Social development & water management system in Indonesia`s rural area

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ABSTRACT

Water is the most essential element in life, it is vital for our survival and it has a crucial role in our ecosystem. Water has many functions, such as firstly for human health, water makes up 2/3 of our body and we cannot survive without water. Secondly for plant health, water is necessary for the transfer nutrients facilitate the growth of plants. Thirdly for animal health, just like for human, water is necessary to maintain the life cycle and survival of the animals. Furthermore is for the earth, water keeps the earth temperature stable, finally water is also used in many sectors to support human life, such as in transportation, agriculture, industries, technologies, etc

With the increasing population of the world, innovations are required to maximize the existing water resources; because as the demand for food continues to increase, the source of water remains the same.

Adequate funding from Indonesian Government is required to improve access to fresh water and also for the sewage treatment to enable the recycling of water and hence an efficient usage of water. An efficient usage of water is very important and it must be socialized and made aware to the public. The role of the government is to monitor and develop a sustainable usage of water, especially for irrigation in Indonesia rural`s area. In small islands, suitable water infrastructures must be developed to give a positive impact to the people`s life.

Keywords: Irrigation in Indonesia`s Rural Area

Water is very important in many fields, such as for living, every cell of living creatures needs water for growth and survives, for energy by utilizing water turbine movement which convert energy kinetic into mechanical energy which can move the electric generator and it supplies 19% of the world’s electricity (“Tenaga Air,” 2016), as for agriculture area, water has been used for irrigation, fertigation system, and so on.

The functions of water in agriculture are considered to be very vital. Water, soil, sunlight, and climate are the basic resources that support agricultural activities. The function of water in agriculture in general is as irrigation, and the absence of good irrigation, will result in crops managed by farmers not getting maximum results.
Indonesia is located at the equator, the rainfall in Indonesia is high, and it has 2 seasons which are dry and rainy seasons. Indonesia is an agriculture and an archipelagic country. Many islands spread from west to east, many plateaus, volcanoes and majority of the population which are 32% worked in the agriculture area. (Indonesian Statistical Centre, 2017)

As an archipelagic country, Indonesia has approximately 16,056 islands (Jefriando, 2017) and out of these only 300 islands are inhabited. Some main islands with a large population, have complete access to the electricity, water and other infrastructures and in contrast to the numerous small islands, which has limited access to all of the above in Indonesia.

For small islands fisheries are an important factor and the majority of the population of the islands are fisherman. Public needs of water and electricity mostly using the utilization of natural resources of the island, such as sunlight, sea water, etc. Utilizing seawater with desalination process producing fresh water for daily use, in this case government may use ASR technology (Brown 2014), as mention above and combine it with reserve osmosis freshwater recovery can be boosted up to 100% of the injected freshwater as shown below:

![Cross section of the ASR system that is combined with RO treatment of brackish mixing water from the base of the target aquifer](image)

**Figure 1:** Cross section of the ASR system that is combined with RO treatment of brackish mixing water from the base of the target aquifer

Although there are a lot of sea water in Indonesia, to make the process of desalination of sea water into fresh water is not recommended because it is expensive and requires difficult treatment processes. People on the islands need clean water for daily uses such as cooking, irrigation, medical activities, and so on. Therefore, some of the population uses rainfall water reservoir, and generator for electricity.

Because of the potential for large fish producer in Indonesia, it would require government’s efforts to develop and provide continuous improvement to maximize the product processing and help the fisherman to get big catch. Investment is needed in technology, equipments and financial sector for the islands to create a good micro-economy in the surrounding. Government has business plan which is evaluated every 5 years to manage and improve periodically on the product processing and human resources, sending technician, mentor, to teach and give them product & technology knowledge’s so they can be independent and able to develop their products, technology and in returns improve their income.
There are 2 kinds of water resources used in Indonesia which are natural water resources and man-made water resources. The example of natural water resources are waterfalls, spring water, rivers, lakes, and sea water; on the other hands man-made water resources are artificial lake, water filtration wall, dam, deep well aquifer, etc.

As most of the highlands main problem is water scarcity in these areas, hence the reliance on the rainfall becoming even more prominent. People use water reservoir or artificial lake, deep well water for daily and irrigation used, and government also built dam or a barrier constructed to hold back water and raise its level, the resulting reservoir being used in the generation of electricity or as a water supply.

From figure 2 below, there are 3 levels of area based on the quantity of rainfall in Indonesia. Yellow area is highest rainfall level with more than 4000 mm/year, red area is moderate level of rainfall with 1000-4000 mm/year, and green area is the lowest rainfall level with less than 1000 mm/year. Therefore, the average rainfall in Indonesia is roughly 2000-3000 mm per year, so it is still possible to depend on the rainfall for irrigation used. (Indonesian Ministry of Education).

Figure 2: Map of Indonesia Rainfall Area

In order to store water from the rainfall, Indonesian Government built rain water reservoir as shown in Figure 3. Initially the rain water flows into the lake, however before reaching the lake, these water is filtered and stored so it can be used anytime.
The advantages of water reservoir are to store water during the rainy season, thus reducing surface runoff, erosion and downstream flooding hazards. This stored water can then be utilized during the dry season, supporting the irrigation and development of farming in dry land; especially for food crops, fisheries and livestock, leisure, sport and activities area; and to prevent soil that minimize the possibility of landslide.

Figure 4 above shows that there is water filtration wall that keep rain water inside wall plateau at the sides of some highways at Indonesia, and it also has an advantage to prevent landslide. From figure 5, rainfall flow down the hill, some water will be absorbed by the soil and keep as aquifer, and some will flow into the water storage. According to Catra Resapan (2013), the more water flows into the soil and the storage means more water will be stored inside, and can be explored anytime needed.
The other way is by using mount spring water or river, rainwater trapped by humus that is found in the forest soil surface, and then absorbed by the pores of the soil. Water absorbed into the groundwater reserves will be streamed a little through the spring and flow as a river. Thus the river and other water sources will flow throughout the years and not dry even in the dry season. Some used for irrigation and distributes through water pipes but it is rarely found since not every highlands has mount spring water or river.

In addition, some farmers’ still utilizing aquifer using deep well sub merged pump for irrigation used. Water from the deep well is better than rainfall since it is contains of many minerals and already filtered through the layer of soil and stones. During the rainy season aquifer will be filled, and it can be used during dry season.
According to DESSIN (2015), in the future, water management through aquifer storage and recovery system (ASR) is promising; this can be done by ASR, in which excess water is injected into sand aquifers and stored there until it is needed in a time of drought as shown on the pictures below.

Figure 7: Aquifer storage and recovery graphic courtesy (BRD)

Water and agriculture is an inseparable aspects for a country to establish food security and maintain food stability. According to Chandra (2017) and Simorangkir (2017), food security is one of the national priority programs of the Indonesia President Joko Widodo. Government has a target to build 65 dams from 2015 to 2019. The 49 of them are new dams, and the rest is a follow-up project from the previous government. Out of the 65 dams, at least 29 dams are expected to be completed by 2019. To achieve food security, the government is building a new irrigation area of 1 million hectares and conducting irrigation rehabilitation of 3 million hectares.

Our companies PT Selektani Induk Usaha dan PT Bibit Baru are located at the highlands of Sumatera and Java island, and our farms located at Brastagi (North Sumatera), Ngablak, Kledung (Central Java) and Batu (East Java). The different locations allow us to choose the most suitable climatic conditions for the flowers and vegetables seeds production of any specific varieties for our customers. We have more than 30 years of experience producing quality seeds for foreign market. We started in flower seeds production and a few years ago we are expanding into vegetable seeds production as well.

"We serve the Grower" is our company's mission and it involves our company's agribusiness system which is divided into three sub-systems: Research, Production and Marketing. This motto is our focus as we act as partners to local Indonesian farmers by providing good quality seed products and agriculture support equipment for the modernization of agriculture in Indonesia. Our Vision is "The goal for our future is to utilize the best production technology and distribution systems for the modernization of agriculture and horticulture. Through our dedication, time and energy, we believe this vision will lead us to become one of the most prominent companies to provide competitive products. PT Selektani Induk Usaha and PT Bibit Baru also distribute seeds and young plants with high quality, virus free, and resistant to disease to the farmers with low cost. Our companies do this as our services to the surrounding communities to help farmers to facilitate their needs for a high quality and virus free plants, and to transfer knowledge on how to get maximum harvest. (Basuki. H, personal communication, May 23, 2017)
Good water management system is important for our company, since our business area is in agribusiness. Therefore it is necessary to balance the use of water resources at our farm, to utilize it efficiently, as well as to collect and store the water during rainy seasons.

Above mention pictures are rain water reservoir and deep well merged used at our farm Ngablak, Central Java. We build our water reservoir below the greenhouses side by side with the deep well water aquifer for daily irrigation. At our farm Ngablak (Central Java), we are using rain water during rainy season and supported by ground water during dry season. We have our own rain water reservoir located under our greenhouses and 2 deep wells ground water build 60-150m inside our farm and operated with pump for daily irrigation.
At our farms, we have a production units or greenhouses, which are made of bamboo, wood and steel frame and we also use drip irrigation at our steel frame greenhouses as shown on the pictures below.

Drip irrigation is a form of irrigation that saves water and fertilizer by allowing water to drip slowly to the roots of many different plants, either onto the soil surface or directly onto the root zone, through a network of valves, pipes, tubing, and emitters. (‘‘Drip Irrigation,’’ 2017). Drip systems are generally more efficient than conventional sprinklers, because they deliver low volumes of water directly to plants' roots, minimizing losses to wind, runoff, evaporation, or overspray Drip irrigations systems use 20 to 50 percent less water than conventional. (Apriani, 2017)

Moreover Apriani also mentioned the advantages of drip irrigation, which are very high efficiency (low evaporation, no movement of water in the air, no leaf discussions, low flow, irrigated watering around the main plant); better crop response resulting in production, quality, product uniformity; not disturbing the soil aeration, can be combined with nutrient elements; reduce the development of insects, diseases and fungi; land is not disturbed due to soil processing, spray, etc and increase surface irrigation.

Our steel frame greenhouses use drip irrigation system for production daily activities such as fertilizer application (fertigation) and watering plants as shown on the following picture:
CONCLUSION

As a conclusion, water is very crucial for human’s life, and we need to be wise in the use of water for our daily activities and for the future. Demand for fresh water continues to rise accordingly as an impact of the increasing number of the population, agriculture, technology, and industrial growth. As an archipelago country, Indonesia is located at equator, many islands spread between the country. The declining accessibility of fresh water and the shrinking of water resources in many areas around Indonesia is a call for the government to look for new approaches to water resources management. Indonesian Government and the communities around the area needs to develop water management system that suit to use on the area either using dam, artificial lake, rain water reservoir, deep well, etc which suit to the certain area of living. Water resource management must be comprehensive, so that the interests of water users are balanced on the area. Especially in the rural area, Government should help people in the community to be more independent by improving their knowledge of product processing, water technology and controlling system, as a result it will increase the community product and income.

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