

# Reading Jose Rizal's Waterworks in Dapitan as Alternative Technology to Water Crisis Mitigation

Rodel B. Ponferrada

College of Arts and Sciences, Department of Natural Sciences, Eastern Visayas State University, Tacloban City, Philippines  
Email address: rodel.ponferrada@evsu.edu.ph

**Abstract**—Water crisis is a growing problem that confronts the modern society. As water is an indispensable need of man, something must be done to mitigate if not eradicate this impasse. The foremost Filipino hero, Jose Rizal lived a productive life as an expatriate in Dapitan, Zamboanga del Norte by building worthwhile innovations to satisfy this vital need. This paper looked into the innovative project designed and built by Rizal while serving his deportation in Dapitan. Using historical records and images, the waterworks of Rizal in Dapitan was reviewed in order to appraise its potential as an alternative solution in mitigating water crisis and other environmental issues. To have a better understanding of Rizal's technology, this paper identified its distinctive attributes and benefits to the town folks and the natural environment. In conclusion, Jose Rizal's waterworks in Dapitan was built to respond to both communal and personal necessities. It had significantly contributed to the betterment of the health and economic conditions of the people in the community. Moreover, the said handiwork is deemed an environmentally sustainable technology because of the following reasons: 1) It was made from indigenous and organic materials such as, bamboo, clay and bricks, 2) It was built without the use of explosives and other environmentally damaging equipment, and, 3) It provided clean, fresh and free water supply to the people of Dapitan. Considering these conditions, Rizal's waterworks is an ecologically workable alternative technology that can be employed in mitigating the current water crisis. Therefore, in our quest for sustainable development, the restoration and possible duplication of this historic water system is favorably recommended.

**Keywords**— Dapitan Waterworks, Alternative Technology, Water Crisis Mitigation, Sustainable Innovation, Indigenous Materials.

## I. INTRODUCTION

The need for water is imperative. According to the Rule of Three, without water man can only subsist for 3 days. A sufficient quantity of water is needed by the human body to sustain its normal functioning. Accordingly, water is life. However, the necessity for water is not only for survival. It is also crucial for economic and social progress. It plays a substantial role in almost every aspect of civilization. Water is needed not only for our daily household chores but also for industrial and agricultural activities. It is essential to sustain humankind and its development.

This is not a strange reality. In fact, the foremost Filipino hero, Jose Rizal, felt the necessity of this natural resource while he was serving his banishment in Dapitan, Zamboanga del Norte. Don Ricardo Carnicero, the political-military governor of Dapitan and captain of the infantry, oversaw Rizal's stay there for four years (Zulueta, 2004). Although Rizal was sent away from his family and friends, his life as an exile was not altogether miserable. The truth is, while in Dapitan he was able

to perform so many productive things that demonstrated not only his intellectual brilliance but his passion to help his fellow men and concern for the environment. Notwithstanding his isolation in Dapitan, Rizal lived a fruitful life through his groundbreaking inventions.

The former DOST Secretary, Fortunato "Boy" T. de la Peña attested to Rizal's inventiveness by saying: "*Having much free time during his exile in Dapitan from 1892 to 1896, Dr. Jose P. Rizal pursued a more scholastic endeavor and distanced himself from his revolutionary reputation. He concentrated on and observed his surroundings, which inspired him to develop novel solutions. He also carried out research in the fields of livelihood, public works, and public health, among others, which was beneficial to a large number of Dapitan residents (Lazcano, 2022).*" As a man of erudition and passion to serve his countrymen, Rizal did not waste time to create innovative technology. Interestingly, Rizal's determination to craft an innovation was motivated by his concern for the people and the environment.

One of the distinguished works of Rizal is the water system project that he designed and constructed in Dapitan. It is interesting to note that during those days when modernity was still embryonic to the Filipino thinking, Rizal was able to build a structure that is tantamount to or can even surpass modern technology. It is better off in terms of its ecological sustainability. Rizal's technology was purely organic in its design and substance. Consequently, Rizal's innovative handiworks gained him praise and recognition. Rizal's engineering work was applauded by an American engineer, Lt. Col. H.F. Cameron. Cameron summarized Rizal's contributions as follows: "Dr. Rizal designed and built Dapitan, Mindanao's water supply during his exile in that municipality by the Spanish authorities. It is another well-known and renowned water source (Zaide and Zaide, 2014)". Rizal's innovative creations cannot be discounted. They did not only draw admiration. They also brought about fascination to those who had witnessed and studied the said constructions. Considering the limited resources and the intricate requirements of the project, one cannot help but wonder how Rizal was able to realize such an exigent undertaking. It is truly astounding to build a project that provides for the basic needs of the people while preserving the natural environment.

Today, the world is facing various water-related challenges. The following are alarming reports associated with water crisis (un.org/en/global-issues/water): i) 2.2 billion people lack access to safely managed drinking water services (WHO/UNICEF, 2019); ii) Almost 2 billion people depend on

health care facilities without basic water services (WHO/UNICEF 2020); iii) Over half of the global population or 4.2 billion people lack safely managed sanitation services (WHO/UNICEF, 2019); iv) 297,000 children under five die every year from diarrheal diseases due to poor sanitation, poor hygiene, or unsafe drinking water (WHO/UNICEF, 2019); v) 2 billion people live in countries experiencing high water stress (UN, 2019); vi) 90 percent of natural disasters are weather-related, including floods and droughts (UNISDR, 2015); vii) 80 percent of wastewater flows back into the ecosystem without being treated or reused (UNESCO, 2017); viii) Around two-thirds of the world's transboundary rivers do not have a cooperative management framework (SIWI); ix) Agriculture accounts for 70 per cent of global water withdrawal (FAO). Water crisis is an emergent global concern. Its menace has shaken not only the poor countries but even the most sophisticated nations in the world.

One of the Sustainable Development Goals (SDGs) of the United Nations is to "Ensure availability and sustainable management of water and sanitation for all" (globalgoals.org). Realizing this goal will bring about significant benefit on the other SDGs particularly on economics, education, environment and health. Therefore, the current crisis in water must not be ignored. With the flourishing technological advancements, numerous innovative options and solutions can be presented. However, the pursuit to resolve water problems should not just be focused on ensuring availability. A technology that is cost-efficient and ecologically sustainable must precede any other considerations. Jose Rizal had made significant contributions to the people of Dapitan. His scheme may be antiquated but its practicability cannot be bargained. Its adverse impact to the environment is minimal if not none at all.

As a country abundant with fluvial resources, water may not be much of a problem in the Philippines. Nevertheless, the water crisis presents a threat to the people. The problem is not because of insufficient resources. It results from irresponsible use and management of these resources. "Water continues to be wasted, not only in the developed world but also in developing countries which possess it in abundance," as stated by Pope Francis in an encyclical letter published in 2015. We need technology to make life better. Unfortunately, the comfort we receive from modern technology is paid dearly by the environment. Nature is exploited in the guise of promoting human advancement. In reality these new schemes are created not to satisfy basic needs but primarily to gratify economic desires. Shortsighted attitudes to the economy, business, and production are also causing the plundering of Earth's resources (Encyclical Letter, 2015). The real challenge is playing a fair game. The natural environment provides humanity what it needs. However, taking advantage of nature without boundaries will result in human and environmental obliteration. The ecological plunder must end immediately to sustain humanity and the natural world. It calls for a new system of rationality and doing things. In fact, it is not totally new. It is but a renewal of the old system. The past can offer us alternative techniques that could somehow respond to our needs. When we say needs, we have to understand it in the context of the necessities to sustain life, not the desire for economic profit. In this

contention, it is worth recalling Jose Rizal's technology. The Dapitan waterworks was an innovation that satisfied the basic need of the Dapitanons. As George Aseneiro puts it in an interview, "It's tremendous work, it was great engineering, and it responds to a society's basic need, which is water... (Laput, 2016)". George Aseneiro is a grandson of one of the students of Rizal in Dapitan. Simple as it was, the project was an ideal invention. What makes it remarkable is the fact that it served humanity without creating environmental distress.

## II. MATERIALS AND METHODS

Prompted by Rizal's ingenuity, this paper attempted to appraise the hero's water system project in Dapitan in order to provide an inspiration to contemporary innovators in their pursuit to craft technology that could efficiently respond to the water needs of the people. That is, a technology that is both economical and environmentally workable. The Dapitan system is significantly attributed to Rizal. Discerning the hero's contribution and role in the realization of the project could provide us better understanding and appreciation of this creative work. As we venture into finding a constructive solution to the global water crisis, it is relevant to consider the work of Jose Rizal. Additionally, inspiring as it is, one must find it interesting to determine Rizal's motivation to construct the said water system and identify the project's distinctive attributes in terms of design, materials used and constructive benefits. These things could provide us, if not a complete answer to the problem, at least a framework for an alternative solution.

In order to draw out information to satisfy the purpose of this inquiry, content analysis was done. Along this, a thorough review of historical records and images was conducted. The historical texts analyzed were derived from the Jesuit Missionary Letters from Mindanao and Rizal's correspondence to his family and friends particularly from the year 1892 to 1896. The consideration of this time frame is based on the fact that the planning and construction of the Dapitan waterworks took place during this period. Moreover, images of the remnants of the Dapitan water system were looked into to get a visual account that would supplement the textual narratives. These images were obtained from the National Historical Commission of the Philippines and Dapitan Historical Society.

## III. RESULTS

Based on the historical texts and images reviewed, the following realizations were uncovered. Results of the analysis are presented in the succeeding discussions.

### Motivation

A plan for a water facility in Dapitan was framed by the Jesuits in the mid-1892. In the letter of Fr. Obach, the parish priest of Dapitan, expressed the reason and urgency of constructing a water facility. The letter says, "Father Pablo Pastells, Mission Superior, accompanied by Fr. [Joaquin] Sancho, visiting Dapitan in June 1892, observed that these people (Dapitanons) were drinking no other water than that of wells. No doubt, this contributed to the precarious health and yellowish complexion noticeable among the inhabitants. This

gave birth to the plan for a water system (Arcilla, 2000).” As pointed out in the said correspondence, the plan to build the water system was to resolve health issues. Since the drinking water consumed by the people was sourced from wells, there was an indication that jaundice was prevalent among the residents of Dapitan. Although there was no mention of a medical examination conducted to confirm such conjecture, the possibility can be linked to the yellowish complexion of the inhabitants as mentioned in Fr. Obach’s letter.

**Design**

As an expert surveyor, Rizal played an extensive role in the construction of the Dapitan water system. Being conferred with the title “Perito Agrimensor” or Master Surveyor by Ateneo Municipal de Manila, Rizal possessed remarkable surveying skills which he demonstrated in his “Linao” waterworks plan. Owing to its accuracy, Rizal’s layout was used in the construction of the water system project. Acknowledging Rizal’s outstanding design, Fr. Obach stated these words in his letter: “Bro. Costa is bringing the scheme made by Don Jose Rizal for the [Linao] water system.” It is precisely drawn, as demonstrated by the engineer (Arcilla, 2000)” The scheme was thoroughly drawn by Rizal employing his knowledge in science particularly on the law of gravity.

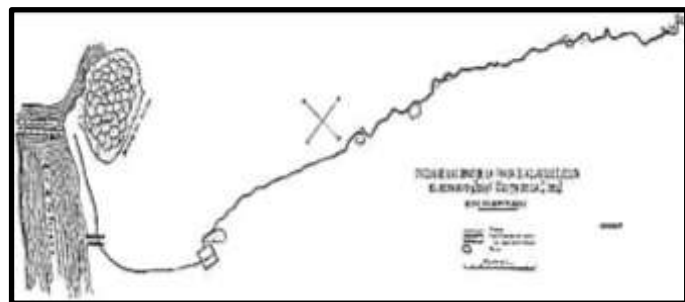


Figure 1. Sketch plan of Linao waterworks made by Jose Rizal (Image from: Craig, Austin. 1913. *Lineage, Life and Labors of Jose Rizal*)

**Materials**

In his letter, Fr. Obach gave further details about the inception of the waterworks: “Brother Costa finally arrived on April 25, 1893 and he immediately set about building a big shed. A kiln was erected for baking bricks, gutters, pipes, and everything needed for the project (Arcilla, 2000).”

The materials used in the construction of the “Linao” waterworks consisted of organic resources such as rocks, limestone, and clay. Round rocks were abundant in Dapitan rivers. They were used to flatten the footing of the earthen pipes. Red clay soil used in making tubing, channels and blocks was obtained from a river in Barangay Maria Cristina. The shoreline of Dapitan offered a rich supply of limestone used as adhesive. It was easy for Brother Costa to gather the raw materials that he needed for the project as the town of Dapitan was rich in natural resources (Barreto, 2022). Additionally, the labor force was provided by the town folks for free. Fr. Obach confirmed this by saying: “For their (Dapitanons) part, the people drew up an act promising volunteer work one day a month (Arcilla, 2000).” The town folks’ cooperative effort was an important part of the Dapitan waterworks.

**Benefits**

Rizal’s technology brought about significant returns. In the letter of Fr. Obach, he spelled out how the project could provide substantial gains to the people of Dapitan: “At the moment, the dam is now ready, and about 200 meters of the aqueduct... The benefits of irrigating the vast plains that will be farmed would be immeasurable for the people, whether it is for the planting of wet rice or for the coconuts and other plants on the mangroves that vanish with the high tide (Arcilla, 2000)”



Figure 2. A simplified perspective of the Dapitan water system (Original image from: [www.google.com/maps/](http://www.google.com/maps/))

Rizal’s creative work was not only limited to providing the layout of the project. He also devised a machine for making bricks. The machine aided in expediting the production of bricks needed for his waterworks. In his letter to Blumentritt, Rizal talked about his new invention by saying: “I have made a wooden machine for making bricks, and I believe it could make more or less 6,000 bricks a day... (dimasalanglaonglaan.wordpress.com).” The brick-making machine made by Rizal was an upgraded version. Considering that it was only made of wood yet it yielded 6,000 bricks in a day. It was more efficient and economical. The old model could only produce 2,000 bricks per day. Additionally, Rizal built the watercourse outlet called *Fuente de Nuestra Señora del Carmen* (Fountain of the Lady of Mt. Carmel) which looked like a lion’s head. Rizal may have been inspired by the sculptural design he saw in Heidelberg, Germany. The fountain which was situated near the shore of the Liboran River served as the main faucet of the Linao water system. However, it is sad to note that this structure has been destroyed as a result of the Bagting Bridge construction. The bridge connects the city proper of Dapitan and Barangay Talisay where Rizal constructed the waterworks.

**IV. DISCUSSION**

Based on the review of historical texts, it has been established that the primary impetus in constructing the Dapitan water system was for health purposes. A supposition that jaundice was rampant among the town folks can be drawn from Fr. Obach’s correspondence. This condition prompted the authorities to look for a clean water supply. Realizing this need, the Jesuits explored the place for a possible source. The search led them to an uncontaminated stream called “Linao”. The

stream was a suitable source for clean and potable water. According to Father Obach's description: "We priests all went to inspect the waters of a location called Linao, which is a little over two kilometers from the town." *The waters are very good and well-purified since they come from far, flowing down among steep rocks like waterfalls* (Arcilla, 2000)." The letter explicitly mentioned the place of the possible water source. It is interesting to note that the name *Linao* corresponds to the quality of the water found in the place. The word *Linao* in the dialect means clear or unblemished. Owing to the water source, the Dapitan water system was also called Linao waterworks.

Additionally, the letter suggests that the search for a clean water supply was a critical task. The involvement of all the priests in the inspection of the waters signifies the importance of finding the best water quality. Based on Fr. Obach's statement, one can presume that the water derived from nearby wells was not as clean or purified as the water from Linao. Although, it was not explicitly cited in the letter that a test was conducted to confirm the suitability of the water from Linao, we can assume that the judgment of the priests was reliable since the Jesuits were known for their systematic and scientific approach in doing things.

Moreover, one can infer from Fr. Obach's correspondence shows that *Linao* is located in an upper ground distant from the households. We could find support to this assumption in the depiction made by Rizal about Dapitan. He described the town in these words: "*It is located on a beautiful bay which looks towards the West... for being the most beautiful thing that it could find in its tortuous and undulating pilgrimage through mountains and valleys, through woodlands and plains* (dapitancity.gov.ph)."

As soon as the Jesuits discovered Linao, a proposal to construct a water system was submitted to the government. Its approval came without delay. In the communication of Fr. Obach narrating about the approved proposal, he stated that: "*[The] approval came on July 21, and we celebrated the news very joyfully to everyone's satisfaction. The night, the music went with the leading figures around the streets* (Arcilla, 2000)." Fr. Obach's narration provides us indications that the project was a priority. In less than a month, the proposal was already approved. The extensive festivity of the people stated in the correspondence could be read as a sign of the substantial significance of the proposed project. Indeed, the Dapitanons had good reason to rejoice. The construction of the water system could not only resolve health problems. In fact, it elevated the stature of Dapitan and its town folks. According to Barreto (2022), *it shared with the Carriedo Waterworks in Manila and the Balingasag Waterworks in Misamis, the distinction of being one of the known places with a waterworks system equipped with aqueducts or pipes*. However, one intriguing supposition that can be drawn from Fr. Obach's correspondence is that the Dapitan waterworks was not an original idea of Rizal. In the same letter, the parish priest mentioned the people who were behind the crafting of the proposal. He also described how the town folks were grateful to the persons who had a substantial role in the approval of the awaited water system project. These were the words of Fr. Obach: "*They were carrying three huge lanterns with these*

*inscriptions: (1) Water System Initiated By Fr. Joaquin Sancho, S.J. (2) Water System Approved By His Excellency, The Governor-General Of The Philippine Islands, Don Eulogio Despujol (3) Water System Started By Don Ricardo Carnicero, Politico-Military Commandant Of This District Of Dapitan* (Arcilla, 2000)."

Based on the above communication, Rizal was out of the picture in the initial plan to construct the water system. There is no hint in the letter of Fr. Obach that Rizal became part of the water system project of Dapitan. How come that the said waterworks is significantly attributed to the foremost Filipino hero?

Of course, the answer to this question is not difficult to find. There is no way that Rizal could partake in the initial planning for the water system project. This is because the proposal was formed before the hero had set foot in Dapitan. According to Fr. Obach, the Jesuits made the proposal in June of 1892 following Fr. Pastell's recommendation to build a structure that will provide hygienic water supply for the town folks. The arrival of Rizal in Dapitan was on the 17<sup>th</sup> of July. That is, a month later than the drafting of the plan. However, Rizal's contribution in the realization of the said project cannot be discounted.

As cited earlier, the proposal was approved on July 21, 1892. However, the construction started only on April 25 1893. The delay in its construction provided Rizal the opportunity to create the design of the water system project. Due to Bro. Costa's late arrival, there was a pause of almost a year before the implementation of the project. Bro. Juan Costa is a known potter who was responsible for the construction of the Balingasag waterworks in Misamis Oriental. By the time the project began its construction, Rizal had already made his waterworks plan. Applying the principle of gravity, the design allowed the water from Linao streams to flow to an outlet located in the Liboran riverbank. Costa supervised the construction of the water system employing Rizal's design as his blueprint.

#### *Talisay Waterworks*

Interestingly, Rizal also constructed a private dam and aqueduct apart from his plan for a public water system. What inspired him to build his own waterworks? Rizal's correspondence provides us the answer. In September 1892, Rizal won from a lottery draw in the *Empresa de Reales Loteria Espanolas de Filipinas*. He was one of the three lucky bettors. The other two winners were the politico-commander of Dapitan, Don Ricardo Carnicero and a Spanish resident of Dipolog, Francisco Equilior. Rizal received the amount of P6,200 for his share. Part of his winnings amounting P4,000 was used to purchase a 16-hectare agricultural land owned by Juana Tabugok. In a letter to his sister Trinidad, Rizal spoke about his property: "*My land is half an hour's walk from the sea. The whole place is poetic and very picturesque... without comparison. At some points, it is wide like Pasig River and clear like Pansol (in Laguna) and has some crocodiles in some parts. There are dalag (fish) and pako (edible fern). If you and our parents come, I am going to build a large house where we can all live together* (Laput, 2023)."

The letter suggests that Rizal was engaged in agronomic enterprise. That would mean he needed water for his farm. This could have prompted Rizal to look for a source that will supply the water needs for his plants and animals. He had grown different fruit trees and raised several livestock. In his letter to Trinidad, Rizal cited the animals and plants he had in his farm: *"In a few months I shall have lanzones, langka, santol on abundance, etc. I have planted some 1,400 coffee seeds, 200 cacao; I have pabo. The boundaries of my land be gone over in four hours... For a beginning I now have one pig that the commandant gave me; I had one hen and eight ducklings, but it was lost and these died... I have 16 coconut trees for making oil and from which we get tender coconut meat (Ocampo, 2012)."*

Given the assortment and volume of his livestock and vegetation, Rizal would have needed sufficient water supply. This could have prompted the hero to build his private water dam. Writing to Ferdinand Blumentritt, Rizal mentioned his structuring of a water reservoir. The letter reads: *"I have undertaken some works on my land. I am constructing a dike in order to have a water depository for the dry season. The water is now more than three meters deep; the wall has a base two meters wide... It is all made of live rock, sand, lime, and cement and constructed by boys of thirteen to fourteen under the direction of one of twenty. They did it as play (Arcilla, 2000)."*

The letter illustrates Rizal's pro-active outlook for he was building his dam for future eventuality. However, as the letter suggests, one might be tempted to accuse Rizal of practicing child-labor. Considering the age of the boys who helped him in the construction work, Rizal could be guilty of committing an offense. Nevertheless, I believe Rizal cannot be charged for a violation. Since a law penalizing child-labor was not extant during that time, Rizal could not be liable for that crime. Besides, the kids seemed to be enjoying their errand. They did not consider their task as work but rather a recreation.

Anyhow, Rizal had a sound reason to encourage the children to work. He candidly explained to Blumentritt why his pupils have to help him in his undertaking. According to Rizal, he had 16 pupils in his school and that these pupils did not pay any tuition (Zaide and Zaide, 2014). Rizal believed in the importance of education for the young Filipinos. He deemed the youth as the liberators of the motherland and as such they have to develop their potentials through good education. Rizal encouraged the children to attend his school and the service he rendered was free of charge. How did the pupils recompense their teacher's labor? Instead of charging them tuition fees, he made them work in his garden, fields, and construction projects in the community (Zaide and Zaide, 2014). As part of the training of the pupils, Rizal exposed them to actual work. Rizal's instruction was designed not only for intellectual development. It was also aimed to foster discipline and hard work among the children. As you might say, Rizal advocated holistic growth and employed a pragmatic approach in teaching.

Rizal's dam and aqueduct also called as *Talisay* water system is distinct from the Dapitan water system or *Linao* waterworks. The former was constructed in Rizal's property for personal use while the latter was intended for public utility. The *Talisay* waterworks sourced its supply from a stream located

within Rizal's estate. It was built through the combination of Rizal's expertise, determination and resourcefulness. It was made from the surplus materials used in the construction of the *Linao* water system. To collect the water from the dam, Rizal used bamboo tubes for the water to flow to his house.

#### *Alternative Technology to Mitigate Water Crisis*

Rizal's inventive proclivity was notable and awe-inspiring. People who had witnessed and seen his innovative creations could not help but express words of admiration. In praise of the hero's ingenious engineering works, H. F. Cameron commented: *"When one considers that Doctor Rizal had no explosives with which to blast the hard rocks and no resources save his own ingenuity, one cannot help but honor a man, who against adverse conditions, had the courage and tenacity to construct the aqueduct which had for its bottom the fluted tiles from the house roofs, and was covered with concrete made from limed burned from the sea coral. The length of this aqueduct is several kilometers, and it winds in and out among the rocks and is carried across gullies in bamboo pipes upheld by rocks or brick piers to the distribution reservoir (Zaide and Zaide, 2014)."* In view of the intricacy of the undertaking, one could not help but wonder how such a great handiwork was made possible. No motorized machinery was employed to clear the passage of the water pipes. Not even an explosive substance was used to discharge the blockading rocks. Only a man with profound skill and fervency could carry out such an enormous task. He must have the perfect blend of a scientific mind and concern for humanity. This extraordinary accomplishment continues to draw fascination and respect. Former DOST Secretary De la Peña in recognition of Rizal's ground-breaking works in Dapitan said: *"In this four-year interregnum, the national hero was considered a scientist and innovator... His inventions were borne out of his bare hands and imagination and the passion to serve the people (Lazcano, 2022)."*

The project was undoubtedly outstanding. It was an innovation made out of the passion to serve humanity while preserving the natural world. Fr. Obach pointed out the advantage that could be gained from the project. He specifically mentioned that it could be useful for the irrigation of different vegetation including rice and mangroves. While the project was primarily built to provide the basic need of the town folks, its economic advantage was also pouring. The project was undoubtedly outstanding. It was an innovation made out of the passion to serve humanity while preserving the natural world. Sufficient supply of water could lead to better production. High farm yield will result in more profit. In this consideration, it is reasonable to assume that the project significantly contributed to the agricultural boom and economic prosperity of Dapitan.

It is worthy to note that the project was functional for more than five decades. During that period, the Dapitan water system did not only promote economic growth but aided in environmental preservation. As it led to the flourishing of various vegetation particularly mangroves, it also helped in advancing ecological development in the locality. The project was not only an achievement of Rizal. It was a fulfillment of the hopes and dreams of the town folks. As Barreto (2022) puts it, *"[The] Waterworks in Dapitan, namely the Linao and Talisay*

water systems, were not just infrastructure for conveying water but also served as symbols of the skillfulness and aspirations of the Dapitanon people". In 1895, the *Linao* water system started its operation. It continued to serve the Dapitanons until the 1950s. However, unlike the *Talisay* waterworks, the *Linao* water system was abandoned and left unpreserved. Only the remnants of the said waterworks stand today as surviving witness to the great innovative work of Jose Rizal. Barreto (2022) expressed his observations in these words: "At present, the *Linao* water system is in ruins and is almost forgotten by today's generation. Only a handful of people, usually historians and heritage enthusiasts, know of its existence and location. Traces of clay pipes and a dilapidated brick water reservoir can still be seen in the neglected *Linao* waterworks site". People's continual attempt to make life better and easier has resulted in the extinction of old contrivances. As man searches for a more effective way of satisfying his desires, past technologies are often underrated if not totally disregarded. Prompted by the want for large profits, technological endeavor shifts from the natural to unconventional alternatives. There is no question about the craving for development. The problem is overlooking the irony of technological advancement. Innovations must not only respond to people's desire whether it is to sustain basic needs or to satisfy personal wants. Resources are not limitless. In fact, they are depleting. An explicit example is the water crisis that currently poses a global threat. Development must not be a one-sided gratification. It has to embrace harmony with the natural world. To awaken this sense of accountability, humanity must realize the anthropogenic damage to the environment. In particular, Patriarch Bartholomew has stated that each of us must confess our sins to the earth because, "inasmuch as we all generate small ecological damage," we must accept "our contribution, smaller or greater, to the disfigurement and destruction of creation" (Encyclical, 2015). Man needs to innovate to improve life conditions. The environment provides the resources for innovation. As it seems, development is impossible without a completely functioning natural environment. It is therefore logical to promote old technology. It may sound regressive but it is the most ideal approach to attain constructive innovation. An invention that is ecologically sustainable makes a lot of sense. In this thought, Rizal's waterworks are a valuable prototype of innovative crafts that can respond to human and environmental needs.

#### V. CONCLUSION AND RECOMMENDATION

Rizal's contribution in the construction of the Dapitan water system is paramount. The famed hero essentially derived inspiration from his ingenuity and desire to help promote the welfare of his fellowmen. Moreover, the challenges posed by his agricultural enterprise prompted him to build yet another waterworks. The creation of the *Linao* and *Talisay* water system had brought about significant advantages. They paved the way for the economic and health development in Dapitan. Rizal's innovative works had substantially contributed to the improvement of the life of the town folks by providing clean, fresh and free water supply for household and farm use. These organic handiworks were founded on his knowledge of science particularly on the principle of gravity. They are reflections of

the hero's true genius. In fact, they are testaments that technological innovations are possible without damaging the natural environment.

Additionally, the said project is deemed to be ecologically sustainable. Firstly, it was made using indigenous and organic materials such as; rocks, clay, limestone and bamboo. Taking these into account, it is safe to say that the waterworks was a cost-efficient scheme. In a world where cost of living is constantly rising, employing inexpensive technology is substantially propitious. Low production cost would mean low product price. Secondly, it was built without the use of explosives and other environmentally damaging equipment. Therefore, it helped in preserving the natural ecosystem and resources. The use of explosives or chemical substances may cause permanent impairment to the environment. The world is confronted with alarming issues linked to environmental degradation. Minimizing if not completely avoiding environmentally damaging chemicals could help foil further ecological destruction. Lastly, it operated using gravitational force. Considering that no motorized machine and apparatus were employed, the project was a pollution-free technology. Air pollution is also a growing international concern. The use of machineries powered by fossil fuel is a contributory factor to climate change and ecological disturbance. Many of the drivers of air pollution (i.e. combustion of fossil fuels) are also sources of greenhouse gas emissions ([www.who.int/health-topics](http://www.who.int/health-topics)). Smoke emitted by motor engines is considered a dominant contributor to air pollution. There is already available technology to lessen the undesirable environmental effect of using fossil fuels. But it does not stop contaminating the environment. Better yet use an old technology that will not contribute to air contamination. Going back to the old fashion may appear difficult but not impossible. The drive for personal or corporate profit is a strong temptation. Apparently, preference for modern and more complex technology is compelling. Employing current innovations ensures availability of supply. They are convenient contrivances for a large-scale production. Voluminous quantity of product generates bigger revenue. If our focus is economic return, then it may not only be problematic to think through old technology. It could be totally impossible. Apart from its ecological and hygienic value, Rizal's scheme significantly helped in providing sufficient water supply and improved the economic productivity of Dapitan. Moreover, it is noteworthy to say that the water system project in Dapitan is an archetype of effective collaboration. The construction of the historic waterworks is an attestation that community advancement is not remote if only the government and its people will work hand in hand.

Considering the ecological, economic and historic value of the Dapitan water system, it is no doubt that the technology can be a potential alternative in mitigating the emergent water crisis. Therefore, its restoration and possible duplication is favorably recommended. Doing so will not only promote Filipino cultural heritage and history but also significantly impact the quest for sustainable development. However, this may not be as easy as it looks. Pursuing the idea would raise a very strong question. Why go back to the old way when there are new ways of doing it? But if we really care for the

environment and the future of mankind, the answer is plain and simple. Rizal gave us an example. It is our decision to choose what we intend to do for our life and the lives of the people in the generations to come. We can live in the comfort of state-of-the-art innovations. Or, we can sustain humanity and the natural ecology by bringing back an old but practical technology.

REFERENCES

- [1]. Arcilla, Jose S. 2000. Jesuit Missionary Letters from Mindanao (Volume Four: The Dapitan-Balingasag Mission). Quezon City: University of the Philippines.
- [2]. Barreto, Albert Vincent F. 2022, May 25. *Flowing Waters of Dapitan: Linao and Talisay Waterworks*. National Historical Commission of the Philippines. <https://nhcp.gov.ph/flowing-waters-of-dapitan-linao-and-talisay-waterworks/>
- [3]. Craig, Austin. 1913. Lineage, Life and Labors of Jose Rizal. Philippine Education Company. p. 204.
- [4]. Laput, Gualberto. 2016, June 19. *Grandson of Rizal's Dapitan Student: Let's restore historic water system*. <https://www.rappler.com/nation/136894-rizal-dapitan-shrine-water-system>
- [5]. Laput, Gualberto. 2023, May 8. *Jose Rizal memorial protected area fees draw criticisms in Dapitan*. <https://www.rappler.com/nation/mindanao/jose-rizal-memorial-protected-area-fees-dapitan-draw-criticisms>
- [6]. Lazcano, Joy. 2022, February 7. *Rizal, Innovating Essential Public Services for Public Good*. Department of Science and Technology. <https://www.dost.gov.ph/knowledge-resources/news/74-2022-news/2652-rizal-innovating-essential-public-services-for-public-good.html>
- [7]. Ocampo, Ambeth R. 2016. Rizal Without the Overcoat. Mandaluyong City: Anvil Publishing, Inc. p. 206.
- [8]. Pope Francis. 2015, May 24. Encyclical Letter. [https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco\\_20150524\\_encyclica-laudato-si.html](https://www.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_encyclica-laudato-si.html)
- [9]. Zaide, Gregorio F. and Sonia M. Zaide. 2014. Jose Rizal: Life, Works and Writings of a Genius, Writer, Scientist and National Hero (2<sup>nd</sup> Edition). Mandaluyong: Anvil Publishing, Inc.
- [10]. Zulueta, Francisco M. 2004. Rizal Life, Works, and Ideals. Mandaluyong City: National Book Store.
- [11]. <https://dapitancity.gov.ph/about-dapitan/>
- [12]. <https://dimasalanglaonglaan.wordpress.com/rizals-exile/>
- [13]. <https://joserizallifeandworks.files.wordpress.com/2019/04/rizal-blumentritt-correspondence-converted.pdf>
- [14]. <https://un.org/en/global-issues/water>
- [15]. <https://www.globalgoals.org/goals/6-clean-water-and-sanitation/>
- [16]. <https://www.google.com/maps/@8.6670653,123.4210089,15.32z?entry=ttu>
- [17]. [https://www.who.int/health-topics/air-pollution#tab=tab\\_1](https://www.who.int/health-topics/air-pollution#tab=tab_1)