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Modern Eco-Friendly Containers: Transforming Water lilies into Proactive Environmental Product

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This research revolves around the negative effects of Water lily can cause within the environment. The rapid growth of a Water lily is dangerous because excess growth will cover the surface, causing a reduce in light penetration into the body of water. Thick growths of Water lilies interfere with oxygen exchange and one of the worst-case scenarios it can lead to being a source of flooding. Lastly, its pad traps the heat that causes the algae bloom which can attract mosquitos that are known to cause dengue.

The purpose of this research is to make recycled and modern styled containers out of Water lilies as an eco-friendly material that does not decompose over time. This qualitative research will explore water lilies as environmental entrepreneurship by making usable containers as a source of livelihood. Instead of treating water lilies as negative environmental pollution, it can be used as a livelihood that will provide a source of income.

In this research, we have gathered water lilies, clean, dried, and used them as raw materials in creating a decorative container. Its durability and uniqueness can make it economically competitive. Water lilies are good because it provides livelihood, though this way, it can mitigate its threat to our environment. We highly recommend the use and promotion of water lilies in developing eco-friendly livelihood products.

Key words: Eco-system; Eco-container; Aquatic threat

I. INTRODUCTION

1.1. Problems with Water Lilies

The researchers saw the negative effects that Water lily (*Nymphaea*) can cause within the environment, one of which is when there are excess growth of these plant because the rapid growth of many other aquatic plants is also a characteristic of a Water lily wherein it becomes dangerous because excess growth will cover the surface, causing a reduce in light penetration into the body of water. Such hindrances can kill fishes and other plants that are in the same body of water. Thick growths of Water lilies also interfere with oxygen exchange and it can lead to being a source of flooding. Lastly, its pad traps the heat that causes algae bloom which can attract mosquitos that are known to cause dengue or other harmful sickness that people near bodies of water, would get if possible. Furthermore, any damaged leaves of water lilies if not removed immediately will attract two of the major insect related problems of water lilies which are Black aphids (*Aphis fabae*) and Aphids (*Aphidoidea*) that are often infected by bacteria, viruses, and fungi that would also be a nuisance to the environment.

1.2. Purpose of the research

Waterlilies may be a menace for our rivers and seas and once they are harvested, they do not easily decompose but eco-entrepreneurship can provide a way to recycle them. The purpose of this study is to make a recycled and modernly styled

container out of Water Lily (*Nymphaea*), an eco-friendly material that does not decompose over time. These recycled containers can be use by people to store in their materials they have and to organize those things. Moreover, it reduces the harmful risk that water lilies pose to humans and other living things surrounding it because water lilies can be a cause of water pollution, loss of lives for some aquatic species, and be a reason to trigger the causes of sickness.

2. Review of Literature

2.1. Water lilies and their Advantages

The Pond Digger (n.d.) justified that for scientists, water lilies (Nymphaea) are considered as the jewels of the pond not only because of their beauty in general but because they too serve an important purpose in aiding its ecosystem which is in the pond. "Water lilies spread across the surface of the water, filling it with color and vibrancy all the while keeping the pond and the creatures in it safe and healthy. Besides being pleasing to the eye, water lilies do a great deal to maintain the well-being of the ponds they inhabit. For one, they provide shade to keep the water temperature down during the hot summer months. By blocking out a lot of sunlight, the lilies help to keep the algae growth down. Their shade also gives shelter to any fish that may be in the pond -– a respite from both the sun and any predators that may be lurking nearby. They also absorb nutrients in the water that would normally feed these undesirable green plants, keeping the water clear and clean-looking." The Pond Digger added.

Along with the advantages of water lilies in the ecosystem, it also has herbal uses and can be a source of health benefits. The Herb Guru (n.d.) discussed in their cleansing articles about the water lilies that, "Water lilies are very nutritious which people may not know. The seeds of the yellow water lily have high content of starch and glucose. Roots and leaves can be boiled and can be eaten to get the nutritious properties of the lilies. Even one can make jam from the flowers and use it on toast. Before consuming the lilies, it is very important to identify the specie because there are many species of lilies which are poisonous. There are a lot of benefits of water lily." then in terms of their health benefits they had indicated that white water lily alkaloids and oils work as very good anti-inflammatory and mild sedative. To get healthy hair, one can boil its roots a bear and can use it as hair rinse. It really gives you beautiful healthy and shiny hair. The seed can be used as an alternate to coffee.

2.2. Disadvantages of Water lilies

Though there are advantages it also has disadvantages as well, Water hyacinth as described and discussed by Agri Life Extension (n.d.), is a free-floating perennial plant that can grow to a height of 3 feet. The dark green leave blades are circular to elliptical in shape attached to a spongy, inflated petiole. Underneath the water is a thick, heavily branched, dark fibrous root system. The water hyacinth has striking light blue to violet flowers located on a terminal spike. Water hyacinth is a very aggressive invader and can form thick mats. If these mats cover the entire surface of the rivers they can cause oxygen depletions and fish kills. Water hyacinths should be controlled so they do not cover most part of the river. Naga Central School (2011) proved that water hyacinth poses threats like hindrance to water transport, clogging intakes of irrigation, hydropower and water supply systems. Increased disease in the habitat, increased evaporation and transpiration of water, reduced biodiversity. One of which is the event of flooding that happened in Mindanao, Philippines that was written in an article found by the researchers that detailed, "Water lilies were also blamed for severe flooding in Mindanao that submerged several villages in Cotabato City and Sultan Kudarat in the past months. Concerned citizens expressed alarm over the presence of water lilies in the river, particularly along the Makati-Mandaluyong bridge. They raised concern that these could lead to massive flooding in the event of heavy rains like that brought by typhoon Ondoy (Ketsana) in 2009." (Kwok, 2011). Then, Jacinto and Lirio (n.d.) stated that "Water hyacinths contributes in the increase of diseases in habitats: Malaria, dengue, water borne parasites and other water borne diseases, Fishing problems because access to the fishing ground becomes difficult when weed infestation is present."

2.3. Solution for the disadvantages of Water lilies

Conforming to some papers that the researchers have found, Water hyacinth was introduced into many parts of the world, including the Philippines, as an ornamental garden pond plant due to its beauty. But today, Tacio declared in his article pertaining to water lilies, it is considered a pest as 10 plants could produce well over 650,000 offspring within eight months. In Laguna de Bay, for instance, water hyacinth is considered a nuisance. "These plants now cover some 20% surface area of lake," said Edgardo Manda, general manager of Laguna Lake Development Authority. He added that such proliferation threatens survival of aquatic

species there since these plants block the penetration of sunlight into the water. (2009). To address the increasing number of water hyacinth clogging the metro waterways and elsewhere, the Department of Science and Technology has just unveiled its locally-developed solution: a machine that scoops up the plants to put them in good use. (DOST, 2012).

Valencia (2012) affirmed that the DOST was able to find a way to address the problem of the continuous rise in the number of water hyacinth through a machine that is able to collect the organism for good use. "The harvester mechanically removes water hyacinths using a specially-developed conveyor system." Valencia added since regarding to the research team of Metro Manila Development Authority (MMDA), "Mechanically removing the plant is the better alternative because chemical methods are hazardous to plants and animals,"

The Harvester or Water Hyacinth Harvester, one of the technology solutions from DOST, is a collaboration between DOST-MIRDC whom developed it, and the Project Management Engineering and Design Service Office, with funding of the Philippine Council for Industry, Energy and Emerging Technology Research and Development. The said technology solution can collect and hold up to 25 kilograms of water hyacinth per load. When full, the harvester discharges the collected plants to a dumping site or an assisting barge. It was then launched on February 15 near the banks of the Laguna Lake in C6 Road, Taguig City.

As reported by Mario Montejo, a secretary from DOST, the water hyacinth harvester prototype can still be developed into a more advanced instrument depending on what type of body of water and what it needs (Montejo, n.d.)

Water hyacinth is seen as an invasive pest and is responsible to many problems summarized earlier, thus, many locals, groups, organizations, local government units and the Department of Environment and Natural Resources conducted researches and studies on the benefits that can get from this plant. Along their journey, they have found out that the stem, leaves and flowers can be made into different materials.

In the Philippines, water hyacinth is dried and used to make baskets and matting for domestic use. The key to a good product is to ensure that the stalks are properly dried before being used. If the stalks still contain moisture then this can cause the product to rot quite quickly.

In India, water hyacinth is also used to produce similar goods for the tourist industry. Traditional basket making and weaving skills are used.

In Bangladesh, they experimented with paper production from water hyacinth for some years now. They have established this project that makes paper from the water hyacinth stems. The water hyacinth fiber alone does not make particularly good paper but when the fiber is blended with waste paper or jute, the result is a good quality paper.

The fiber from the stems of the water hyacinth plant can be used to make rope. The stalk of the plant is shredded lengthways to expose the fibers and then left to dry for several days. Fiberboard in Dhaka, they developed a fiberboard that has general purpose uses such as low cost roofing. The process has many steps and the labor is intensive.

Basket work: as what is mentioned earlier are being practiced in the Philippines and India, they dry the water hyacinth to be used in making baskets and matting for homes and the local tourist trade. Fertilizers. Water hyacinth can be used directly from harvesting or dried to be used to mix with the soil or as mulch. It breaks down quickly and can be mixed with ash, other soils and some animal manure to increase soil fertility and crop yield.

Fish feed, Tilapia and silver carp consume aquatic weeds, like water hyacinth. Moreover, Melican acknowledged in one of his articles about Water Hyacinth. Products made out of water hyacinths also includes trays, chests, bags, traditional bags, hampers, cabinets, lamp shades of various shapes and sizes and even dining tables and in additions, slippers too.

2.4. Feedbacks about Water lily products

Some of the positive feedbacks written by some authors are; waterlilies can provide livelihood for hundreds of families in Las Piñas, the water lily business has also cleaned up the waterways of the city." Villar Foundation noted in the article of Melican. Also, M. Villar (2012) assured, "This project shows a lot of creativity of the Filipinos because of different in water lily products. The industry has become so successful our Zapote River is now free of water lilies and fish have begun breeding here again. We are now getting our water lilies from the Laguna de Bay, and I hope the lake will also be cleared of water lilies because of this business." Then he added that their foundation is open to starting a similar

program in Cotabato to help in alleviating the flood problem in the city. They are currently looking for a non-government organization to partner with for this project, and are ready to help the local government if asked.

Meanwhile in an article of Morelos, the Villar Foundation also said that "Some weavers are sent overseas for training and the skills they acquire are shown in the quality of their work" which really shows the advantages of recycling water hyacinths. Other feedbacks were, "The industry is growing leaps as they developed so many product since then and they have new ideas and outline in the pipeline. A lot of water lily products have already been exported to other countries, but more than this, the water lily industry is appreciated for providing livelihood to poor families." (Torres)

2.5. Waterlilies as alternative to plastic containers

It is known to many that containers are used to store materials. From an article of the website entitled References (n.d.), "Plastic containers with plastic lids are a great way to store leftovers. Glass jars with screw on lids can be used to store and reheat homemade baby food. Glass jars or hard plastic containers can also be decorated to give as gifts. Sets of containers in any material with tight lids can be used to store stickers, brads, beads, and other scrapbook or craft supplies. Many people use mini containers in the home office to keep paperclips and rubber bands organized." they cited.

4.6. Disadvantages of Plastic containers

However plastic containers also give different kinds of hazards with in the environment and to the health of many. As explained by EcologyCenter.org (n.d.), "People are exposed to these chemicals not only during manufacturing, but also by using plastic packages, because some chemicals migrate from the plastic packaging to the foods they contain. Examples of plastics contaminating food have been reported with most plastic types, including Styrene from polystyrene, plasticizers from PVC, antioxidants from polyethylene, and Acetaldehyde from PET.". Furthermore, it was mentioned in an article by Levin (n.d.) that, "According to Scientific American, studies have shown that these chemicals can promote human breast cancer cell growth and lower sperm counts. Pregnant women, infants and children are especially at risk. Plastic does not last forever. The more it is heated and cooled, and heated and cooled, the more the chemicals in that container begin to break down. And when they start to break down, they break down into the food inside. As a result, detrimental and expensive health issues can arise. Thus, it is important try to make reasonable efforts to replace plastic in our kitchens."

Then moving on to the threats that plastic containers pose to our environment, the Conserve Energy Future (n.d.) affirmed that, "as plastic is composed of major toxic pollutants, it has the potential to cause great harm to the environment in the form of air, water and land pollution. Put simply, plastic pollution is when plastic has gathered in an area and has begun to negatively impact the natural environment and create problems for plants, wildlife and even human population. Often this includes killing plant life and posing dangers to local animals. Plastic is an incredibly useful material, but it is also made from toxic compounds known to cause illness, and because it is meant for durability, it is not biodegradable."

3. Methodology

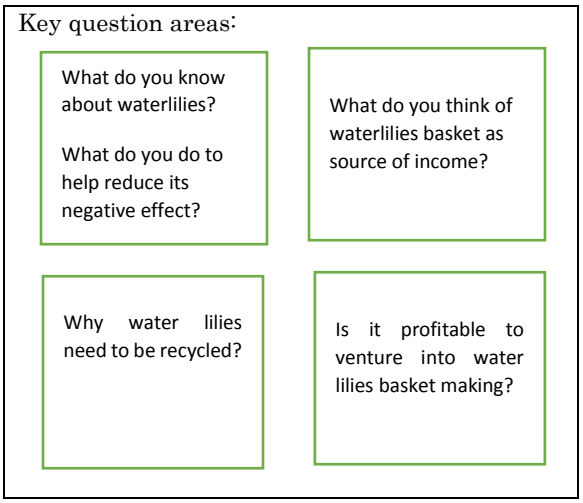
The main objective of this research is to be able to make a recycled product using waterlilies and promote it as a means of effecting environmental change. The researchers realized that we often advocate environmental friendly campaign such as the popular slogan, "reuse, reduce and recycle" but we do not offer concrete and practical ways of recycling. We also used qualitative method as a way to explore attitudes and beliefs of people about recycling water lilies.

3.1. Participants and Setting

In this qualitative research, the participants for the survey interview categorize into three who has connection to water lilies and they are: the vendor, the gatherer, and the product producer, all for water lilies. The participants may be of any age, gender and occupation as long as they met any of the categories given because their experiences and perspectives are the focus of this research. Their physical information was foreseen to be not necessary but still, ages of the participants are to be asked. Participants may not be considered as official vendor, gatherer or product producer as long as they have experienced being a vendor, gatherer, or product producer.

The limitation for the number of participants to be interviewed was limited to only 20 persons. Participants were asked 8 common questions and additional 2 questions for each group. We conducted our interview in 3 areas: Dangwa flower market in Sampaloc, Manila knows as

"Bulaklakan ng Maynila". The said market is composed of several small individually-owned stalls and street vendors selling flowers, other plants and plant products such as weaved baskets; Bagong Barrio; San Jose del Monte in Bulacan.



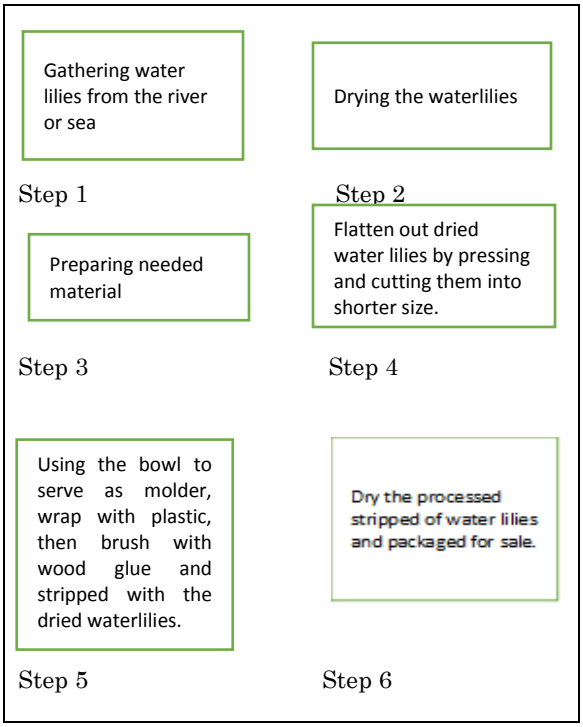
3.2. Procedure for interviewing

The procedure done by the researchers are: First, prepare the things needed which includes the questionnaires, notebook, pen, IDs and letters for the barangay captain. The reason why questionnaires, notebook, and pen was brought is simply because there should be a record of what transpired during the interview. IDs were also brought to bring credibility for the researchers and to be able to use it in case they would verify our identities, then the letters, both for the barangay captain and interviewees were assured of privacy of personal information and identities. Participants were oriented of consent form and the purpose of our study.

Onto the process of doing the survey the researchers planned to meet up in MCU, Ministop at 11:30, March 12 of 2017. Their itinerary started from taking a jeep to LRT then from LRT to Tayuman station and finally walking towards Dangwa. There are two (2) persons assigned for 1 interviewee and the duration of the interview lasted three 3 to 5 minutes. Also on March 12, 2017, 7 PM there had been 2 interviews made in San Jose del Monte, Bulacan by one of the researchers who happen to be just in the neighborhood of Court of Tierra Benita Village. The interview lasted for about 3 minutes. On March 13, 2017, 2 of the researchers interviewed also in their neighborhood that were in Inapostol and Concepcion of Bagong Barrio. There was no itinerary report because it was also in their respective neighborhood. The duration of the interview lasted for 5 minutes. During the gathering of data, expenses includes only transportation and food.

3.3. Procedure in doing our product

The things to do in doing a container out of water lilies is simple. Gathering the needed materials which are dried water lilies, presser, wood glue, plastic food packaging film, pair of scissors brush and a bowl is the start of this project making. The presser could be anything that would be used to flatten out the dried water lilies and once those were flattened out they will be cut into shorter strips. Grab the bowl that will serve as the shape or base of your container then put plastic film around it and finally put some wood glue onto the exterior part of the bowl by using the brush then follow it up by putting the strips of water lilies. Cover the whole exterior part of the bowl and wait for it to dry for about 15 – 30 minutes. Once it is completely dried, take out the bowl with plastic film from the water lily and it is done, an eco-container out of water lilies will be made.



4. Results, discussion and analysis

The interview that was carried out helped us widen our understanding and knowledge in the said plant. Water lilies are known for being a plant that grows on river, a flower decor, and material that can be used in making a basket, but despite all of these, it still has its unheard-of use. According to the vendors, water lilies can be used as decorations in Karosa. Most people are unfamiliar on how to get water lilies in the river, much are unaware of the danger that they can encounter while doing the said acts. According to the gatherers, wading in the river may cause skin itchiness and a risk of getting bitten by a snake, boat and sticks are needed in order to get water lilies. According to the product producers, it is easy to manufacture products made from water lilies. Necessarily, it is needed to be dried, flatten, and stick with wood glue in order to be molded in the bowl, afterwards, the basket is ready. The vendors double the price of their water lilies, while the gatherers sell theirs in a low price which made the product producers buy their water lilies from the latter. In contemplating whether water lilies should be removed or reduced, the vendors, gatherers and product producers disagree for this is their only source of income. Despite disagreeing in the said idea, they are well aware of the damage it causes in the environment, such as being a blockage in the river and the cause of death of the fishes. The three said groups wish that the government would advise the use of water lilies in making different products in order to help the jobless, and it will also make a great contribution in our economy for it will not just develop our own products but can also help in the growth and improvement of each citizen.

Among twenty (20) participants who were interviewed in this research, 13 out of 20 or 65% of the population size considered the Water lily as a material for decorating purposes and a kind of aquatic plant. 45% of them said that this plant is good by the means of their livelihood and 40% of the participants considered this plant both good and bad. 65% of them have the same opinion to minimize the growing population of the plant because it causes water clogging in many drainages. For the advocacy majority of the participants doesn't know what kind of advocacy they can share to support the products of water lilies. 70% of the population have the same preferences of the product they like. 90% of the people are sure about their answers that making this water lily product is effective especially in livelihood and this must be encouraging in every home, with the same percentage they said that water lily helps the developing economy of the country.

5. Conclusion

The results of the survey conducted for the people in relation to water lilies which were discussed to be categorized into three (3) namely the vendor, gatherer and product producer created many conclusions and realizations. It was evident that they mostly see and do products from water lilies being made into baskets, hats, bags, crown and arrangement and so on but no one among the twenty (20) respondents answered a container made out of water lilies. The researchers, likewise, conclude that though majority of the respondents agreed that water lilies are good because it provides them livelihood, they were still aware of the threats it opposes. Some respondents do know advocacies in which those served as solutions for the decreasing of the population of the said aquatic plant, they agree that products made out of water lily does help in the economic growth of the country which led them thinking it was truly advisable to be done at home for it promotes taking care of the earth and it also promotes taking steps into making an end to the problems with water lilies.

Since the researchers succeeded in making a container made out of water lilies the possibility of making an eco-container out of it is proven to be realistic. This success added one more possibility that water lilies can be made used of, it expanded the range of water lily products -- this also makes more use for them which can have the after math of having a large number of lilies being decreased in rivers. Given that kind of case, the disadvantages of water lilies has for its surroundings would also be diminished as the population of it goes down too. Plastic containers now can be replaced by the eco-friendly container that will be also decreasing the harmful hazards people might get from using so.

Recommendation

The researchers would like to recommend to focus on the following areas such as the public awareness of the people on the benefits that they will get on the water lilies and their reaction toward it. The researcher would also like to recommend to focus more on how to publicize and to influence other people to make eco-friendly container out of water lilies as their livelihood, it was also advised that for the future individuals who will be under in this same study to widen and to have deeper research and observation on this study in order to help the people to know more and widen their knowledge in the possible outcome on this research.

6. References

ABS-CBN News (2011). *Water Lilies can be source of* livelihood. Retrieved from http://news.abs-cbn.com/lifestyle/06/23/11/water-hyacinths-can-be-source-livelihood

AgriLife Extension (n.d.). *Water Hyacinth*. Retrieved from http://aquaplant.tamu.edu/plant-identification/alphabetical-index/water-hyacinth/

Ecology Center Org (n.d.). *Adverse health effects of plastics*. Retrieved from http://ecologycenter.org/factsheets/adverse-health-effects-of-plastics/

Herb Guru (n.d.). *Herbal uses and health benefits of Water lily*. Retrieved from http://herb-guru.com/healing/herbal-uses-and-health-benefits-of-water-lily/

Jacinto & Lirio (2016). *Environmental Impact – The Water Hyacinth.* Retrieved from http://www.jacintoandlirio.com/page/environmental-impact-the-water-hyacinth

Kwok, A. (2011). *MMDA monitors growth of water lilies in Pasig River amid rainy season.* Retrieved from http://interaksyon.com/article/9606/mmda-monitors-growth-of-water-lilies-in-pasig-river-amid- rainy-season

Levin, H. (2004). *Danger of plastic food containers, water bottles, and bisphenol A (BPA).* Retrieved from http://www.moneycrashers.com/dangers-plastic-food-containers-bottles-bisphenol-a/

Melican, N. (2012). *Water Lily handicrafts pays off in Las Piñas.* Retrieved from http://newsinfo.inquirer.net/232409/water-lily-handicraft-trade-pays-off-in-las-pinas#ixzz4Wb0AUjn1

Naga Central School (2011). *Focus study.* Retrieved from http://nagacentralschool1-waterlily.blogspot.com/p/focus-study.html

Pene, A. (n.d.). *Water Lily: From serious pest to profitable crop*. Retrieved from https://www.scribd.com/document/105453677/Water-Lily

Rinkesh (2009).*Conserve energy Future*. Retrieved from http://www.conserve-energy-future.com/causes-effects-solutions-of-plastic-pollution.php

Tacio H. (2009). *Water Hyacinth Ecological Value, Environmental Impacts*. Retrieved from http://www.gaiadiscovery.com/nature-biodiversity/water-hyacinth-ecological-value-environmental-impacts.html

The Pond Digger (n.d). *Water Lilies, Popular Aquatic Pond Plants.* Retrieved from http://theponddigger.com/water-lilies/

Valencia, G. (2012). *DOST Launches solution to the Water Hyacinth problem*. Retrieved from http://www.dost.gov.ph/knowledge-resources/news/35-2012-news/238-dost-launches-solution-to-the-water-hyacinth-problem

What are some of the uses of mini storage containers? (n.d.) Retrieved from https://www.reference.com/home-garden/uses-mini-storage-containers-190e12ff8eedc7b