies have their headquarters. So that the need for human resources in Jakarta required the largest and more varied human resources. Meanwhile, other regions in Indonesia apart from Jakarta, only Bandung, appeared more than others.

Singapore has an important role in the development of innovation and business development for technology companies in Indonesia. Three companies have branches in Singapore such as Tokopedia, Traveloka, and Gojek.

Meanwhile, Bengaluru, India has emerged as the second largest city after Singapore. Bengaluru is considered not only as India's Silicon Valey (Heitzman, 1999; Parthasarathy, 2004), but also as a center for Asian technology companies (Saxenian, 2001). Since 1985, the value of software exports in India increased steadily until the 2000s, by which time Bengaluru was the region that had the largest contribution (Parthasarathy, 2004). Current developments have made Bangalore the center of the innovation network in the global information economy (Parthasarathy, 2019). As a result, many technology-based industries were indirectly connected to the Bengaluru network. Before Gojek officially opened its representative office in Bengaluru, some of Gojek's programmers were Indian. In addition, Gojek was often involved in online communication with technology companies in Bengaluru.

In 2016 a representative office in Bengalure was established with the aim of finding new seeds for developers, including as one of the company's talent development to accelerate Gojek technology innovation and development (Detikinet, 2016; Gojek, 2017). Apart from Gojek, Traveloka established a research and development (R&D) center in Bengalure in 2019, which is also one of

the company's foundations in developing corporate technology and innovation (Traveloka, 2019). In other words, the human resources demand of the three companies (Tokopedia, Traveloka, and Gojek) to fill job positions with highly skilled were recruited from Bengaluru and Singapore (Figure 10).



Source: authors

**Figure 10.** Job positions by placement location

Apart from these two cities, the human resources demand of technology companies from Indonesia was greatest in various other cities, such as Bangkok (Thailand), Ho Chi Minh (Vietnam), Gurugram and Noida (India), Kuala Lumpur (Malaysia), and Sydney (Australia). In these countries, most of the science and technology human resources are placed in business operational branches, not as research, development, and human resource development centers as in branches in Bengaluru and Singapore.

#### IV. CONCLUSION

The ease of access to technology is currently increasing the number of technology-based companies in Indonesia. However, the absorption of highly skilled workers was only needed in Jakarta and was slightly absorbed in other regions in Indonesia. Whereas the largest supply from higher education of HRST was in regions outside Jakarta. In addition, samples from large technology-based companies in Indonesia showed a tendency to reach the demand of HRST in the global network with the established overseas branch office, especially from regions that are the

world's technological centers, such as Bengaluru, India and Singapore.

This study suggests that these companies still created jobs but HRST still survived from dehumanization because the demand of some specific competencies.

Future research on the demand for HRST and skills needed by large technology-based companies in Indonesia can provide a more detailed picture regarding the mapping of the absorption of science and technology human resources in Indonesia.

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