The Nation Readiness in Facing Industry 4.0 viewed from Clean Water and High School Teacher Availability toward GDRP without Oil

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Abstract

The resilience of a country can be seen from the ability to stabilize its economic growth supported by the resources within it. This paper wants to explain how this country achieved economic success through natural and human resources, namely the management of clean water and the provision of secondary school level teachers in districts and cities throughout Indonesia. The methodology used in this analysis is Robust Ordinary Least Square Regression for cross-sectional data for 501 districts and cities in Indonesia. The results show that the robust model with all the independent variables is significant at the 5% level. The results of this study prove that with this proposed a new model which is a strong model that can be applied in Indonesia in the future. The results of this study also recommend to the government in making key policies to achieve growth in every region in Indonesia.

Keywords: clean water, high school Teacher, GDRP without Oil

Introduction

With the development of automation technologies such as the internet of things (IoT), big data and artificial intelligent (AI) become a big challenge while providing many opportunities with the emergence of several new choices for business people (Aileen, et al, 2019, Purba & Panday, 2015, Tan, et al, 2019). Thus, business players who have business from small, medium and large must run their businesses to adjust to the development of the technology in question. This is because consumers can quickly determine their choices available online in cyberspace media (Kim, et al, 2019, Purba, et al, 2020).

The readiness of a country in facing the industrial revolution 4.0 can be seen from one of the indicators (Purba, et al 2019; Tan, et al 2018), namely the Global Competitiveness Index issued by the World Economic Forum (WEF). In 2018 Indonesia's ranking is in 45th in the world, better than 47th in 2017. Meanwhile, for the ASEAN region, Indonesia sits at 4th place below Singapore, Malaysia and Thailand. Therefore the challenge for the Indonesian people is to be able to immediately advance to a higher level.

The World Economic Forum also released 12 components to measure the readiness of a country to enter the industrial era 4.0 with their respective rankings in 2018 ago. Indonesia's ranking in each of these components is 48 for institutional development, 71 for infrastructure, 50 for ICT adoption, 51 for macro-economic stability, 95 for health, 62 for skills, 51 for product market, 82 for labor market, 52 for financial system, 8 for market size, 30 for business dynamism, and 68 for innovation capability. All of them require programs and formulas and commitment from many parties, so collaboration is needed to improve Indonesia's ranking in each of these components (Kearney, 2017, Indrawati, 2019, Purba & Purba, 2020).

When the momentum of the Fourth Industrial Revolution came, decision makers in the public sector as well as from the private sector were faced with a series of new uncertainties regarding the future of production and how best to respond to and utilize the technologies that emerged in this era (Purba, et al, 2019, Purba & Panday 2015) . The speed and scope of change adds a layer of complexity to the already challenging task of formulating and implementing industrial strategies that promote productivity and inclusive growth (Aileen, et al, 2019, Purba, et al, 2020, Purba, Samuel and Purba, 2020).

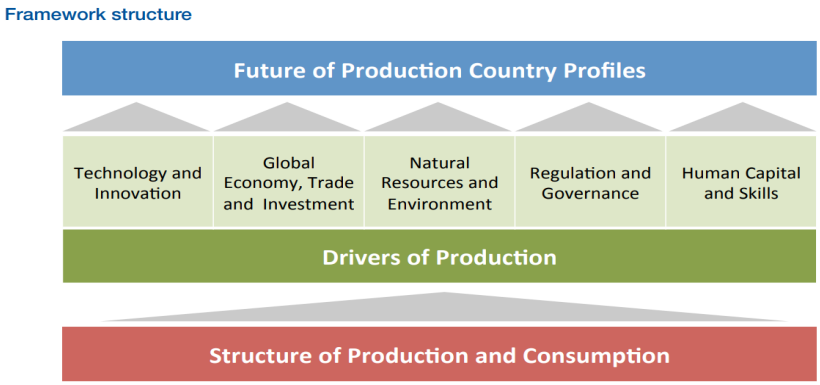

Figure 1.Frame work structure Future Production for Industry 4.0

When viewed in a macro framework in fig. 1: technology and innovation, economy, natural, regulations and human capital with their skills become the drivers of production. Then, The industry strategy can use a country profile to determine an agenda that can be followed up on an ongoing basis (Budiono, 2011, Budiono & Purba, 2020). The Readiness for Future framework described in this brief note must address two types of impacts: 1. Structured multi-stakeholder dialogue to identify strategic priorities, actionable agendas and monitoring progress in a particular project context. 2. The establishment of institutions that facilitate permanent dialogue in a system that promotes coordination within the government and between the government and the private sector (Indrawati, 2019, Tan, et al, 2018).

There are several fiscal policies to support the service delivery of Indonesia's readiness to enter the industrial era 4.0 including the development of digital infrastructure such as data centers, for big data, followed by continuing to build the Palapa Ring national optical fiber network. Until now, 35,280 km of submarine cable and 21,807 km of land cable have been realized (Indrawati, 2019, Budiono & Purba, 2019, Purba, et al, 2020). Besides that, improving the quality of Human Resources (HR) is also needed, so it is done by providing government (Purba, 2015, Butarbutar & Purba, 2016, Purba, 2002) scholarships through the Government Fund Management Institute (LPDP) which has reached 20,255 scholarship recipients. Improvement in the field of health and social security for the people is also a concern of Joko Widodo's regime, namely the provision of a Healthy Indonesia Card (KIS) which reached 96.8 million people, and an effort to increase the percentage of drug and vaccine availability in the Puskesmas by 95% in 2019 (Indrawati, 2019,).

Clean Water in Indonesia

Water is a natural resource that is very important and needed by every living thing in this world. All living things including humans absolutely need water because almost all human activities on this earth need water (Budiono & Purba, 2020). As well known, that the availability of clean water will determine the condition residents in an area. This has been stated by Hunter (2001), the life of the inhabitants of an area has a very important influence on the ecosystem, including the availability of water or clean water. A high level of population growth can certainly have implications for access to clean water (Budiono & Purba, 2019). However,

there are many intervening variables that bridge the relationship between the availability of clean water and the population, including technology, policy, and culture (Mujiyani, Rachmawati & Hidayati, 2006).

The general condition of water resources in Indonesia is based on research results from the Center for Research and Development of Water Resources The Ministry of Public Works in 2009 mentioned Indonesia still has a large enough water reserve, namely as much 2,530 km3, or in other words that this country is ranked fifth in the world. Even so, in fact the distribution of water resources in Indonesia is not evenly distributed. In the western region it is quite large but in the eastern and southern regions it is lacking so that the threat of water crisis in a number of regions in Indonesia is frequent and it is feared that it will become more widespread (Qodriyatun, 2015).

High School Teacher in Indonesia

Human Resource Development starts from education, training, internships and guidance for HR in Industry 4.0 (Nadeak & Purba, 2014, Purba, 2015). Basic capital in the development of human resources that must be possessed include: skills, agility and culture, with different cultural backgrounds can still work together (Simbolon, et al, 2020a). In this case HR is the most important role to face the industrial revolution era 4.0. The development of SMA from year to year has been quite a lot, there are around 13,700, approximately 99 percent use the 2013 curriculum but some still use the 2006 KTSP. Accredited high schools are quite a lot, around 44.7 percent but private or private more private sectors, but the students are more public. Learning is a process that takes a long time, because there are many elements involved in it which can be seen from the managerial side of school principals, teachers, students, facilities and infrastructure, environment, curriculum, procurement and so on (Purba, 2014, Simbolon, et al, 2020b). Of the many factors, one very important determining factor is how the capacity of a school leader and the competence of each teacher in understanding and designing a good learning system, strengthening this capacity in facing Industry 4.0 (Butarbutar & Purba, 2016)

Literature Review

Model of the relationship between water use and economic growth in a country is due to water become a primary need that determines the type of economic goods of the community, especially in urban areas. In some countries there has been an increase in private sector involvement provide water service needs. Barro's (1990) and Sala-I-Martin (1992) approach model, namely influence the use of water for economic growth with a growth model is part of the goods available to the public. As well known that public infrastructure is an important part of the availability of water to be distributed to producers, this illustrates where water availability is a good or commodity that cannot be separated and can be produced with the accumulation of public capital, which will be an interesting theoretical part of this paper (Budiono & Purba, 2020). For example, g functions as public infrastructure per person and r as per capita use of clean water, it can be said that $r = r(kg)$, $r' > 0$, $r'' < 0$, and equation 2 in this model, hereinafter below, will modified to ($g = z(\rho)$), where the z function has the same properties defined in equation no 2.

Therefore; a country needs to implement an appropriate measurement framework to assess readiness for coming changes and they also need a platform for modern ICT solutions to facilitate local collaboration with small and medium to large business ecosystems to adopt the evolving expectations set by the key players global industrial production value chain (G. Nick & F. Pongrácz, 2016, Purba, et al, 2019, Purba, 2015).

Figure 2. Interrelated Basic technologies for Industry 4.0

As displayed in Figure 2. Talking about Industry 4.0 is basically related to new industry revolution or new innovation and focuses on the integrated use of state-of-the-art information technology and operational technology such as; IoT, cyber physical systems, big data, and advanced data analytics and decision making methods, artificial intelligence and robotics, cloud and haze calculations, virtual and augmented reality and others (Batchkova, 2017, Tan, et al, 2019, Purba, 2018, 2014).

When viewed from a technical perspective, the context of Industry 4.0 can be the development of digitalization and automation of information and communication technology with the creation of digital value chains' (Oesterreich and Teuteberg, 2016). Thus there is no doubt that the term 'Industry 4.0' is a trend in the development of digital technology that has attracted the interest of practitioners and community academics (Liao et al., 2017; Purba, et al 2019; Fatorachian and Kazemi, 2018). The presence of Industry 4.0 with the support of the Internet of Things (IoT), cloud and cognitive computing, the availability of digital infrastructure and strong cyber physical system applications can collect, transfer, and understand Big Data (Zhou et al., 2015) on intelligent industrial development that is capable of meet fluctuating market demands with high quality accuracy production.

That is why industry 4.0 is widely used in the manufacturing industry such as the car industry and by other kinds of companies. Now industry 4.0 has been in our midst as a series from the previous industrial period, called Industry 1.0, 2.0 and 3.0 (Pereira and Romero, 2017). As a result of the transformation of a series of opportunities according to the demands of the era which was previously defined as a manufacturing model by proving the operational processes and targets that are most suitable and able to face the associated challenges (Almada-Lobo, 2016; Pereira and Romero, 2017).

The core principles of Industry 4.0 lay the foundations for the Industry 4.0 manifesto published in 2013 by the German National Academy of Science and Engineering. According to Kagermann (2011), "Industrie 4.0 is a new level of value chain organization and management throughout the product life cycle." 1) Production needs to adapt to low, medium and high demand by varying product types; 2) Self-tracking and recognition of parts and products through intelligent machines; 3) Better interaction between Human Machine Interface; 4) Optimization of production based on communication tools for the Internet of Things (IoT); 5) Radical changes in business models that contribute to changing the form of interactions with the value chain (Santos, et al. 2017, humas Sekneg 2020).

The Fourth Industrial Revolution represents a momentum for decision-makers from the public and private sectors to be faced with a new set of uncertainties regarding change in many fields. With technology enabling efficient computing with the digital revolution, transforming the physical world through robotics and new production methods; enhances human physically, mentally, and experience; and penetrate the environment to facilitate greater interconnectivity, monitoring, and efficient use of the resources available for use. Advanced technology such as; The Internet of Things, artificial intelligence, wearable, robotics and additive manufacturing - are spurring the development of new production techniques and business models that will fundamentally transform global production (Kearney, 2018) .

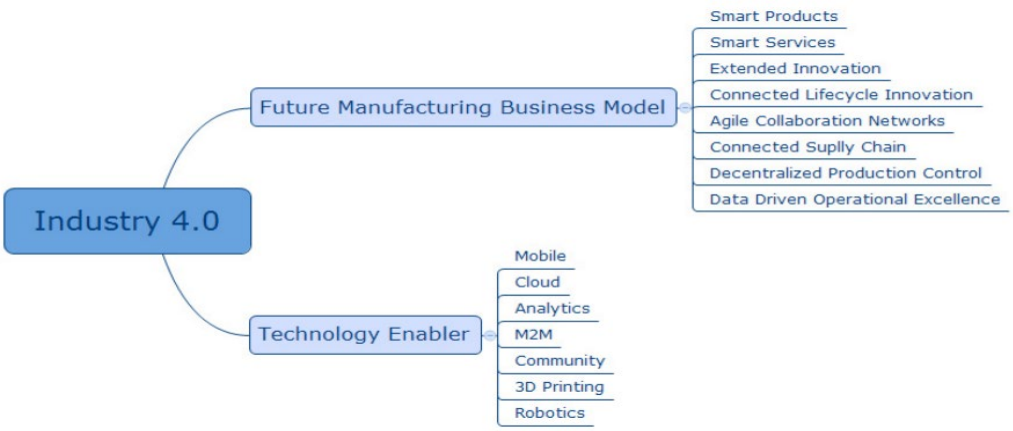

Figure 3 Pilars of Industry 4.0 (Bechtold, 2014)

From the fig.3 above there are pillars of industry 4.0 that required collaboration in such as, first; Future Manufacturing Business model consisting of: smart products, smart services, extended innovation, connected lifecycle innovation, agile collaboration networks, connected supply chain, decentralized production control, and data driven operational excellence. All of these components are well integrated with each other so that production and service will provide good and optimal results.

In the second component are the Technology Enabler which consists of; mobile, cloud, analytics, M2M, Community, 3D Printing, and Robotics. Integrated prototyping like this would accelerate and the production process was highly decentralized: product models with technological innovation have substantially increased the integration of robotics engineering over the past few decades, making robots workable in almost every sector. In Industry 4.0, they will determine process efficiency and reduce complexity.

In the end, it all comes down to people and values. The citizens need to shape a future that works for all of us by putting people first and empowering them. In its most pessimistic, dehumanized form, the Fourth Industrial Revolution may indeed have the potential to "robotize" humanity and thus to deprive us of our heart and soul. But as a complement to the best parts of human nature—creativity, empathy, stewardship—it can also lift humanity into a new collective and moral consciousness based on a shared sense of destiny. It is incumbent on us all to make sure the latter prevails.

Methodological Approach

This study uses aggregate data covering cross-sections in 501 districts / cities in 2016 throughout the Republic of Indonesia (Purba & Budiono 2019). Because aggregate panel data in a study is expected to provide more complete information and be able to show a more realistic relationship because the number of observations is quite adequate and large (Nijkamp and Poot, 2003). The purpose of this study was to determine the extent to which GRDP is influenced by the presence of clean water, and high school teachers so that the dependent variable is GDRP without oil. Furthermore, the existence of clean water teachers and senior high schools is described in 2 independent variables of household access capabilities, namely household access to clean water (HH_W), and high school teachers (HST). The basic framework for analysing data is the regression model of the formula (Greene, 2018):

$$\mathbf{GDP\_wttO = \alpha_0 + \alpha_1\ HHH\_W + \alpha_2 HST + \varepsilon_i}$$

The use of GDRP excluding oil is intended to show that the economic activities of individuals in all regions of Indonesia are more reflected in GDRP excluding oil compared to petroleum mines. The following (table 1) is an explanation of the variables used in the analysis of this study.

Table. 1. Variable, Indicator, Description, and Label

Variable	Indicator	Description	Label
GDRP	GDRP without Oil	GDRP without oil in each district and city.	GDRP_wttO
Waters	Household Water Access	Clean water that can be used by the public/ households for drinking water, bathing, and cleaning in each district and city	HH_W
High School Teachers	High School Teachers	The amount of high school Teachers in each district and city	HST

The partial and joint analysis of this model is as follows:

The effect hypothesis of household water access on GDRP without oil is explained as follows:
H0 : household water access does not affect GDRP without Oil
H1 : household water access affects GDRP without Oil

The effect hypothesis of high school teachers on GDRP without oil is explained as follows:
H0 : high school teachers does not affect GDRP without Oil

H1 : high school teachers affects GDRP without Oil

Data analysis was performed by following the Robust Ordinary Least Square econometric model framework. The data collected for this study were processed by the STATA Application Release 15 version.

Conducting Research

Application of Regression with Robust Ordinary Least Square (OLS) estimation is as in table 2,

Table 2. Results of Robust Regression Analysis

Ordinary Least Squared Model				
Linear Regression		Number of observation = 501 F (2,498) = 32.27 Prob. > F = 0.0000 R-squared = 0.7581 Root MSE = 1400000.0		
GDRP_wttO	Coefficient	Robust Standard Error	t-test	Probability > |t|
HH_W	77136.21	35316.7	2.12	0.029
HST	5762.32	718.4	8.02	0.000
Constant	-5183323	1899395	-2.73	0.000

From the results equation it is clear that the existence of clean water and high school teachers is important for GDRP. In summary, the results of the regression analysis are as follows:

$$\mathbf{GDP\_wttO = -5183323 + 77136.2\ HHH\_W + 5762.3\ HST}$$

Results of the analysis of the F test of 32.27 and probability > F of 0.0000 show that all independent variables of household water access, and high school teachers collectively significantly influence the independent variables of economic growth.

Industry 4.0 applies to a series of five action areas (purchasing, production, intralogistics, sales and people). This paper provides insight into the nation's national readiness in facing the Industrial era 4.0 with the presence of water and the presence of high school teachers towards GDRP without Oil. The first results show that the econometric model can be used for the future benefit of the nation.

Conclusion

Indonesia's readiness to face the industrial era 4.0 continues to improve clean water infrastructure in provinces and districts and cities in Indonesia. It has been proven that the existence of clean water and teachers in senior high schools is an economic driver. With a population of more than 260 million in Indonesia, it is a domestic market for clean water with a very large area. Because human resources are a strength as well as a challenge for the progress and development of the Indonesian economy. That is why the existence and readiness of school teachers, including high schools in Indonesia, must be the main concern of the central and local governments. In developing the right skill set in his current workforce as production shifts from a labor-intensive to a knowledge-intensive environment. Thus adopting industrial technology 4.0 that has been in front of us today is a must.

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