Integrated Biosystem Farming Model at Cebu Technological University-Barili Campus: Techno Pack

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Abstract - The study aimed to establish the process flow and to determine the costs, productivity, and the return of investment (ROI) It also sought answers to quantify the environmental impact on soil nutrition and utilization, ambient temperature, and rainwater conservation, and also the problems encountered in the development and establishment of the Integrated Biosystem Farming Model (IBFM). The IBFM greatly considered the sound process flow in developing and establishing an ecological interaction of the components for maximum maximization of the available resource that can be found both land, air and water. The following that highly considered in the process were the site selection, plan, design and layout, inputs, fish, crops, poultry and livestock establishment, production, caring and feeding practice, harvesting and marketing.

IBFM increased the amount of soil nutrients and lowered down the inner temperature. Furthermore, this farming model was quite productive for it utilized and conserved the natural resources particularly the volume of soil and water. Thus it saved a lot of money. The IBF was a good source of additional income and a mean of living for food self sufficiency. This study was feasible for an entrepreneurial venture.

A proposed techno pack for an IBFM that has a farmers-based application is hereby recommended for wide dissemination and adoption.

Index terms— bioarts, conservation, do-it-alone, entrepreneurship, establishment process, site selection, 4 R's

INTRODUCTION

Integrated biosystem farming is a farming practice that follows the law of nature where both plants, animals, microorganisms and environment established an inter relationship each other. These components in nature have niches to perform in a favorable habitat to live, grow and reproduce.

Integrated biosystem farming helped attain the maximum maximization of available resource found both land, air, water and energy for sustainable and profitable production of the basic needs of man.

This farming practice can be done alone by farmers with the association of common sense, resourcefulness, perseverance, positive outlook, scientific and technical initiative.

Integrated Biosystem farming is a farming system that utilizes the physical and biological resource in the backyard that are readily available and in great usefulness when given a considerable importance. Backyard physical resource such as water from the pavement and roof gutter, land elevation and household wastes such as plastics, cellophanes, sacks and tin cans can be utilized into plant pots. For biological resource such as decomposable materials and wood can be used for planting media of the marcotted fruit bearing trees and vegetables, and substrate of the ornamental plants for maximum maximization of resource.

Fish farming in the backyard is a salient response for the gradual diminution of our wild resource at the ocean, lakes and rivers due to overexploitation. This is to remind us that fish protein can be drawn out in the backyard with limited water resource.

Biodegradable materials from households and from the surroundings are one of the common waste problems nowadays. In addition to rainwater run-off from the pavement and from the houses roof had least importance household uses due to availability of water supply from the commercial water work system. On the other hand, It causes household drainage problem especially in low-lying houses from the elevated land resulting to a very common flash floods.

To mitigate the problem on solid waste and rain water run-off from the pavement and from the house roof , the study is designed. The main focus of the study is to make biodegradable materials and rain water run-off from the pavement and from the house roof with the advantage of land elevation will be converted into a nature available resource through the establishment of an integratedbiosystem farming. A biosystem that could be able to supplement/augment income and sustain the basic needs of the medium size family.

Theoretical Background

Integrated biosystems, where connections are made between different food production activities, can take a wide variety of forms. Such integrated systems offer many opportunities for increasing the efficiency of water and nutrient use, productivity and profit, and represent practical, creative solutions to problems of waste management and pollution. Environmental pressures and economic drivers such as the rising costs of water, fuel and other inputs are stimulating growing interest in eco-efficient production options that minimize resource consumption and pollution. Integrated biosystems satisfy these requirements because they conserve soil and water, increase crop diversity and can produce feed, fuel or fertilizer on-site. Integrated biosystems are relatively sustainable and resilient and can do much to support local economies. They can help farmers diversify or combine forces with other complementary operations. Integration can be achieved over a range of scales and can assist in community, catchment and regional planning. Biosystem integration therefore helps to achieve the economic, environmental and social aims of sustainable development. Many examples of integrated design now exist worldwide and appropriate technologies for ecological engineering have been developed.

This information builds on the RIRDC Research and Development Plan for Integrated Agri-Aquaculture Systems and describes many alternative and interchangable integrated options that promise to increase the diversity, flexibility and resilience of Australian production systems. Integrated biosystemsmake functional connections between agriculture, aquaculture, food processing, waste management, water use, and fuel generation. They encourage the dynamic flows of material and energy by treating wastes and by-products of one operation as inputs for another. In this way food, fertilizer, animal feed and fuel can be produced with the minimum input of nutrients, water and other resources.

Iintegratedbiosystems take advantage of natural ecological processes, and as a result some components of such systems can be low technology, requiring less management, less maintenance and less capital expense (Harris and Glatz 1995).

Integrated biosystems are scalable both in size and in technical complexity and can be developed in stages, possibly through joint enterprise arrangements. These features help in the take-up of local farm-based systems .

In this study, the integration is premised to the following theories of tilapia and ornamental fish, chicken , quail , rabbit, lovebird, vermi, banana, veggies and marcotted citrus raising.

Tilapia Raising. Tilapia was introduced in the Philippines in 1972 and it became popular due to their hardness, resistance to diseases, ease in breeding, reasonable growth rate, good taste, and tolerance to wide range of environmental conditions including temperature and salinities. Most tilapia species of the tribe Tilapiani are under the three genera, namely Tilapia, Sarotherodon, and Oreochromis now being profitably used in aquaculture farming businesses. These genera were classified based largely on the differences on the reproduction and feeding habits. (http//www.pinoyfarmer.com)

Ornamental Fish Raising. Fish is one of the most popular hobbies in the world. A tank or pond filled with colorful fishes is always a conversation piece be it at home, office or shops and malls. What with huge number of fish species to choose from, any fish tank or pond owner can take delight just by choosing what fish to take home and care for. Taking care of fishes, aquariums and ponds is not as complicated as other pet hobbies. This makes fish shop a good business anywhere in the globe.However, as with any other trade, it is important that the entrepreneur entering into this kind of industry do not only have knowledge on the area but a genuine interest is beneficial in successfully running this kind of business. If you are into fishes, be it fresh water or salt water, establishing a fish shop business may just be for you.

Before you start your fish shop business, it is important to figure out first what kind of fishes and fish aquarium and pond accessories are you going to focus on. Is it going to be for fresh water fishes or for saltwater fishes? Salt water fishes, like its name suggest, are fishes that live in the sea like clown fish, angel fish, cardinals, etc. They are more expensive to buy and take care of than that of the fresh water type. Caring for these fishes require that the tank or aquarium that closely mirrors the water environment of their sea home. However, specialty shops have been breeding salt water fishes for some time now and fishes that are breed are mostly more tolerant to makeshift habitat. Fresh water fishes are those that naturally live in the river or lake such as gold fish, koi, catfish, etc. These are more tolerant than salt water fishes and they are easier to take care of either in an aquarium or in a pond. Fresh water fishes may be a good place to start for an entrepreneur just entering into this kind of business. (www.startupbizhub.com/Starting-a-Fish-Shop.htm).

Why pay for expensive, imported farm-raised fish when you can create and catch your own right at home? Thrifty homeowners can easily “grow” fish in their own backyards, making a dent in their food budget, as well as greenhouse gasses. If you can tend an aquarium, then you can probably raise your own fish

Aquarium fishes are quite an easy pet in all other pets. It can be .in a second with little care which is suited for a busy people. (www.businesspj.com/gardening-for-the-entrepreneur)

Chicken Raising.A micro livestock- a little known small animals with a promising economic future. Throughout Africa, Asia, and Latin America these are one of the poultry animals collectively most common of all farm stocks together with ducks,
muscovies, geese, guinea fowl, pigeons and turkeys. In many-perhaps most – tropical countries practically every

family, settled or nomadic, own some kind of poultry animals. These birds occur most often in scattered household flocks that scavenge for their food and survive with little care or management.

Their size bestows micro-livestock advantages, including low capital cost, low food requirements and little or no labor requirements. They are also "family sized" easily killed and dressed with little waste or spoilage.

In addition to, these birds grow quickly and mature rapidly and adapt readily to being fenced and penned much, or all of the time. Their life cycles are short and their production of offspring is high. Thus, farmers can synchronize production to match seasonal changes in the availability of feed.

Although poultry contribute substantially to human nutrition in the tropics, it is a small fraction of what it could be. The meat is widely consumed and is in constant demand. An excellent source of protein, it also provides minerals such as calcium, phosphorus, and iron, as well as the B-complex vitamins.

Clearly, these chickens should be given far more attention. They represent an animal and a production system with remarkable qualities for they compete little with human for food , they produce meat at low cost and they provide a critical nutritional resource. (http//www.pinoyfarmer.com)

Quail Raising. The true or old world quail, locally known as pugo is a migratory bird that can be found in Europe, Asia, Africa and Australia. The American quail called "partridge" is non-migratory. In Bible, quail was served by the Lord by the fleeing Israelites. During the present critical period of population explosion, with rampant malnutrition and unrelenting price rises for both cereal and meat, the quail is an answer to the consumer's need for cheap eggs and meat, just as it was during that critical Biblical time.

With the advent of the "instants" like instant coffee and tea, soft drinks, instant soup etc. quail eggs and meat can also follow.

From egg to egg production is barely two months or fifty seven (57) days to be exact. For meat production, the time is even shorter. A quail egg is hatched in just sixteen (16) days and the hen is ready to lay eggs after forty-one (41) days. Isn't that instant?

Nutrition-wise, this is the answer to the quest for a source of economical protein for malnourished children. Economically, it is a very promising project for a very nice additional income. (http//www.pinoyfarmer.com)

Rabbit Raising. A micro-livestock – alittle known small animals with a promising economic future. Contrary to popular opinion, the domestic rabbit is a substantial part of the world's meat supply. Rabbits are now intensively raised for food only in temperate, mostly industrialized nations like France, Italy, Spain, Germany, Hungary, and the United States which produce million of millions of rabbits each year for consumption in homes and in restaurants.

Any rabbit, hare, or pike could be raised in captivity. All are clean, fast growing and rapid breeding. They are opportunistic feeders and can digest fibrous vegetation. Their meat taste better that chicken and does carry the stigma of rodent. The animals are small inoffensive, efficient at foraging, and generally tolerant of difficult environments and could be raised on vegetation not used by people or by many domesticated livestock.

One specie worthy for exploratory research is the domestic rabbit (Oryctolaguscuniculus) is suited to small scale production and backyard farming. It is easily maintained, requires scant space, makes minimal demand on the family budget, and thrives on plant materials that usually disdained by humans. It utilizes forage efficiently, even coarse vegetation that is high in fiber and under ideal condition it can grow so rapidly that its rate is only slightly lower than that of broiler chicken.

The rabbit 's capacity for reproduction is legendary. A single male and four female can produce as many as 3,000 offspring a year, representing some 1,450 kilograms of meat- as much as an average size of cow.

Rabbits are multipurpose animals yielding the following products such as meat that can be breaded and fried, broiled baked or barbecued. Used as wool, fur, leather or vellum. The rabbit manure often contains high proportions of nitrogen, phosphorus, and potash and it come in convenient dry pellets form. It can be used for tourist charms for it is connected with good luck, feet and tails used for car decoration, key chains, charms, and mementos that appeal to tourist and they are also used in biochemical and physiological research. (http//www.pinoyfarmer.com)

Lovebirds Raising. Breeding Parakeets, Cockatiels, Lovebirds, Finches and other pet birds is considered by many to the " The Greatest Backyard Business Ever", and it can be done full time or part-time. It is fun, enjoyable, and best of all, profitable. If you love pets and could use traditional income, then you should consider breeding parakeets, cockateils, lovebirds, or finches.

Breeding pet birds can provide you with an opportunity to enjoy your own business that can literally change your life. Explore this entire website and see for yourself that Small Birds Are Big Business. (www. Amazon.com/Complete Guide Raising Birds Profit/dp/0974390402)

Vermi Composting. Vermi composting defines the thrilling potential for waste reduction, fertilizer production, as well as an assortment of possible uses for the future. Vermiculture enhances the growth of plants that provide food along with producing prosperous and financially rewarding fertilizer.

The earthworm is one of nature's pinnacle "soil scientists". Earthworms are liberated, cost effective farm relief. The worms are accountable for a variety of elements including turning common soil into superior quality. Worms facilitate the amount of air and water that travels into soil. They breakdown organic matter and when they eat, they leave behind castings that are exceptionally valuable type of fertilizer.

Charles Darwin's primal struggle to survive and reproduce entailed the terminal disappearance called extinction. Darwin was haunted by irredeemable loss and studied the benefits of worms over one hundred years ago. Today, his foresight on Vermiculture (worm) has influenced the profit margin for many farmers across the country.

Vermicomposting is the easiest way to recycle food wastes and is ideal for people who do not have a compost pile. Composting with worms avoids the needless disposal of vegetative food wastes and enjoy the benefits of a high quality compost. It
is done with " redworms" (Eiseniafetida) who are happiest at temperature between 50 ^{0}F and 70^{0}F and can be keep indoors at home , school, or the office. Worms process food quickly and transform food wastes into nutrient-rich "castings" (http//www.pinoyfarmer.com)

Growing Calamansi (a.k.aCalamondin.). Calamansi or calamondin(Citrofortunellamicrocarpa) is a frut native to the Philippines. It is the most commonly grown backyard tree among the citrus species. It can thrive in a wide variety of environmental conditions. Citrus can be propagated by seed budding, grafting and marcotting. For commercial, seed budding is preferred although grafting and marcotting produce a satisfactory results that are recommended for small scale propagation.

Calamansi is rich in phosphorus, calcium, iron and vitamin C or ascorbic acid. It is the most popular and most commonly used citrus in the country. Its juice is nutritious and traditionally made into a fruit drink that helps prevent respiratory diseases, strengthen bones and stimulates growth among growing children, circulates blood evenly and facilitates normal digestion. It can be also used as a flavoring ingredient in a dessert, beverages syrups, concentrates and purees.

Filipinos can have a year round supply of this versatile citrus fruits by growing the plant right in their front yards and backyards or even in big boxes. It is to cultivate calamansi for it grows in cool and elevated areas and in sandy soil rich in organic matter. (http//www.pinoyfarmer.com)

Banana Raising. Small Farmers.Big Change. A green and more just food system starts with small farmers. Bananas are the most frequently bought grocery item in the United States, and they have a huge impact on a grocery store's volume sales and profits.Unlike starting other tree farms and orchards, starting a banana farm and growing bananas are easier and less complicated. Although growing bananas still require on less attention, the level of skill required is not as intensive as other trees. An assured profitable market is what prompts the farmers to go for banana farming.

An interesting aspect of the banana market is that there has been no serious price fall for the past couple of years. Prices have been remaining satisfactorily steady. Banana farming fetches good profit. Farmers' show interest in the crop as prices remain steady. Rich profits makes farmers go bananas. ALLAHABAD: The Sangam city may soon earn a new sobriquet, that of 'City of Bananas'. Allahabad, till now known as 'City of Guavas', is reaping rich profits from banana cultivation.

This is perhaps the main reason why banana has become a cash rich crop in the area which was erstwhile known as the "Banana belt of north India

Veggies Raising. In the world of agribusiness, vegetable farming ranks high in terms of the flexibility and scalability it offers startup entrepreneurs. Whether you plan to farm five acres or five hundred, it's possible to devise a business model that results in bottom line profitability. With demand for fresh produce and vegetables at an all-time high, you'll have a steady market for your products. But to be profitable, you'll have to work at controlling costs and finding buyers who are willing to pay a fair price for your crops.

For a small operation, it might make sense to sell directly to consumers through farm markets, a produce stand or even a small store. But if your plans include quickly ramping up to a medium or large-scale farming enterprise, you're probably better off developing relationships with grocery stores and other produce distributors from the outset.

Common sense will tell you that to enter the world of vegetable farm, you'll either need to start a new business or acquire a promising company on the business-for-sale marketplace. Although startup vegetable farms are common, many new entrepreneurs overlook the benefits of buying a vegetable farm on the business-for-sale marketplace.

THE PROBLEM

The study assessed the integrated Biosystem Farming Model at Cebu Technological University, Barili Campus during the inclusive years 2006-2010 as basis for a package technology.

Statement of the Problem

Specifically, it sought answers to the following problems:

1. What is the process flow in establishing an IBF?
2. Based of the data gathered on Integrated Biosystem Farming Model, what is its
   2.1 performance in terms of:
   2.1.1 cost
   2.1.2 productivity
   2.2.3 return of investment (ROI)
   2.2 environmental impact on
   2.2.1 soil nutrition and utilization
   2.2.2 ambient temperature, and
   2.2.3 rainwater conservation?
3. What are the problems encountered in the development of an Integrated Biosystem Farm?
4. Based on findings, what technology package could be developed?

Significance of the Study

The important contribution of this study is to provide a concrete sample model of an integrated biosystem farming that will lead to additionally increase interest of the land use towards maximum maximization. The findings of this study provide a package technology to be the tool of getting self sufficient way of living and serve as a profitable venture as an additional means of livelihood.

The study is beneficial to the following entities:

Agro-Fishery Industry. The result of the study would serve as an avenue for new business potentials. It would encourage agro-fishery industry on shifting integrated biosytem farming as a profitable venture which could contribute increase of food production, waste utilization and near-zero environmental impact.

Community. This result of the study would provide a show case for the maximum utilization of space both land, air and water.

Educational Institution. The study would be beneficial in many case to actively involve the academe as catalyst for inspiration and motivation towards the dissemination of the techno pack as an output of this research.

Farmers. This study resembles the common practice by the farmers tilled their own land. The researcher did the labor in the creation of the IBF as he put himself to the shoes of the farmers who efficiently applied the wise conversion of food energy into useful and creative works for the utilization of space and available resource found in the immediate surrounding to supplement income and meet daily food needs.

Government. It is the concern of the government to promote best farming practices to improve the standard of living of every farmers. And one of this best practices, is to help introduce the integrated biosystem farming to the farmers.

Researchers. This study opens new integrated biosystem technological horizon into a macro level practices to improve food production nationwide.

Students. The study will serve as a guide in the creation of an integrated biosystem. This will also serve as a sample model for a new farming system on biological integration.

THE RESEARCH METHODOLOGY

The research design used was a case study. The study laid out in the development of an Integrated Biosystem Farming Model to an area of three hundred square meter (300 m^2) at Cebu Technological University-Barili Campus from 2006-2010. The study assessed the IBF Model 1).establishing a process flow, 2) the performance in terms of cost, productivity and the return of investment and the environmental impact in terms of soil nutrition and utilization, ambient temperature and the rainwater conservation.3) the problems encountered in the development of an IBF and 4) the development of technology package.

The process flow was discussed from the site selection, IBF layout and plan design, material inputs, crops, poultry and livestock establishment, production, harvest and down to market.

The integrated biosystemfarm (IBF) productivity was computed per annum as total production income in a year and the development and operational cost were done per pond compartment as this was integrated with fish, crops and animals.

Return of investment was calculated annually for four (4) years to trace projection and trends of the IBF income production.

As pertained to the environmental impact in terms of the soil nutrition was analyzed in the Department of Agriculture Soil Laboratory and for the soil utilization, the soil was weighed with the respective polyethylene sizes and was multiplied by the number of the polyethylene used in the potted marcotted citrus. In terms of the ambient

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temperature was collected during summer at noontime and the amount of water was conserved was done by computation with its average size of the 15 fishponds if change water was practiced every three months.

About the problems encountered were listed down and its action taken in the entire operation of the study.

The gathered data were analyzed using the appropriate statistical tool and data processing would be followed. Based from the findings, a proposed technology package on integrated biosystem farm was formulated, as output of this study. The process flow of this study is shown in Figure 1.

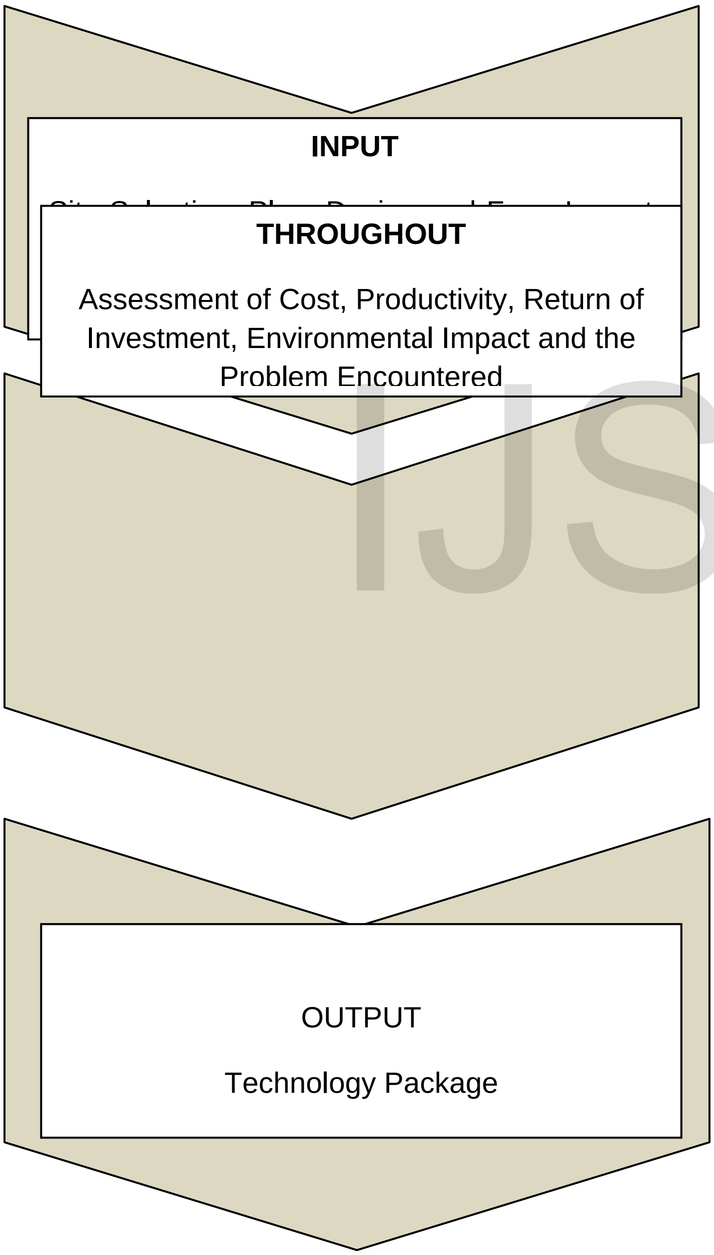

Figure 1. **The Flow of the Study**

Environment

The raising of fish and animals and planting of crops was conducted at Cebu Technological University-Barili Campus Compound. The University is surrounded by three Barangays such as the Brgy, Kalubihan, Brgy. Cagay and BrgyKabkaban.in which part of it is under with. The establishment of IBF was installed at the researcher's ... with a land area of three ... evation approximately 30 ... clay to clay loom. The ... in Figure 2.

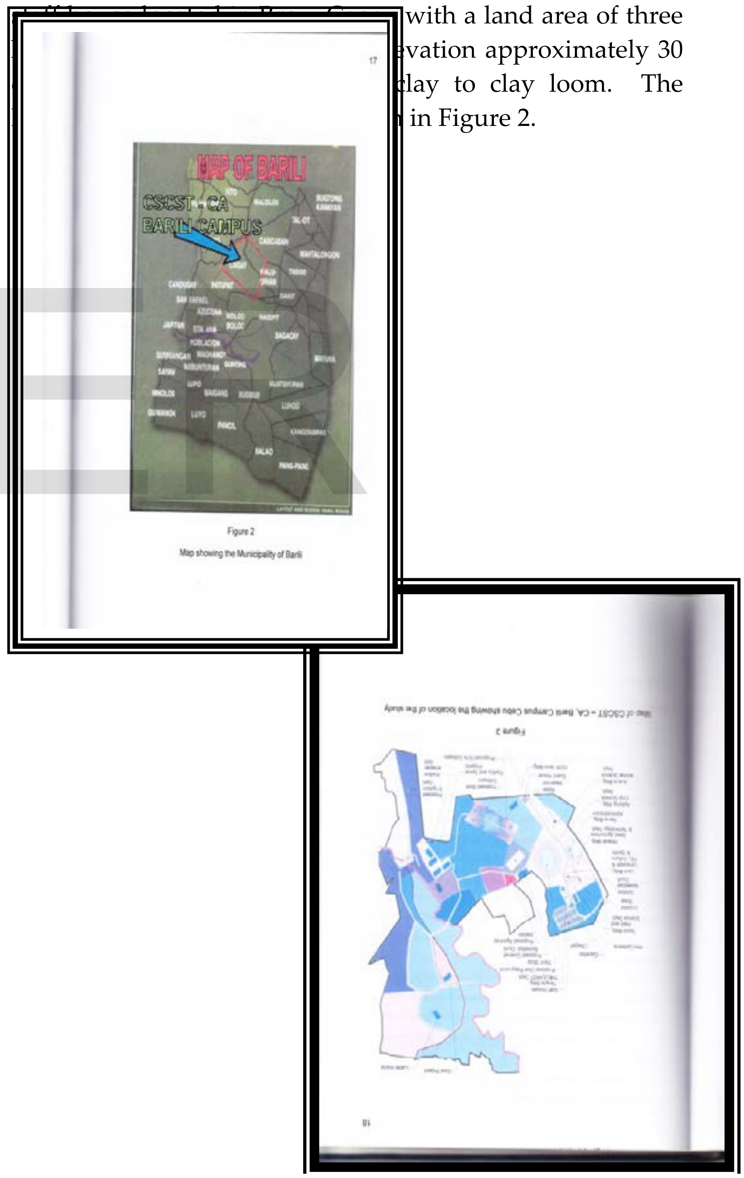

Figure 2. Map Showing the Location of the Study

Subjects

Fish Tilapia fingerlings were taken in CausinFishfarm in the town of Barili, Cebu. Some of the crop seeds were bought from one of the Agrivet supplies and vegetable vendors in the Barili and Carcar, Cebu . The animals such as chicken, quail , lovebirds rabbits, and earthworm were bought from the neighboring towns such as in Dumanhug and Carcar.

Fish such as tilapia, black moor, sword tail, black molly, guppy and carp were used from this study. Potted crops such as string beans, eggplant , tomatoes, creeping potato, Chinese kangkong, pepper, ampalaya, patola, malunggay, Table banana, jackfruit and marcotted citrus were also used from this study. Animals like rabbit, native chicken, lovebird, quail and earthworm were also raised and used from this study.

The researcher selected some fishes, crops and animals occupied and cultured in great number in a limited space according to organism maximum tolerability and according to farm plan and design.

Fish

Fishes are classified under the KingdomMetazoa and specifically belonged to Phylum Chordata under the classes of Chondrichtyes and Osteichtyes. These fishes might live in freshwater and marine water. They are heterotrophs or consumers for they entirely dependent to other organisms for their nourishment. In this study, freshwater fishes were selected and cultured in the area of 300 square meters. Table 1 presents the distribution of fishes and the number of ponds in percentage.

Table 1
Distribution of Fish of the Study

Fish	Number of Ponds per 7.5 m^2	Percentage
Tilapia	6	40%
Black Moore	1	7%
Black Molly	3	20%
Japanese Koi	1	7%
Sword Tail	2	13%
Guppy	2	13%
Total (n)	15	100%

With the given average area, it can be gleaned in Table 1 that tilapia ponds greatly occupied in the 300 square meter IB farming which gave the percentage of 40 %. This means that there were five (5) ponds were used for tilapia culture out of the 15 ponds designed by IBF. Black Molly culture was the second highest number of ponds used with the percentage of 20% which means three (3) ponds occupied by Black molly culture out of 15 ponds, This was followed by sword tail and platy culture and the guppy which occupied two(2) ponds at 14 percent. One (1) pond or seven (7) percent was used for culturing carp and black moore.

Each pond had an average area of 7.5 square meters. This implied that the total land area occupied by fishpond was about 105 square meters of the 300 square meters
IB Farm.

Crops

Crops are classified under the Kingdom Metaphyta. These occupy the bottom part of the food chain which are made-up of autotrophs or producers for they can manufactured their own foods in the process of photosynthesis. These crops are composed either of fast and slow growing plants that can be annual, biennial or perennial which are categorized into herbs, vines, shrubs or trees.

Potted Crops

Potted crops are those crops that have potential to be grown normally inside the pot. In this study, the chosen crops are the citrus, tomato, pepper, onion leaves, eggplant and pechay. Table 2 shows the distribution of crops and the number of pots in percentage.

Table 2
Distribution of Potted Crops of the Study

Crops	Number of Potted Crops	Percentage
(Citrus)	1000	86.96%
Tomato	30	2.61%
Pepper	30	2.61%
Onion leaves	30	2.61%

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eggplant	30	2.61%
pechay	30	2.61%
Total	1150	100%

It can be directly seen from the Table 2 that there were 1000 marcotted citrus or 86.96 % planted in a pot. The rest of the crops such as eggplant, tomato, pepper, onion leaves, pechay and tomato were only be given 2.61 % or 30 pieces of potted plant used to maximize the land area.

Ground Crops

Ground crops are crops that grew heavily in the ground. They are big and required more nutrients and space. The ground crops used in this study were the string beans, creeping patatas, ube, table banana and patola. Table 3 presents the distribution of ground crops and the number of plants in percentage.

Table 3
Distribution of Ground Crops of the Study

Ground Crops	Number of Plant Hills	Percentage
String beans	40	36%
Creeping Patatas	10	9%
Ube	10	9%
Table Banana	30	28%
Patola	10	9%
Jackfruit	10	9%
Total	110	100%

It is shown in the Table 3 that string beans were given highest priority of ground crops for it can utilize the air space by suspending relays of GI wire at the perimeter of the study. Number of string beans planted were 36% from the total number of ground crops. Table banana was followed at 27 % ad 9% jackfruit from the total number of ground crops for these was used in this study for it provides natural shadow of the fish and citrus plants. Creeping patatas, ube and patola were given the least number of plants planted at 9% each for it has a wide range creeping ability and broader leaves.

Animals

Animals are classified under the Kingdom Metazoa as multi-cellular organisms. They are heterotrophs or consumers that live on land, air, water or in other lives which are entirely dependent to other organisms for foods. In this study, the animals used were those that can provide directly or indirectly beneficial to man for meat, recreation, fertilizers and money such as chicken, quails, lovebirds, rabbits and earthworms.

Table 4 shows the distribution of animals and the number of cages in percentage.

Table 4
Distribution of Animals of the Study

Animals	Number of Cages	Percentage
Chicken	3	44%
Rabbits	1	14%
Lovebirds	1	14%
Quails	1	14%
Earthworms	1	14%
Total	7	100%

It is presented in the Table 4 that chicken were given the highest number of cages. Three (3) out seven (7) cages or 44 % was given for the raising of chicken. Rabbits, quail, lovebirds, earthworms cage was only one(1) cage or only 14%.

This implies that chicken produced more number of young and needed additional cages than the rest of the animals. And the other animals were used in the study for a continuous source of organic fertilizer for the plants.

Instruments

To assess the integrated biosystem farm, the following instruments were used in this study:

1. For the process flow was dealt with 1) the site selection 2) farm layout, plan and design, 3) material inputs 4) crop, poultry and livestock establishment, 5) production, caring and feeding practices, 6) harvesting and 7) marketing

2.1 For the integrated biosystem farming model was measured in terms of the performancefollowing:

2.1.1 Costpertained to the IBF development and operation was calculated every year from 2006-2010.

2.1.2 Productivity in which production of each organism in integrated biosystem was calculated every year started from 2006-2010;

2.1.3 Return of investments were computed every year from first year of operation. This was done by getting the net income of the year divided by the total expenses.

2. environmental impact on;

2.2.1 soil nutrition and utilization. For soil nutrition, the soil sample was brought to the Department of Agriculture for analysis. And the soil utilizationwas done by calculatingthe 10x10x 14 size of polyethylene filled with soil and multiplied by the number of garden plastics used to get the total mass.

2.2.2 ambient temperature was done by recording the temperature inside and outside the IBF.

2.2.3 rainwater conservation was determined through calculating the volume of water conserved in 15 fishponds with an average size of 16ft X 5 ft x 1.5 ft in which change water was done in every three months.

3 Problems encountered in the development of IBF were the infestation of insects, attacked and killed by stray animals, intruded by some animals,

4 Technology package was developed.

Procedures

The sequences of events in creating an integrated biosystem were as follows: (A) Farm layout , plan and design, (B) Pond construction, (C) Plant establishment, (D) Assessment, (E) Tabulation and analysis of gathered data and, (F) Output development.

A. Farm. Layout, plan and design is the blue print of the actual picture, shape, position and location of the farm with respect to the pond structure, land topography and plant arrangement. Design and plan requires sound and systematic set of activities, program of works which includes the necessary material, labor and other technological requirements needed for IBF formulation. To make design requires creative arts with harmony with respect to arrangement and interrelationships and interactions of the fish, crops and animals within the IBF. Figure 3 shows the shape and area measurement of the IB Farm.

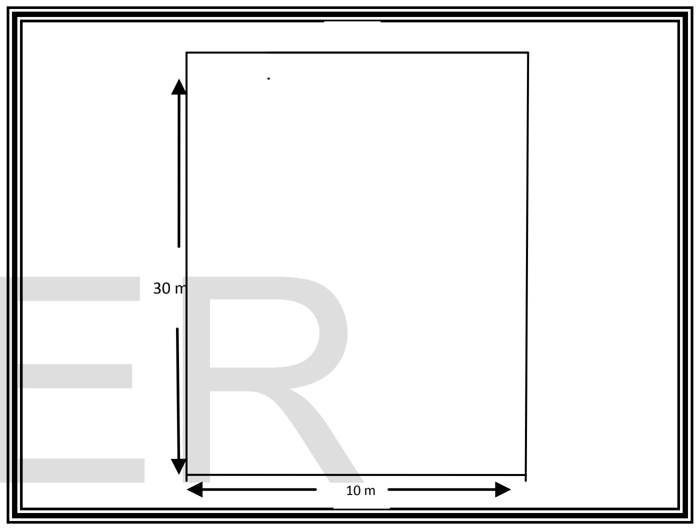
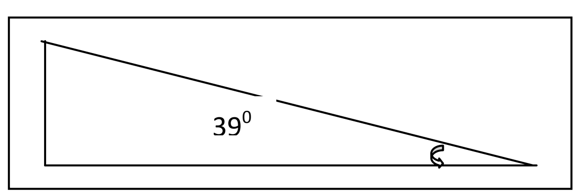


Figure 3.
Shape and Area Measurement of the Integrated Biosystem Farm

Figure 3presents the shape and area measurement of the integrated biosystem farm. It showed that the area of the farm was measured its length and width.. The area was determined through the use of formula A= LW. The computed area of the farm is 300 square meters. Figure 4provides the picture of the land topography, design and plan of the integrated biosystem farm..



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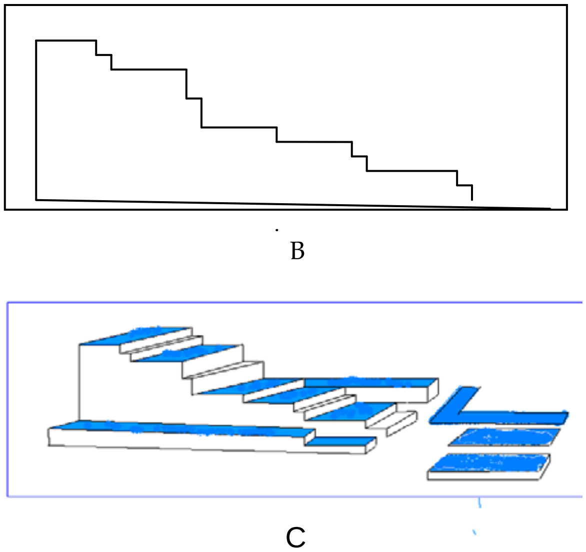

Figure 4
Land Elevation, Contour Terracing and Pond Design

Figure [illegible] showed that the land topography is presented on A has a [illegible] of 30°. Side view of the contour terracing in which a pond compartment was designed is presented on [illegible] The ponds were constructed by contour terracing by following its elevation. The [illegible] the pond which served as an actual picture of the pond formation. IBF layout and the pipe design is presented on Figure 5.

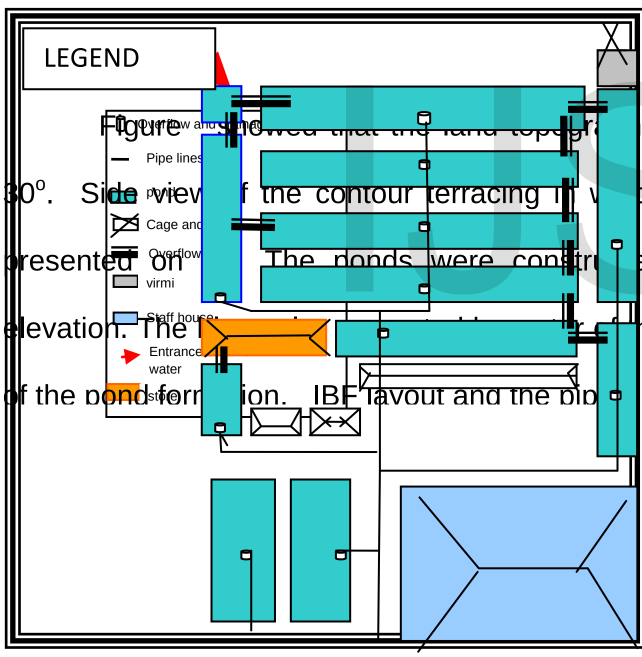

Figure 5
IBF Ponds and Piping Design

Figure 5 showed that the green color represented by fishpond and there were circular objects and connecting lines which represented by standing pipes and pipe lines that run underground at the center of the pond compartments. Heavy dark lines were the overflow pipes that transferred water the higher pond compartment to the lower pond compartment. Gray color box was intended for the vermiculture compartments where organic wastes were deposited and decomposed by the aid of earthworm. The orange color was the proposed display store of the farm products for sale. The blue and the white color were the researcher's staff house and the animal cages respectively.

B. Pond Construction is crucial and tedious works. It required precise measurement and enough pond strength to hold water. It is tedious for it required a big amount of manpower to carry the following sequential activities as shown in Figure 6.

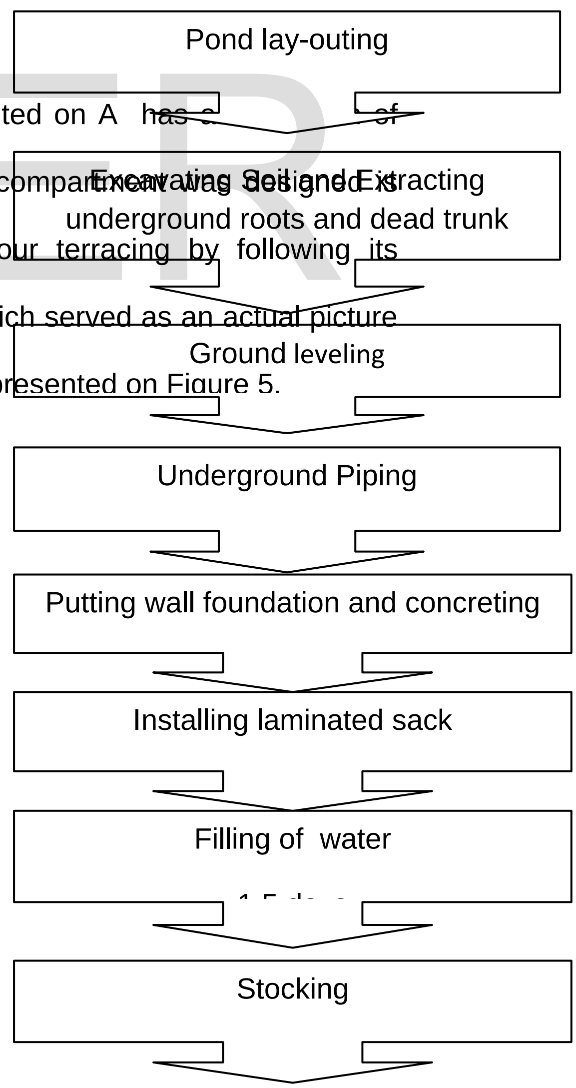

Figure 6
Steps in Making a Pond

Figure 6 shows the steps on making a fishpond. The diagram gave the direction and procedures in constructing a pond.

The steps involved in the pond making were followed;

Excavating of soil for dike formations, extracting of weeds, and underground roots and dead trunks.

Leveling is an activity took place with the used of leveling instrument such as the used of transparent hose commonly used by construction worker to find the correct land level. This is very important for the pond to have well leveled pond bottom in order to have uniform water level in both sides of the pond

Piping is done through setting of underground pipes to serve as water passage during the pond undergone change water. The pond water will be drained out when standing pipe inside the pond will be temporarily removed which allowed water to pass through the hole that passed to connected pipe lines designed for drainage.

Wall concreting of the pond measured 16 ft by 5 ft by 1.5 feet on its height , This height can be the water deep when the pond is filled with water. The study used ratio of cement, sand and gravel was 1:6:3. This means one sack cement, six sack of sand and 3 sacks of gravels for the wall construction.

Installing a laminated sack on 16ft by 5ft by 1.5ft. The sack was firmly fixed on the pond size. It was then clipped by a bamboo strip to keep the sack attached to the hollow blocks walls. The standing pipe was installed to the center by making a hole of the sack where drainage pipe is located. The standing pipe located at the center to get water balance from both sides of the pond served two functions as a overflow pipe and a drainage pipe.

Water filling and stocking were done after laminated sack was carefully fixed. The pond was ready to be filled with water at 20% level. After it stood for 5 days, the pond was ready for stocking. The fry should be acclimatized first by letting the vessel used temporarily submerged with entrance wide open in the pond water for 10-15 minutes until the fry adjusted the pond water parameter and swam freely. Pond layout and measurement is shown in Figure 7.

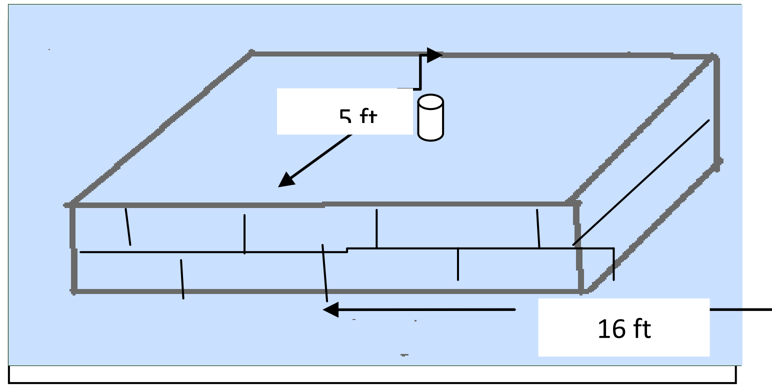

Figure 7
Pond Layout and Measurement

Figure 7 displays the pond lay-out with the measurement. It showed that the pond was measured 16 feet by 5 feet by 1.5 inches. Both sides were concreted except the floor. Ground pipe was buried at the center fitted with the elbow pipe where the standing pipe was installed. The standing pipe was served as an overflow and drainage pipe. This standing pipe was used during heavy rains in which there were plenty of water entered to the pond. And also this was used during change water and total harvest in which water should be drained out.

C. Plant establishment

After the pond construction. The plant establishment followed. It undergone the following activities such as preparing soil for potting media, marcottingcalemonden and planting crops. The soil medium was composed of 90 % decaying acacia leaves, 5% soil and 5%animal manure was practiced in this study. This was put in a 8 inches by 8inches by 14 inches polyethylene bag and watered for 5 days before these were planted with the specified crops and marcotted calamonden (Citrus). Figure 8 below shows the arrangement of the marcottedcalamonden in an integrated biosystemfarm.

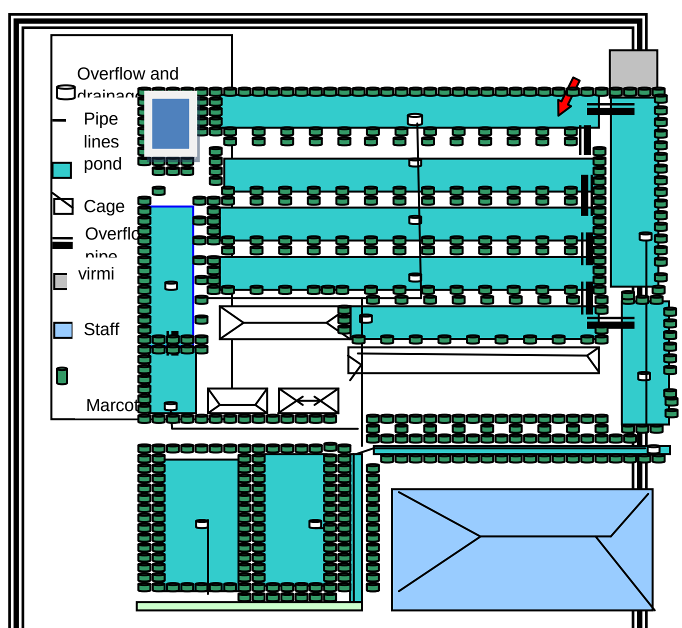

Figure 8.
Arrangement of Potted Citrus and the Establishment of Animals Cages

Figure 8 shows the arrangement of the marcotted citrus in an integrated biosystem farm. The small green cylindrical vessel was presented by the potted marcotted citrus in a polyethylene bag or garden plastic. As shown on the figure, the bagged marcotted citrus were arranged around the pond compartment that provided shade for the fish and the laminated sack from prolonged exposure to the sunlight. It showed also the location of the establishment of animals cages for chicken, quails, lovebirds, rabbits and earthworms.

D. Assessment of the Integrated Biosystem Farm (IBF)

Assessment of the IBF focused to the four (4) concerned such as the productivity, development and operational cost, return of investment and the environmental impact. The productivity was determined from the gathered data from the yearly production income within 4 years production operation intended for the study. The development and operational cost was done per pond compartment. This included the material and labor costs, and overhead cost. For the IBF return of investment was calculated every year. The average income was determined for the 4-year production operation. This part presented the tabulation and analysis of the data gathered.

E. Output development and formulation of the techno-pack of IBF.

Technological package of the integrated biosystem farm was formulated based on the result of the study.

Statistical Treatment

The data gathered were treated using the following statistical treatments:

1. **Percentage.** This numerical analysis was used to determine the budgetary allocation of materials labor and equipment cost of fish, crops and animals and its distribution . .

   P = f/Nx100%

   Where:

   P = percentage

   f = frequency

   N = number of cases

2. **Average Mean**. This was used to determine the average size of fishponds The formula is:

   X = ∑X/N

   Where :

   X = Average mean

   ∑X = Total Area of the Ponds

   N = Number of ponds

3. **Return of Investment (ROI).** This was used to evaluate the justification of investing the project. The formula used is:

   ROI = net income / total investment

DEFINITION OF TERMS

To ensure the clarity in the presentation of the research and other pertinent information, the following terminologies are conceptually and operationally defined.

Ambient Temperature. It is the amount of hotness and coldness of air that was measured inside the IBF. It used a unit that was expressed in degree centigrade (^{o}C).

Crops. These are the fast growing and fruit bearing plants planted in the pot and in the ground. In the study. It used the selected plants such as citrus, eggplant, onion leaves, pechay, pepper, banana , patola, creeping patatas, etc were planted in the pot or in the ground.

Cost. This is the cost incurred during the development and operation of the study such as the construction, planting, poultry, and livestock materials, feeds, water, medicines, power, transportation

Livestock. In this study, it is operationally defined as those animals that cannot be put in cages like Tilapia and ornamental fishes.

Integrated Biosystem Farming. This refers to the farming system enterprise where fish, crops and animals play a major role for a productive interaction in an integrated biological ecosystem.

Rainwater conservation. This refers to the volume of conserved rainwater as it is used in the fishponds. Rainwater from the roof gutter and in the pavement were collected to the ponds to raise Tilapia and ornamental fishes.

Return of Investment. Thisis the amount of money was returned after the operation which can be calculated by net income divided by the total expenses.

Poultry. This refers to a number of chicken, quails, rabbits, lovebirds and earthworms as chosen animals used in an integrated farm for their manure and profitability.

Process Flow. In this study, it refers to the sequential activities to be done in establishing an integrated biosystem farming such as the site selection, IBF layout, plan and design, material input, crops, poultry, and livestock establishment, production, care and feeding practices, harvesting and marketing.

Productivity. As used in this study, this is referred to the difference of the gross annual income and the development and operational cost of the IBF.

Soil Nutrition. It is operationally defined as the amount of nutrients present in the soil that are essentials for the normal growth of the plants such as the nitrogen, phosphorous, potassium, other trace minerals and organic materials.

Soil utilization. This is referred to the volume of soil was being utilized in the potted plants in a established IBF. For instead of garden soil, it used decomposing leaves of rain tree and acacia leaves.

Technology Package. This refers to the output which included the study rationale, objectives, materials and equipment, and procedure used in the creation of an integrated biosystem farming which have been studied its productivity and sustainability. This is useful in the dissemination of the tested IBF to the small farm entrepreneurship.

Chapter 2
REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents the related literature, which the researcher reviewed, from the books, journals, website links and other unpublished materials which has some bearing on the study. It also presents some findings of related literature and studies.

Review of Related Literature

With its emphasis on holistic, multi-component design, permaculture can contribute valuable insights relevant to biosystem development. The overall design philosophy of permaculture, plus particular design principles such as sector/zonal planning, closed systems and species complementarity an be applied when setting up many forms of integrated biosystem. The overall aim of permaculture is to construct a balanced production system that mirrors a real ecosystem. The aim is to minimize the amount of land under cultivation while maximizing ecosystem services from the surrounding landscape, and in this respect permaculture systems represent good models of sustainable land use. Because no designs are perfect there should be an openness to change, experimentation and improvement. The relative advantages and efficiencies of different alternatives should be evaluated. (Millington, 2000)

Life cycle analyses and cleaner production strategies for assessing and minimizing the environmental impacts from production and consumption be used. This would allow a review of the opportunities in an integrated biosystem in order to optimize the interplay of the components and ensure that full use is being made of different parts of the system. Several authors stress the increases in efficiency that can be achieved by biosystem integration when compared to conventional monocultures as proposed.(Pagan and Greenfield,1998)

Doelle's, 1996 designs for biorefineries for processing biomass are good examples of how genetic, biochemical and other forms of biotechnology can be applied to produce a rich diversity of products. A single integrated biosystem may produce biogas, microbial protein, mushrooms, compost, animal feed, ethanol, antibiotics, vitamins and acids.

A major concern in contemporary Australia is water conservation, and the multiple use of water that illustrates on how aquaculture, hydroponics and modern plastic house technology can be effectively integrated with irrigated agriculture. Models of optimal water use developed in Israel and other countries where water has always been a scarce and expensive resource can be used as reference points for Australian systems. (Peterson, Kumar, McVeigh, Tay andGooley and Gavine,2000)

Integrated farm provides encouragement for other producers keen to explore options for low-cost diversification and the production of high-quality fish in an environment where pesticides are conventionally used on crops such as cotton and grain. (McVeigh's,1996)

Such integrated, water efficient solutions can help to solve important environmental problems such as soil and water salinity, ground water contamination, reduced river flows and ecological pollution. A parallel concern to water management is waste management. (Tay,1996)

Capeness, 2000 indicates how large-scale vermiculture can be used to process a wide variety of organic wastes, and that new system designs greatly increase the intensity of production while minimising the land area required. Additionally, the vermicompost produced by these systems is almost pure humus. It acts as a rich carbon energy source and contains high densities of beneficial bacteria and useful quantities of non-leachable macronutrients, trace elements and rock minerals.

Iker and Monk, 1993 similarly highlight the role of manures and green matter in conditioning and protecting the soil and reducing disease and pest problems.

Iker,2004, stresses the advantages of integrating animal husbandry with cropping, so that organic soil quality can be maintained by manuring in areas where all above ground plant matter is removed for silage. Warburton and Hallman note the high efficiency with which insect larvae can reduce a wide variety of organic materials and convert them to a high-protein food source for livestock or fish. Despite the development of successful insect-based systems overseas, there has been little recognition of their potential in Australia.

In a global overview of biosystem integration, Foo notes that while traditional IBs tend to be labour intensive, low-input, micro-level systems, the new millenium will bring challenges that will make integrated biosystems relevant solutions at larger dimensions. Global challenges will include the sustainable use of natural resources and biodegradable wastes from cities and farms in the interests of food security and poverty reduction. Integrated biosystems can contribute to solutions through diversification, intensification and urban agriculture.

In a similar vein, Ziebarth, 2006 contends that reliability and intensity of production must complement sustainability. To these ends, Wilson identifies a trend towards the convergence of different technologies - such as aquaculture, agroforestry,
hydroponics, probiotics and aeroponics - to create new opportunities in both food production and waste management.

Gooley and Gavine, 2000 contend that, while relevant to subsistence scale enterprise, an integrated systems approach in a developed country like Australia will see the greatest flow of benefits to rural and regional communities through the adoption of industrial scale enterprise.

Integrated biosystems can enhance local economies in a range of ways - for example, by minimising the need to import chemical fertilisers (Capeness; Iker,1998) or foreign oil (Doelle,2002); by allowing farmers to diversify into additional value-added areas (McVeigh, 2006); by helping to meet potential new markets for tradeable emissions such as salt and nutrients (Gooley and Gavine, 2007); and by creating jobs in new sectors (McKinnon et al. 2000; Harris and Glatz; Wilson, 2001)..

There can be no one "ideal" integrated biosystem, as each application will have different constraints, abilities and aims. At the same time, model or example systems can be used as starting points for site-specific applications so that each system suits local conditions, resource availability, the enterprise mix and the individuals concerned. This will avoid pushing up input costs by excessive demand and depressing the value of outputs by oversupply.(Harris and Glatz and Kumar, 2000)

IB principles can be applied, at different spatial scales, to the design of human settlements. At both levels the guiding principles are the same - circular flow and closed loop ecosystems. Biosystem principles lie at the heart of designs for self-contained communities where recycling of grey water and domestic wastes is coupled with renewable energy use in order to grow food and increase resource economy - these technologies are already crucial in ecologically sensitive locations such as barrier reef islands. (Hallman, 2003)

In the context of integrated catchment management, a biosystem approach can increase options for land use planning by placing the emphasis more on the functional integration of complementary activities (e.g., by using vermiculture to process wastes from dairy/pig/fish farming, or by combining cane/grain growing with fuel generation), rather than merely on the balanced coexistence of existing practices. Biosystem integration offers a context within which producers and other practitioners with different skills can combine complementary expertise, equipment and other infrastructure to their mutual advantage. Such developments also stimulate a search for the scale at which system efficiencies and economic returns can be optimized. Integration can be facilitated by the formation of local cooperatives and clusters, which help to unite communities in a common purpose. Initiatives such as these help to build community by encouraging communication, social exchange and sharing (Hallman, 1997).

It has been argued that prerequisites of sustainability include a strongly democratic civil society as well as the development of economic and ecological alternatives such as green cities, clean production and biologically diversified forms of agriculture (O'Connor 1994).

In more general terms, integration also encourages a better awareness of relationships between the biophysical and socioeconomic environments and factors that constrain or enhance the viability of sustainable options. Such awareness is crucial to the development of informed policy with respect to the integrated sector, and is best be fostered through multidisciplinary programs involving specialists who share an holistic perspective. Ultimately, the selection of the correct technology for an integrated biosystem requires a careful study of economic viability, government policy, regulatory direction and market opportunity . Spencer's paper indicates that IB developments have to be integrated into a broader framework of natural resource management. Both regulation and planning are available as instruments to facilitate these processes byalleviating constraints and maximizing opportunities, but regardless of the type of mechanism, decision-making has to be underpinned by community acceptance. The most effective moves towards sustainability will be those that recognize that resource use, environmental protection and quality of life are interconnected issues that demand to be considered within a common, holistic framework. ((Spencer 2000).

Several aspects of biosystem integration are consistent with the achievement of key sustainability objectives such as ecological integrity, live-ability and equity. In the interests of intergenerational equity, new legislation that places a greater emphasis on preventative action means that (a) waste streams will have to be treated as resources to be recycled or reused, and (b) waste production will have to be reduced or prevented through the efficient design of entire industrial processes (Wright and Clague 2000).

Similarly, with respect to the liveability of the physical environment, integrated planning legislation (e.g., the Integrated Planning Act, Queensland 1997) requires the specification both of desired environmental outcomes and quantitative performance indicators with respect to measures of carrying capacity (Wright and Clague 2000).

Biosystem integration lends itself to the definition of clear performance indicators and measures of efficiency. Some indicators of the sustainability of integrated biosystems include species diversity, bioresource recycling, natural resource systems capacity and economic efficiency (Lightfoot et al. 1996).

In terms of achieving the objective of ecological integrity, the similarities between integrated biosystems and natural ecosystems help to define a common framework within which appropriate approaches to production and natural resource management can be developed. Indeed, large-scale natural ecosystems (e.g., lakes, forests, and grasslands) as well as smaller-scale mesocosms (e.g., soils, digesters, and ponds) can form vital components of integrated biosystems. There is a growing awareness of the cost-effective services provided by properly functioning natural ecosystems (e.g., water purification, nutrient cycling, soil enhancement, pollination, carbon sequestration, nitrogenfixing), and of the need for improved awareness of ecosystem processes and their potential economic benefits (Daily 1997; Cork and Shelton 2000).

Unlike conventional production systems, integrated biosystems are intrinsically diverse and emphasisepolyculture and mixed farming rather than monoculture. In this espect they more closely emulate natural ecosystems. Natural ecosystems can be highly diverse (i.e., contain many species) and complex (i.e., exhibit many connections between species in the food web). However, in such systems the component species and sub-systems are not connected at random, and the stability of the system as a whole (i.e., its capacity to resist environmental stress) depends on the sub-systems being loosely coupled (Kikkawa 1986).

The same is true of integrated biosystems, where high overall diversity and strategic links between component activities help to maintain relatively stable yields from the system as a whole and thus minimize economic risk. Natural ecosystems have inspired a wide range of models for balanced and diverse production systems (e.g., permaculture designs). The integrated biosystem approach increases the usefulness of component species - e.g., by using legumes and water ferns to fix atmospheric nitrogen for use in the system as a whole, and by utilising duckweed and other floating aquatic plants to convert dissolved nutrients to protein-rich feed for fish, livestock and humans. It is worth noting that while some such species (e.g., water hyacinth and Salvinia) are normally regarded as "pest" organisms in natural waterways, their aggressive growth can make them a positive asset in an integrated biosystem context. More imaginative use could be made of native Australian species and this is an area requiring further research. A planned approach to IB development will ensure that the potential of IB is maximised in a context of appropriate land use (Ziebarth, 1984)

The optimal use of locally produced materials. For example, the establishment of bio-refineries requires knowledge of land and biomass availability, crop biodiversity, maintenance of soil fertility crop yields, local population growth and demand, and the production of livestock and animal manures (Doelle, 2003).

Intelligent planning will also help to bring producers and consumers closer together so as to improve resource use efficiency, protect valuable agricultural land and reduce storage, preservation, packaging and transport costs - thereby aiding local self-sufficiency and food security (Lines-Kelly, 2006).

Community models that satisfy the requirements of both land and community development already exist - for example, in the form of mixed enterprise farms that blend activities such as market gardening, nursery operations, livestock farming, flower and bush tucker production, farm tourism and art and craft production (Mitchell and Rooney, 2001).

The integrated biosystem approach can provide sustainable methodologies to help realize the vision articulated in regional plans. By way of example, the SE Queensland plan envisages discrete human scale urban areas framed by green open space; the clustering of mutually supportive economic activity; urban form that is well defined, integrated and efficient in its use of land and energy; protection of natural assets such as air, water, forests, landscapes and biodiversity; a focus on waste minimization and environmentally responsible technologies; and ongoing participation and commitment by all sectors of the community (QDLGP 1998).

Biosystem integration encourages holistic, systems-level thinking in which the dynamics of interconnection and interdependence are as important as the components that are connected. Thus, it helps to raise awareness of flows and transfer processes and develop a conceptual framework for effective resource management. It also promotes flexibility, adaptability and openness to new possibilities and experimentation. These are essential if innovative design solutions are to be found.

The Integrated Bio-Systems: A Global Perspective that provides the holistic approach to utilize a resource fully is not a new concept or a new practice. It is common sense. (Jacky Foo, 2000)

The Integrated Farming for Sustainable Primary Industry: Water and Nutrient Recycling through Integrated Aquaculture. SARDI Aquatic Sciences Centre has significantly enhanced agricultural production and sustainability in many parts of the world. An underlying process in integrated farming is recovering resources such as nutrients and water for reuse. This improves the sustainability of the system and minimizes environmental pollution. The incentive to reclaim nutrients from wastewater, releasing clean effluent and simultaneously producing fish has proved successful in many parts of the world. The South Australian Research and Development Institute (SARDI) is actively involved in projects promoting sustainable farming practices and the integration of aquaculture with more traditional land based farming. Consequently SARDI hosted a national workshop, "Integrated waste water treatment and aquaculture" on the 17-19th September 1999, which proved a landmark national event, to progress the development of sustainable farming practices into the next millennium. This national workshop brought together international speakers from Australia, India, Vietnam, USA, Samoa and Malaysia. The event also brought out some excellent papers on integrated farming all over the world. When an industry must comply with environmental standards that require treatment of effluent, it often constitutes an added operational cost. However, if the treatment itself produces income, minimizes pollution and complies with environmental standards, it not only increases the profitability, but also enhances the sustainability of the industry. The 'waste' which provides income by producing a valuable product in effect becomes a 'resource'. While treating the organic waste produced by livestock, a number of by-products such as bio-energy (gas and heat), aquaculture products (fish) and aquatic plant and agricultural products can be produced(Martin S Kumar,1996)

Integrated farming systems with aquaculture as a component differ greatly from traditional extensive and intensive farming systems. In the process aquaculture is used as a tool for recycling wastewater and recovering nutrients. Nutrient recovery is facilitated by combining dissolved nutrients in the water with energy from sunlight to promote primary and secondary production as useable organic material for consumption by aquatic organisms (eg fish). (Ryther 1990; Edwards 1990).

Chapter 3
PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter presents, analyzes and interprets the data gathered based on the results of the study conducted on the integrated biosystem farming. The results of the study are therefore categorized into four major components:

Part I provides the process flow of establishing of an integrated biosystem farming.

Part II presents the assessment of the integrated biosystem faming performance in terms of cost, productivity, return of investment and the environmental impact on soil nutrition and utilization, ambient temperature and the rainwater conservation.

Part III deals on the problems encountered in the development of an IBF

Part IV presents the findings in which technology package could be developed.

THE PROCESS FLOW OF ESTABLISHING AN INTEGRATED BIOSYSTEM FARMING (IBF) MODEL

The Process Flow

In every single work there's always a process flow that served as the sequence of activity to be done in order to facilitate work and expect better outcome. In this study the process flow undergone by the study in establishing an IBF were the following 1) the site selection 2) plan, design, and lay out 3) material input 4) fish, crops, poultry and livestock establishment 5) production, care and feeding practice, 6) harvesting and 7) marketing.. And each of these major processes contained specific activities that was performed in the development of an IBF Model. The list of sequential activities performed in the site selection,

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planning, designing and lay outing, procurement of materials, fish, crops, poultry and livestock establishment, production, care and feeding practice, harvesting and marketing is presented in Table 5.

Table 5

List of Sequential Activities Performed in the Process Flow

ACTIVITIES
1. Site Selection
1.1 Water Supply
• planning for the installation of gutter
• installing of gutter
• fixing of the polyvinyl chloride (pvc) pipes
1.2 Types of soil
• Collecting samples
• Referring soil sample to book and to soil science professor
• Subjecting the soil to absorption rate
1.3 Topography
• making hole for the post
• fixing the post in the hole
• connecting the line into the two posts
• getting the level of the line
• Measuring the angle of the slope
1.4 Vegetation
• Preparing the necessary tool
• Partial clearing, cutting and uprooting of weeds and shrubs
• Cleaning up of debris and left over
1.5 Drainage
• Planning and estimating the number of S 500 pvc pipes, elbows, coupling,
• Burrowing the ground for the pipe lines
• Installing the pipes
1.6 Free from floods
• Observing and recording the area during the rainy days
• Creating a diversion canal
• Making a contour terracing landscape

3.2.2 Filling of bagging the garden plastics with manure aure leaves
3.2.3 Planting of the ground crops
3.2.4 Transferring the harvested marcotted citrus into the
3.2.5 Planting the seedlings into the ground and into the
3.2.6 Arranging potted marcotted citruses in the
3.3 Poultry and Livestock Establishment
3.3.1 Poultry
3.3.1.1 Measuring the pond perimeter
3.3.1.2 Cutting the lumber and bamboo strips into speci
3.3.1.3 Carpentry
• frame
• Flooring
• sidings
• roofing
3,3,1,4 putting on the top of the ponds
3.3.1.5 stocking of the poultry animals
3.3.2 Livestock
3.3.2.1 Measuring and lay outing of the area
3.3.2.2 Putting boulders and gravels in the fo
3.3.2.3 Cutting and fixing the iron bars in the
3.3.2.4 Mixing masonry materials and filing c blocks
3.3.2.5 Rechecking the perimeter size of the p the carpentry work
3.3.2.6 carpentry
• framing
• siding
• roofing
3.3.2.7 stocking of the rabbits and earthworm
4. Production, Caring and Feeding Practiced
4.1 Production
4.1.1 Fish
4.1.1.1 Rearing
4.1.1.2 Breeding
• separating the brood stock
• putting the brood stock to the spawnin
• transferring the brood stock to other compartment
4.1.2 Crops
4.1.2.1 Citrus marcotting
• Preparing the stem cutting knife and the plastics
• Putting the wet clay soil in the sized plas
• Girdling the matured stems at one inch
▪ Putting and tightening the wet clay soil i the sized plastic to the girdled stem
• Waiting for the root establishment
▪ Harvesting the marcot citrus
4.1.3 Other crops
4.1.3.1 Seeds
• collecting the matured ovule from the fr
• Germinating
• Transferring the young seedlings to the individual basin
• Revitalizing the seedlings
• Planting
4.1.3.2 Bananas suckers
• Planning and making holes of the area
• Removing of the suckers from the moth
• Planting the suckers
4 .1.4 Poultry

remarkab were fol topograp easy me supply o spoiled pl Water Su should be flow shou rich ipp a study, th supply f

productively even below 30 centimeters deep. It negated of what is ideal.
Soil. The soil should be sticky or clay loam which was enough to hold concreted water and dikes.
Topography. This is a relied feature of the land or the physical appearance of land area whether it is a plain or mountainous. A good site should be elevated from the lowest level of the land surface.
Vegetation.. This characteristic included the growth of trees, grasses and other plants covered in a certain area within the IBF. A good and productive site must have scanty vegetation. The dike should be free from tree's roots.
Drainage. The site must be at least 2-3 ft higher than the lowest land level, so it can be easily drained. Proper drainage is important to make harvesting , leveling of the pond, and change water easy.
Free from flood. The suitable area should be free from flash floods Fishponds located along riverbanks are usually flooded during the rainy seasons and are usually less productive that those located in plains where flood water is not known.
Market survey. IBF products command a good price if these reach to the consumers/buyers in a very healthy conditions which travel at the least possible time.
Supply of crops, poultry and livestock materials. The supply of stock is important. The availability of the crops, poultry and livestock materials all year round make the IBF can possibly run under all conditions.
Cheap supply of skilled labor. Supply of cheap skilled labor is available all year round to make production continuous. The skilled labor such as the carpenter and the mason were used to perform in the cage and pond construction activities such as following: excavating and extracting underground roots and dead trunk, ground leveling, underground piping, putting wall foundation, cutting the corrugated bars, placing the cut bars to the layout, mixing masonry material and filing the hollow blocks, Installing the laminated sacks,measuring the perimeter of the ponds,cutting of lumber into specific measurement, carpentry on frame, floor, siding, and roof,

Table 5 also presents the specified different activities in the establishment of an IBF of fish, crops, poultry and livestock. Fish, poultry and livestock establishment activities, it started with the canvassing and purchasing of the needed materials and tools, planning and lay outing, measuring, and performing masonry and carpentry works and then stocking of the intended animals.. Meanwhile in the crop establishment, remarcotting of citruses was practiced.

As noticed there were major and sub activities performed in the process flow.

IBF planning designing, and lay outing was focused particularly to the pond and cage construction . It planned the area for contour terracing and designed for an IBF of fish, crops, poultry and livestock were raised.

Inputs of the IBF. These were the needed materials and labor in establishing crops, poultry and livestock. The list of the needed materials labor is presented in Table 6.

Table 6

Inputs Needed in the Development of an IBF of Fish

NO	Materials	Unit	Qty	Cost/ Unit	Total co
1	cement	sack	20	195.00	3900.00
2	hollow blocks	pc	400	9.50	3800.00
3	corrugated bars	pc	30	50.00	1500.00
4	sand	cubic meter	4	950.00	3800.00
5	gravel	cubic meter	2	950.00	1900.00
6	2" S-500 PVC pipe	pc	20	65.00	1300.00
	2" S-500				

It can be gleaned from the Table 6 that there was twelve (12) materials and three (3) tools needed with varying units, quantity, cost per unit , the total cost and its technological uses. These were the needed materials and the total budgetary allocation cost for the whole IBF construction in the entire duration of the study.

The steps involved in the construction of fishponds were the following: lay-outing, excavating the soil , extracting underground roots and dead trunks, pond leveling, installing underground pipes, filing a hollow blocks for the wall formation, installing and fixing a laminated sack, putting a standing pipe, filling of water and stocking of fry. Fish monitoring and feeding were became a routine activities until the fish reached the marketable size. percentage of the allocated cost in the development of an IBF of fish. is presented in Figure 9.

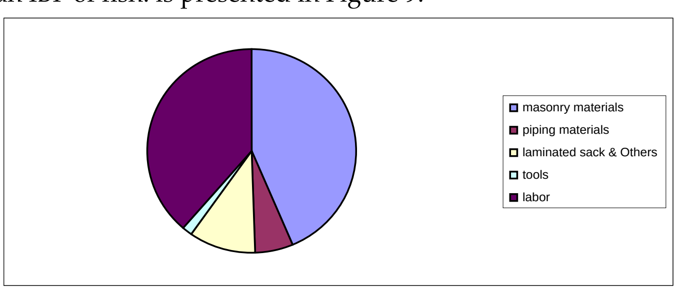

Figure 9

Percentage of the Allocated Cost in the Development of an IBF of Fish

The Figure 9 above indicates the allocated cost for the masonry materials, piping materials, laminated sack and accessory and the labor needed for the development of fish. It was observed that the masonry materials had the highest percent cost allocation of 49 %. And it showed also that the labor cost was next with 37% budgetary allocation cost in the development of an integrated biosystem of fish.

This implies that greater number of masonry materials were very much
necessary for the development of an IBF of fish. The price was also considered quite expensive which contributed much to high percentage of the allocation cost.
Labor cost was second from the masonry materials yet this was overcame since the researcher did it alone for he put himself to the shoes of the farmers. This means that this study was farmers' based integrated biosystem farm since farmers were well rounded and knew everything in a construction of a farm. The material inputs needed in the development of an integrated biosystem of crops could be seen in Table 7

Table 7 below presents the six major items needed in the development of an integrated biosystem of crops. It showed the number of polyethylene bags, enumerated planting media and planting materials, number of tools and a number of work force. It can be directly observed that planting media, marcottedcalemonden contributed to a big amount of cost if these were bought in the local market and the labor cost if the two persons have been compensated for 14 days used in potting the media and planting the crops. If this study could be done alone by the farmer itself re-marcotted the marcottedcalemonden, utilized the planting media found and wasted in the ground and the wise used of time and energy potting the planting media and the planting of the crops, then the table evidently showed that it saved the cost of one hundred eleven thousand nine hundred pesos (P 62,650.00). Ninety three and ninety seven percent (91.81%) was saved in establishing an integrated biosystem of crops. The percentage allocated cost in the development of an integrated biosystem of crops is shown Figure 10

Table 7
Inputs Needed in the Development of an IBF of Crops

No	Materials	Unit	Quantity	Cost/Unit
1	Polyethylene bags			
	1.1 10"x10"x 14"	pc	500	6.00
	1.2 8 x 8 x 10"	pc	300	2.75
	1.3 6 x 6 x 8	pc	200	2.00
	1.4 4 x 4 x 6	pc	200	1.00
2	Planting Media			
	2.1 *Soil	cubic	2	950.00

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		meter				
	2.2 *Manure	sack	20	90.00	1800.00	for planting material
	2.3 *Decaying rain tree leaves	sack	200	20.00	4000.00	for planting material
4	**Crop seeds/planting materials**					for planting material
	4.1 tomato	pack	1	45.00	45.00	for planting material
	4.2 patatas	kilo	1	50.00	50.00	for planting material
	4.3 eggplant	kilo	1	45.00	45.00	for planting material
	4.4 patola	pack	1	45.00	45.00	for planting material
	4.5 onion	bunch	1	40.00	40.00	for planting material
	4.6 ampalaya	pack	1	45.00	45.00	for planting material
	4.7 string beans	kilo	1	20.00	20.00	for planting material
	4.8 kangkong	pack	1	50.00	50.00	for planting material
	4.9 pepper	kilo	1/2	50.00	25.00	for planting material
	4.10 * Marcottedcalemonden	pc	1000	50.00	50,000.00	for pond protection
	4.11* banana suckers	pc	30	25.00	750.00	for pond protection
	4.12 Jackfruit seedling	pc	10	-	-	for border
5	**Tools**					
	5.1 Twig cutter	pc	1	250.00	250.00	for cutting marcottedcalemonden twigs
	5.2 hand trowel	pc	1	120.00	120.00	for scooping and transferring soil
	5.3 shovel	pc	1	250.00	250.00	for tilling and mixing plant media
	5.4 digging bar (wide blade)	pc	1	260.00	260.00	For uprooting and excavation
6	*Labor	person		150.00/day	4200.00	manpower
	mason		1	for 14 days		
	carpenter		1			
				TOTAL	**68, 240**	

*** no cost**

Figure 10 presents the percentage allocated cost for the polyethylene bags, planting media, planting materials, tools and labor needed for the technological requirements in the development of an integrated biosystem of crops. A close looked to the bar graph provides a succinct idea that the planting materials have the highest allotted budget of 85.55% for the IBF development of crops which mainly contributed by the price of marcotted citrus. This was followed by the cost of planting media of 6.47% from the total cost.

This implies that marcotted citrus as the secondary crops of the IBF and the labor were costly and expensive. Yet, in this study the marcottedcalemonden were also re-marcotted and the wise conversion of energy through a hobby of collecting manure and decayed rain tree leaves and acacia aure. Vermi composting was also established for the utilization of IBF and household waste.

This means planting materials and labor cost could be eliminated from the list of the budgetary allocation through mother seeds and re-marcotting technique and do it alone with full of fun, initiative, common sense, perseverance, skills, positive attitude and outlook to have an objective work. The inputs needed development of an integrated biosystem of poultry and livestock is presented in Table 8.

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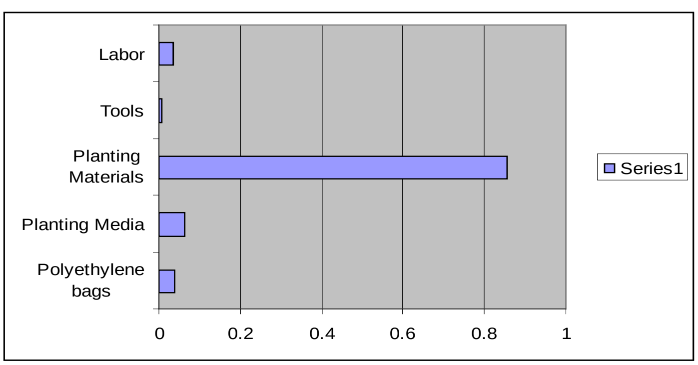

Figure 10.
Percentage of the Allocated Cost Needed in the Development of an IBF of Crops

Table 8
Inputs Needed in the Development of an IBF of Poultry and Livestock

No	Materials	Unit	Quantity	cost/Unit
1	**Construction Materials**			
	1.1G.I Roof Sheet Gauge #24	sheet	8	23
	1.2 Lumber	pc		
	1.3 1 x 2 x 8	pc	14	35.0
	1.4 2 x 2 x 8	pc	4	75.0
	1.5 Bamboo poles	pc	4	50.0
	1.6 G.I Nails			
	1.6.1 1"	kg	1	52.0

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	1.6.2 2.5"	kg	1	52.00	52.00	for fixing
	1.7 chicken wire	m	6	55.00	330.00	for the sidings
	1.8 umbrella nails	kg	1	60.00	60.00	for fixing the Roof
	1.9 pail	pc	1	50.00	50.00	for water carrier
	1.10 hinge	pair	6	15.00	[illegible]	for connecting to [illegible]
2	**Tools**					
	2.1 hammer	pc	1	150.00	[illegible]	[illegible]
	2.2 screw driver	pc	1	100.00	[illegible]	[illegible]
	2.3 cross cut saw	pc	1	250.00	[illegible]	[illegible]
	2.4 wrecking bar	pc	1	275.00	[illegible]	[illegible]
	2.5 pliers	pc	1	120.00	[illegible]	[illegible]
	2.6 thin cutter	pc	1	175.00	[illegible]	[illegible]
	2.7 electric drill	pc	1	1600.00	[illegible]	[illegible]
3	**Masonry Materials**					
	3.1 cement	sack	3	195.00	585.00	component
	3.2 gravel	m³	0.5	950.00	475.00	component
	3.3 hollow blocks	pc	100	9.50	950.00	component
	3.4 sand	m³	0.5	950.00	475.00	component
	3.5 9 mm corrugated bars	pc	8	50.00	400.00	For strength
4	**Operational Materials/Animals**					
	4.1 Waterer	pc	1	35.00	105.00	for providing water
	4.2 Feeds	sack	2	750.00	1500.00	for food supplement
	4.3 Rabbits	pc	2	175	350.00	organic fertilizer source
	4.4 Chicken	pc	4	100	400.00	Organic fertilizer source
	4.5 lovebirds	pair	2	350	700.00	organic fertilizer source
	4.6 quail	pc	4	50	200.00	organic fertilizer source
5	*Labor	person	1	200/day	1904.70	for work force
	carpenter			for 5 days		
				TOTAL	**15024.00**	

* no labor cost + optional

Table 8 presents the technological requirements needed in the development of an integrated biosystem of animals. It showed that there were five (5) categories namely the construction materials, masonry materials, tools , operational materials and labor with its unit and required quantity, The cost per unit , the total cost and its individual technological use were also presented. These materials, tools and labor were used to construct two to three cages with the size of 1 meter by 2 meters by 1.5 meters cage for chicken, quail, lovebird and a pen for rabbit.

The cost implies that with numerous numbers of materials and tools needed and with the corresponding prices made the construction of animals cage was quite expensive. The percentage of the allocated cost in the development of an integrated biosystem of the poultry and livestock is shown in Figure 11.

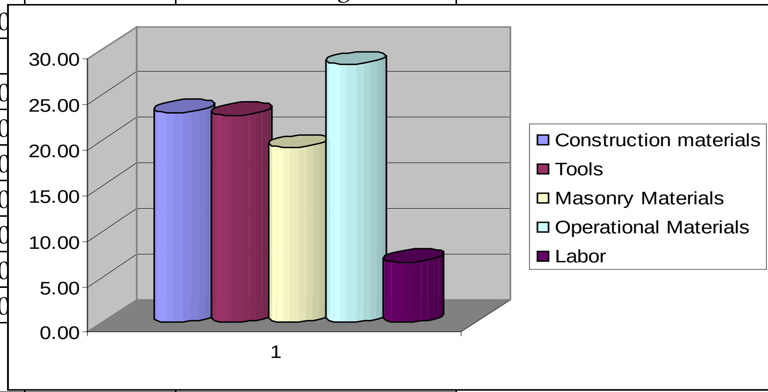

Figure 11
Percentage of the Allocated Cost Needed in the Development of an IBF of Poultry and Livestock

Figure 11 presents the percentage of the budgetary allocation cost needed in the development of an integrated biosystem farm of poultry and livestock It was noticed that operational materials got the highest percentage allocation cost of 28.32 %. Then these were followed closely by construction materials with 23.06% and masonry materials with 22.76%. Tools budget allocated only with 22.76% including the optional tools cost and the labor cost was 12.68%. As observed, there was no labor cost allotted for it replaced the acquisition of tools in the construction of all the cages and houses of animals. The idea was farmers did not have labor budget for they knew all labor works.

The high percentage of operational materials implies that raising livestock had greater budgetary allocation cost especially the food consumption. Therefore number of livestock that required feed pellets should be limited specifically number of chicken.

4. Crops, Poultry and Livestock Establishment Creeping plants were planted in the ground near at the interling fence while selected potted crops were arranged in perimeter of the ponds while table banana at the corners. Cages for lovebirds, quail and chicken were installed at the top of the strategically located ponds. Vermi-rabbit pens was uniquely designed at considerable distance little away from the neighbor residence. The activities and number of days in establishing an IBF of fish, crops, poultry and livestock is presented in

5. Production, Caring and Feeding Practiced. Production of fish, lovebirds, chicken, and rabbits was quite easy for these animals reproduced naturally and produced young

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with little care. And for quail, since it did not sit down the egg, an improvised incubator worked to produce a number of young quail Meanwhile fast growing crops were produced favorably by seeds and other produced by stem and buds like citrus. It started only out of forty marcotted one was again remarcotted to reach thousands of it.

Caring of crops, poultry and livestock was one in the heart-a central tendency to care living things. For caring crops was done by monitoring the growth, infestation of diseases, and applying supplemental organic and inorganic fertilizers. Watering and removing of weeds was also done everyday especially during summer and rainy days. Transferring of crops to the ground, from small pots to bigger pots and also adding of new soil were practiced. And the caring of fish, lovebirds, chicken, and quail was required a little care for this just merely provided with foods, space, resembled habitat, water and periodic clean up of the cage and pens.

Feeding of chicken, quail, lovebirds, and rabbits of course required specific feeds and enough amount in the number heads. Basically it depended on the condition, feeding habit, size of animal as well as the time it became active and inactive. It required a keen observation from time to time and day to day basis. There were times not to feed, underfeed and overfeed them.

Pre Harvest, Harvest and Post Harvest. In the pre harvest of tilapia fish, the matured and the same size fishes were caught with the used of push net and swing net and was transferred to smaller size ponds filled with one day old clean water . This fishes were fed with azolla or floater feeds. These fishes were allowed to spend 3-5 days in the pond before it was sold. For ornamental fishes, the newly caught were put to the different sized aquarium, ready to be packed. In the pre harvest of crops was done by mapping out of matured crops and the clean-up of pathways began and for the animals were the selected pairs

In the harvest of crops was not quite difficult for these crops were man's tall that can be done by hand picked and can be slowly laid down in the smooth leveled ground or either place in a basket or in a flat basin. For fish was harvested with the used of push net or swing net. There was no total harvest in which pond water was completely drained for the reasons that water was limited and expensive and also there were many weeks old fry or the newly hatched eggs still left.

In the post harvest of crops, poultry and livestock was done just a thorough cleaned up, made repair of cage and pens. For fish was the partial removal of sludge and the repair of the laminated sack and the sidings.

Marketing. The products were sold directly through farm visit or by orders. Some products were displayed in the IBF store.

As enumerated in the process flow, IBF Layout, plan and design was the actual picture, shape, position and location of the farm with respect to pond structure. land topography, development, and the plant and animal cages and pens arrangement.. The IBF layout was constituted mainly of fishponds constructed in contour terracing farming style. It is the best way to be done in an elevated land surface. The layout required an art of commons sense and technique to fit in the number of crops, cages, and pens of poultry and livestock materials such as potted and ground crops, fish, chicken, quail, lovebirds, and rabbits.

The Gantt chart indicated the different major activities and their duration in the process flow of the IBF Model. Detailed information on specific activities and its respective time duration is presented in Table 9

Table 9

Gantt Chart of Activities of the IBF Process Flow

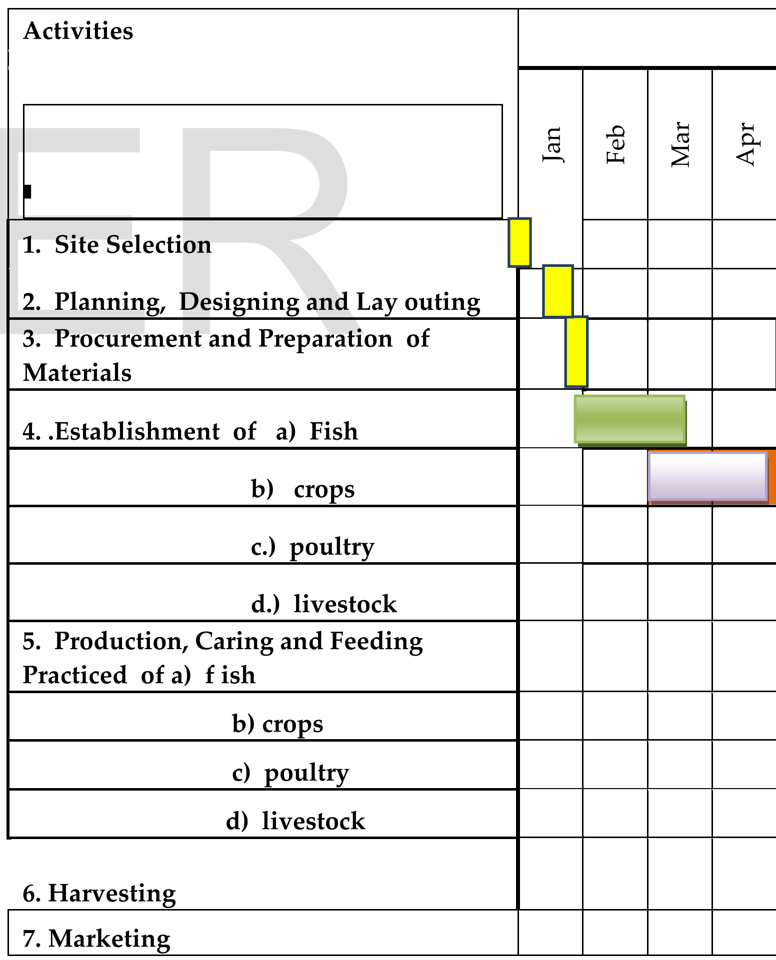

Figure 13. Gantt Chart of Activities of the IBF Process Flow

Table 9 shows the Gantt chart of the major activities from site selection to marketing stage and the

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duration undertaken in the process flow of an IBF Model. It revealed that production, caring and feeding practice/management took almost four (4) years for this was an operation stage where return of investment can be drawn out.

PERFORMANCE OF THE INTEGRATED BIOSYSTEM FARMING MODEL

Cost

There were two (2) costs computed separately in this study such as the development and the operational costs. The development cost was the cost expensed during the process of creating or developing an IBF which made up mainly of the construction materials, tools and labor while the operational cost were those materials that were consumable and highly need of organisms existence such as foods, vitamins, fertilizers, water, medicines, etc. Table 10 shows the development and operational cost of fish

As shown in Table 10 the cost of fish for four (4) years. It showed that development costs were the construction materials, tools, and labor with the total amount of 32,480.00 pesos. For the operational costs of the of fish foods, water, laminated sack, maintenance, fuel and others with the total amount of 55,334.00 pesos. The total development and operational costs for four years was 87, 814. 00 pesos.

Table 10

Development and Operational Cost of the Fish for Four Years

NO	Items	Unit	Quantity	Cost/Unit	Total cost
1	Material				
	1.1 cement	sack	20	195	3900
	1.2 hollow blocks	pc	400	9.5	3800
	1.3 corrugated bars	pc	30	50	1500
	1.4 sand	cubic meter	4	950	3800
	1.5 gravel	cubic meter			
	1.6 2" S-500 PVC pipe	pc			
	1.7 2" S-500 PVC elbow	pc			
	1.8 2" S-500 PVC T- pipe	pc			
	1.9 2" S-500 PVC coupling	pc			
	1.10 2.5" GI Nail	pc			
	1.11 bamboo pool	pc			
	1.12 laminated sack	meter			
2	Tools				
	2.1 hacksaw	pc			
	2.3 Masonry trowel	pc			
	2.4 Shovel	Pc			
3	Labor	person			
	Mason				
	Carpenter				

4	OPERATIONAL COST	Unit	Quantity	Cost	Cost per year	No.of years	Cost
	3.1 Fish foods	sack	4	1,350	5,400	4	21,600.00
	3.2 Water	m^3	40	15	600	4	2,400.00
	3.3 laminated sack	meter	18	50	900	4	3,600.00
	3.4 Maintenance	peso		500	500	4	2,000.00
	3.5 Fuel	Liter	96	56.60	5,433	4	21,734.00
	3.6 Miscellaneous	peso		1,000	1,000	4	4,000.00
				Sub-total	**5000**	4	55,334.00
				Grand Total	**37480**		**87,814.00**

This implies that operational cost on feeds and fuel contributed much in the expenses. Figure 12 below described the percentage of the distributed cost in the IBF development and operations of fish for 4 years.

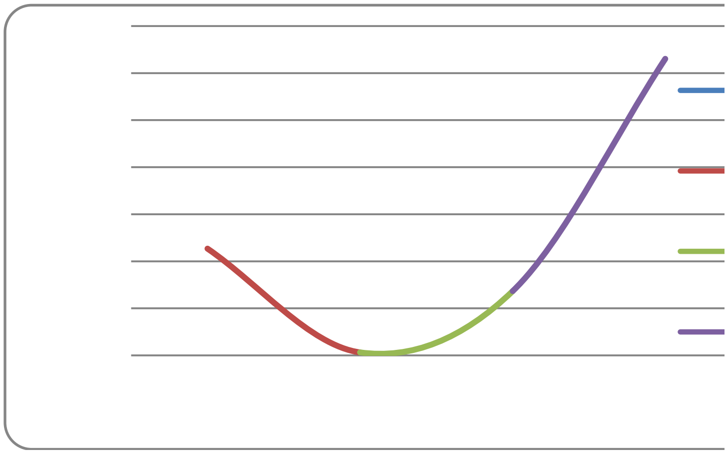

Figure 12
Percentage of the Distributed Cost in the Development and Operation of Fish for 4 Years

Figure 12 graphs the cost of the IBF development and operations. It showed that operational cost got the highest expense at 63% of the total budget. These were followed by the construction materials at 23 % and the labor cost at 14%. This means that operational cost should be given attention for a maximum minimization by cutting of necessary non priority cost of the operations. The development and operational cost of poultry and livestock for four (4) years is presented in Table 11

Table 11
Development and Operational Cost of the Poultry and Livestock
for 4 Years

No	Items	Unit	Quantity	cost/Unit	Total	No. of Years	Total
1	**Construction Materials**						
	1.1 G.I Roof Sheet Gauge #24	sheet	8	230	1840.00		1840.00
	1.2 1 x 2 x 8	pc	14	35.00	490.00		490.00
	1.3 2 x 2 x 8	pc	4	75.00	300.00		300.00
	1.4 Bamboo poles	pc	4	50.00	200.00		200.00
	1.5 1"	kg	1	52.00	52.00		52.00
	1.6 2.5"	kg	1	52.00	52.00		52.00
	1.7 chicken wire	m	6	55.00	330.00		330.00
	1.8 umbrella nails	kg	1	60.00	60.00		60.00
	1.9 pail	pc	1	50.00	50.00		50.00
	1.10 hinge	pair	6	15.00	90.00		90.00
2	**Tools**						
	2.1 hammer	pc	1	150.00			
	2.2 screw driver	pc	1	100.00			
	2.3 cross cut saw	pc	1	250.00			
	2.4 wrecking bar	pc	1	275.00			
	2.5 pliers	pc	1	120.00			
	2.6 thin cutter	pc	1	175.00			
	2.7 electric drill	pc	1	1600.00			
3	**Masonry Materials**						
	3.1 cement	sack	3	195.00			
	3.2 gravel	m³	0.5	950.00			
	3.3 hollow blocks	pc	100	9.50			
	3.4 sand	m³	0.5	950.00			
	3.5 9 mm corrugated bars	pc	8	50.00			
4	**Operational Materials/ Animals**						
	4.1 Waterer	pc	1	35.00			
	4.2 Rabbits	pc	2	175			
	4.3 Chicken	pc	4	100			
	4.4 lovebirds	pair	2	350			
	4.5 quail	pc	4	50			
5	*Labor	person	1	200/day			
	Carpenter			for 5 days			
				TOTAL			
6	**Operational Cost**						
	6.1 Water	m³	6	25.00			
	6.2 Feeds	sack	2.4	1,300.00			
	6.3 Vitamins/Antibiotics	pack	4	12.00			
	6.4 Miscellaneous	peso					
				Total			
			Grand Total				

Table 11 shows the compound items that contributed costs in the development and the production operation of poultry and livestock. For four years, the cost bestowed was up to twenty six thousand eight hundred seventy-five pesos (**26,875. 00**) . As shown on the Table 11, development and the operational cost were very closefigure with a difference 372.00 only. This implies that operational cost was quite expensive for it really cut the budget. Feeding alternatives must be practiced. Figure 13 presents the percentage distribution of cost in the development and operation of animals for four years.

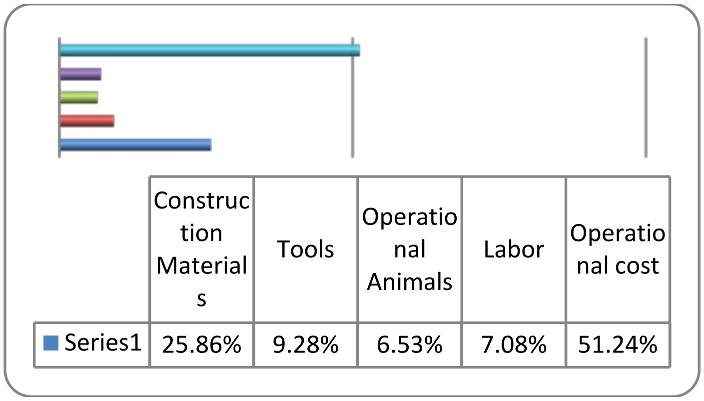

Figure 13 **Percentage of the Distributed Cost in the Development and Operation of Poultry and Animals for 4 years.**

Figure 13 depicts the cost of the IBF development of animals and its operation. It was observed that operational cost top of the rest compound items at a rate of 51.24 % of the total budget of twenty six thousand eight hundred seventy-five pesos (26,875.00). As noticed, 25.86 % went to construction materials that composed of masonry and carpentry materials that slashed the total amount. The data presented in Table 12 tabulates the development and the operational cost of crops for four years.

Table 12

Development and Operational Cost of the Crops for Four (4) Years

No	Materials	Unit	Quantity	cost/Un			
1	Planting Materials						
	1.1 10"x10"x 14" poly bags	pc	500	6.(			
	1.2 8 x 8 x 10"	pc	300	2.7			
	1.3 6 x 6 x 8	pc	200	2.00	400.00		400.00
	1.4 4 x 4 x 6	pc	200	1.00	200.00		200.00
	1.5 Soil	m³	2	950.00	1900.00		1,900.00
	1.6 Manure	sack	20	90.00	1800.00		1,800.00
	1.7 Decayed rain tree leaves	sack	200	20.00	4000.00		4,000.00
	1.8 tomato	pack	1	45.00	45.00		45.00
	1.9 patatas	kilo	1	50.00	50.00		50.00
	1.10 eggplant	kilo	1	45.00	45.00		45.00
	1.11 patola	pack	1	45.00	45.00		45.00
	1.12 onion	bunch	1	40.00	40.00		40.00
	1.13 ampalaya	pack	1	45.00	45.00		45.00
	1.14 squash	kilo	1	20.00	20.00		20.00
	1.15 kangkong	pack	1	50.00	50.00		50.00
	1.16 pepper	kilo	1/2	50.00	25.00		25.00
	1.17 Marcotted citrus	pc	1000	50.(			
	1.18 banana suckers	pc	30	50.(			
2	Tools						
	2.1 Twig cutter	pc	1	250.(			
	2.2 hand trowel	pc	1	120.(			
	2.3 shovel	pc	1	250.(			
	2.4 digging bar (wide blade)	pc	1	260.(			
3	Labor	person	2	150.00/day			
	Mason			for 14 days			
	Carpenter						
				TOTAI			
4	**OPERATIONAL COST**						
	4.1 Water	m³	50	50.(			
	4.2 Inorganic Fertilizer	kg	20	28.(			
	4.3 Maintenance			1000.(			
	4.4 Miscellaneous	peso					
				Sub-total			
				Total			

Table 12 shows the four (4) compound items that budget had gone for the IBF development and operational cost of the crops for four (4) years with the grand total of eighty three thousand eight hundred ten pesos (83,810.00). Figure 14 shows the percentage of the distributed cost in the development and operation of crops for four (4) years.

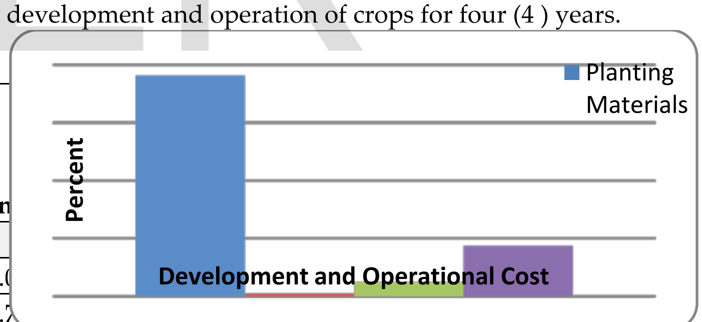

Figure 14 **Percentage of the Distributed Cost in the Development and Operation of Crops for Four (4) Years**

Figure 14 reflects the percentage distribution of the cost in the development and operation cost of crops for four (4) years. It was revealed on the graph that planting materials where the most cost had gone up to 76 % . Then it was followed by the operating expenses that cost up to 18 % from the total cost. Table 13 presents the total development and operational cost of the IBF.

Table 13 exhibits the total developmental and operational cost of the integrated biosystem farm. It showed that the amount needed in the establishment of ponds and its operating expenses for fish culture at an amount of eighty seven thousand eight hundred fourteen pesos (87, 814.00), and for the establishment of animals cages and pens including the operating expenses, the needed amount is twenty six thousand eight hundred seventy-five (26,875,00). Then, for the establishment of crops, it required at an amount of eighty- three thousand eight hundred ten pesos (83,810.00). The total amount required for the development and operation of an Integrated Biosystem Farming is one hundred ninety-eight thousand four hundred ninety-nine pesos (198,499.00).

Table 13

Total Development and Operational Cost of the IBF

Development and Operational Costs	*Amount*
Fish	87,814.00
Animals	26,875.00
Crops	83,810.00
Total	198,499.00

Productivity

The IBF productivity was determined yearly. These were the production income earned from the fish, crops and animals. Fish income contributed mainly of the following fishes such as tilapia, platys, sword, black molly, moor, koi, and guppy while for animals were the chicken, quail, rabbits, lovebirds, and earthworms. Income came from the crops were highly contributed by marcotted citrus, citrus and banana fruits and veggies. Reflected in the Table 14 is the income of the first year production operation of an integrated biosystem farm model.

It showed that the first year operation of the integrated biosystem farm had the total production income of **28,157.50**. This income was contributed by 9 major products namely these were the Tilapia and Aquarium fishes, chicken, rabbits, quail. earthworm, banana, crops and orchids. It was observed that marcot citrus provided big sales but it was not been sold for the purpose that it will be subjected for remarcotting to increase exponentially the number of marcot citruses.

Table 14

Income from the 1st Year Operation on the IBF Model

No	Organisms	Unit	Quantity	Price	Total	Remarks
1	**Fish**					
	1.1 Adult Tilapia	kg	40	100.00	4000.00	
	1.2 Tilapia Fingerlings	pc	1000	1.00	1000.00	
	1.3 Black Molly	pc	100	5.00		
	1.4 Sword Tail	pc	1000	5.00		
	1.5 Moore/gold fish	pc	100	20.00		
	1.6 Shabonkin	pc	5	50.00		
	1.7 Japanese koi	pc	5	150.00		
2	**Chicken**					
	2.1 Adult	pc	10	1200.00		
	2.2 Chicks	pc	15	40.00		
	2.3 Manure	sack	0.5	70.00		
3	**Rabbit**					
	3.1 Adult	pc				
	3.2 Young	pc				
	3.3 Manure	sack	2	70.00		
4	**QUAIL**					
	4.1 Adult	pc				
	4.2 YOUNG	pc				
	4.3 Manure	sack	0.25	17.50		
5	**Earthworm**	pc				
	5.1 Adult	pc	2000	1.00		
	5.2 vermi cast (Fertilizer)	kg	100	10.00		
6	**Calemonden**					
	6.1 fruits	hundred	6	50.00		
	6.2 marcot	pc	80	100.00		
7	**Banana**					
	7.1 fruits	pc	320	1.00		
	7.2 suckers	pc	4	25.00		
8	**Crops**					
	8.1 Patola	pc	10	10.00		
	8.2 Tomato	kg	3	35.00		
	8.3 Kangkong	bunch	6	15.00		
	8.4 Eggplant	kg	5	35.00		
	8.5 Onion leaves	bunch	2	25.00		
	8.6 Ampalaya	kg	10	40.00		
	8.7 Malunggay leaves	bunch	15	5.00		
	8.8 Patatas	kg	5	60.00		
	8.9 Ube	kg	5	20.00		
9	**Orchids**					
	9.1 Suckers/plantlets	pc	2	100.00		
	9.2 Flower	pc	50	1.00		
				Total	2	

This implies that little of everything can provide additional income and food to the farmers than those without

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anything. The computed return of investment per annum is 13.31 %. Most of these crops were planted on the pots using the polyethylene bags and few were planted in the ground especially vines. Figure 15 displays the percentage of the organisms comprised of the income from the first year operation of the IBF.Model

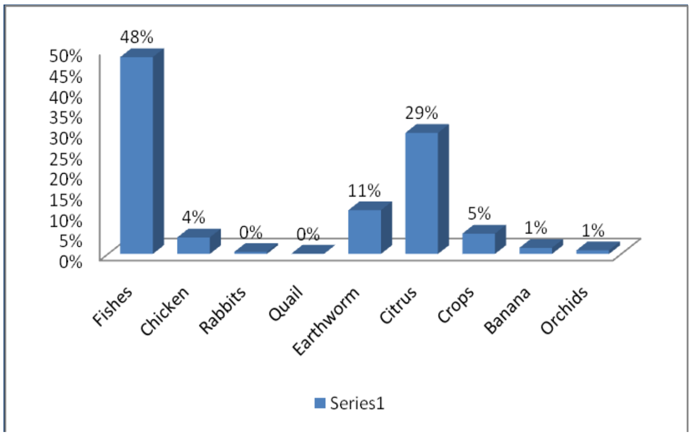

Figure 15
Percentage of Organisms Comprised of the Income in the 1st Year Operation on the IBF Model

It can be looked forward from the Figure 15 that fishes had the highest percent income contributed at 48% and which was followed by citrus of 29% and the earthworm of 11% of the first year production operation. Income of the second year operation of the IBF model is presented on Table 15.

Table 15
Income from the 2nd Year Operation on the IBF Model

o	Organisms	Unit	Quantit
1	Fish		
	1.1 Adult Tilapia	kg	3
	1.2 Tilapia Fingerlings	pc	150
	1.3 Black Molly	pc	50
	1.4 Sword Tail	pc	100
	1.5 Black Moore	pc	5
	1.6 Shabonkin	pc	1
	1.7 Japanese koi	pc	1
2	Chicken		
	2.1 Adult	pc	1
	2.2 Chicks	pc	2
	2.3 Manure	sack	0
3	Rabbit		
	3.1 Adult	pc	
	3.2 Young	pair	
	3.3 Manure	sack	
4	Quail		
	4.1 Adult	pc	
	4.2 Chick	pc	
	4.3 Egg	pc	3

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Table 15 reveals the 10 major organisms used in an integrated biosystem farm. It was noticed that there was an increased of an annual production income from 28,157.50 to 54,950.00 as it started from 2007 to 2008. This income mainly contributed by the increase population of Tilapia and Aquarium fish and the increase number of marcotted citrus and other crops productions.

This implies that there was an annual growth income of 30,048.00 pesos or 54.68 % production income for the second year operation. Figure 18 below shows the percentage and the organisms comprised in the second year production income.

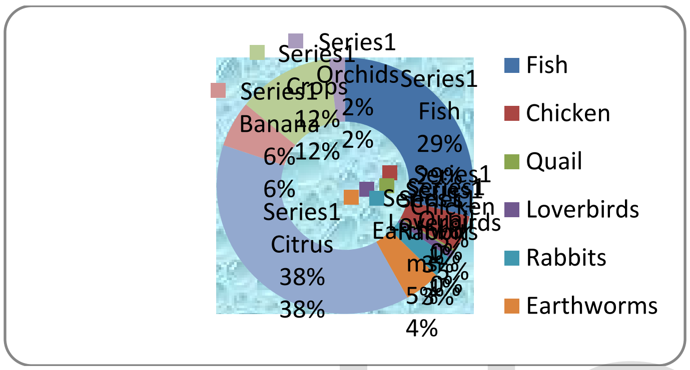

Figure 16

. **Percentage of the Organisms Comprised in the Income from the 2nd Year Operation of the IBF Model**

It can be gleaned directly from Figure 16 that citrus, fishes, banana and earthworm and chicken garnered 38%, 29%,, 6% and 5% respectively have greatly contributed in the second year production income of the IBF with the amount of 54,950.00. Table 16 presents the third annual production income of an integrated biosystem farm.

Table 16 Income from the 3rd Year of Operation on the IBF Model

No	Organisms	Unit	Quantity	Price
1	Fish			
	1.1 Adult Tilapia	kg	50	120
	1.2 Tilapia Fingerlings	pc	2000	1
	1.3 Black Molly	pc	300	5
	1.4 Sword Tail	pc	2000	5
	1.5 Black Moore	pc	40	20
	1.6 Shabonkin	pc	20	50
	1.7 Japanese koi	pc	20	100
2	Chicken			
	2.1 Adult	pc	8	140
	2.2 Chicks	pc	10	40
	2.3 Manure	sack	2	70
3	Rabbit			
	3.1 Adult	pc	8	250
	3.2 Young	pair	5	350
	3.3 Manure	sack	1	70
4	Quail			
	4.1 Adult	pc	1	50
	4.2 Chicks	pc		
	4.3 Eggs	pc	30	1.75
	4.4 Manure	sack	0.5	35
5	Lovebirds			
	5.1 Adult	pair	1	350
	5.2 Manure	sack	0.25	70
6	Earthworm			
	6.1 Adult	pc	3000	1
	6.2 vermi cast	kg	100	10
7	Calemonden			
	7.1 fruits	hundred	50	50
	7.2 marcot	pc	400	100
8	Banana			
	8.1 fruits	pc	1960	1
	8.2 suckers	pc	20	20
9	Crops			
	9.1 Patola	pc		
	9.2 Tomato	kg	3	35
	9.3 Kangkong			
	9.4 Eggplant	kg	1	35
	9.5 Onion leaves	bunch		
	9.6 Ampalaya			
	9.7 Malunggay leaves	bunch	15	5
	9.8 Patatas			
	9.9 Ube			
	9.10 Pepper (espada)	kg	5	45
	9.11 Pepper (Native)	kg	3	130
10	Orchids			
	10.1 Suckers/plantlets	pc	2	100
	10.2 Flower	pc	50	1
				Total

Table 16 shows the same 10 major crops used in an integrated biosystem farm. It was noticed that there was an increased of an annual production income from 54,950. 00 to 80,027.50 for the year 2008 to 2009. This income mainly contributed by the increase population of Tilapia and Aquarium fish and the exponential increase of marcotted citrus which can be sold at 100.00 pesos each in the local market.

This implies that there was an annual income growth of 25,077.50 pesos of the third year operation or an increase of 42.38 % for the yearly production with a computed return of investment of 31.34%. Figure 17 shows the percentage of the organisms comprised in the third production income of the IBF

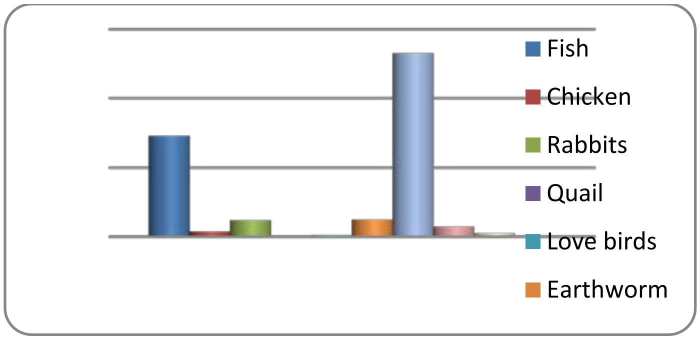

Figure 17

Percentage of the Organisms Comprised of the Income from the 3rd Year of Operation on the IBF Model

Figure 19 illustrates the third year production operation of the IBF. It showed that citrus was the highest with 53%, fishes 29% and banana 5% had contributed much in the production with an aggregate income of 80,027.50. The income from the fourth year operation on the integrated biosystem farming model is presented on Table 17.

Table 17

Income from the 4th Year of Operation on the IBF Model

o	Organisms	Unit	Quantity	Price	Total	Remarks
1	Fish					
	1.1 Adult Tilapia	kg	20	120.00	2400.00	
	1.2 Tilapia Fingerlings	pc	1000	1.00	1000.00	
	1.3 Black Molly	pc	300	5.00	1500.00	
	1.4 Sword Tail/Platys	pc	1500	5.00	7500.00	
	1.5 Black Moore	pc	10	50.00	500.00	
	1.6 Shabonkin	pc	5	100.00	500.00	
	1.7 Japanese koi	pc	5	150.00	750.00	
2	Chicken					
	2.1 Adult	pc	5	120.00	600.00	
	2.2 Chicks	pc	10	40.00	400.00	
	2.3 Manure	sack	1	70.00	70.00	
3	Rabbit					
	3.1 Adult	pc	2	200.00	400.00	
	3.2 Young	pc	2	150.00	300.00	
	3.3 Manure	sack	2	70.00	140.00	
4	Quail				0.00	
	4.1 Adult	pc	1		50.00	
	4.2 Manure	sack	0.25	70.00	17.50	
5	Lovebirds					
	5.1 Adult	pair	2	300.00	600.00	
	5.2 Manure	sack	0,25	70.00	17.50	
6	Earthworm					
	6.1 Adult	pc	1500	1.00	1,500.00	
	6.2 vermi cast (Fertilizer)	kg	200	10.00		
7	Citrus					
	7.1 fruits	hundred	40	50.00		
	7.2 marcot	pc	400	100.00		
8	Banana					
	8.1 fruits	pc	1764	1.25		
	8.2 suckers	pc	6	20.00		
9	Crops					
	9.1 Patola	pc	10	10.00		
	9.2 Tomato	kg	3	35.00		
	9.3 Kangkong	bunch	6	15.00		
	9.4 Eggplant	kg	1	35.00		
	9.5 Onion leaves	bunch	1	40.00		
	9.6 Ampalaya	kg	2	40.00		
	9.7 Malunggay leaves	bunch	20	5.00		
	9.8 Patatas	kg				
	9.9 Ube	kg				
	9.10 Pepper (Espada)	kg	5	60.00		
	9.11 pepper (Native)	kg	4	140.00		
	9.12 Alugbati	bunch	5	5.00		
10	Orchids					
	10.1 Suckers/plantlets	pc	30	100.00		
	10..2 Flower	pc	100	1.00		
				Total		

Table 18 presents the same 10 major crops used in an integrated biosystem farm. It was noticed that there was decreased of an annual production income from 80,027.50 to 66,595.00 from the inclusive years 2009 to 2010. Natural problems occurred like dissolved oxygen depletion caused the sudden death of fish and the prolonged warm and the unpredictable changed of weather condition sprung out diseases that caused death of plants and animals. Still this income was mainly contributed by the Tilapia and Aquarium fish and the marcotted citrus which can be sold at 100.00 pesos each in the local market.

Figure 20 describes the percentage of the organisms comprised of the income from the 4th year of operation on the IBF Model.

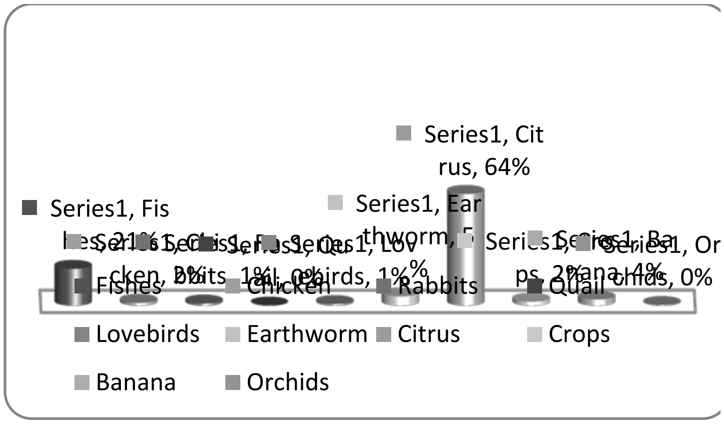

Figure 18

Percentage of the Organisms Comprised of the Income from the 4th Year of Opeartion on the IBF Model

It can be directly observed from the Figure 18 that citrus with 64% and fishes with 21% contributed much in the production of IBF from the total amount of 66,095.00.

Return of Investment (ROI)

This portion determined the study whether in gained or lost. With the revelation of the total development and operational cost of the IBF of fish, crops and animals, the returned of investment was then calculated based from the formula which was the gross income minus the total expenses to extract the net income. And finally, to find the return of investment then the net income is divided by the total expenses multiplied by 100%. The result of the yearly incomes and the return of investment is presented in Table 18..

Table 18

Incomes and ROI's of the IBF Model

Operation Year	Cost	Yearly Income	ROI
1st	119,099.40	28,157.00	-46%
2nd	39,699.80	54,950.00	8%
3rd	19,849.90	80,027.00	30%
4th	19,849.90	66,095.00	23%
Total	198,499.00	**229229**	15%

Table 18 exhibits that the cost from the first year to fourth year at 60-20-10-10 percent were 119,099.40, 39,699.80, 19,849.90 and 19,849.9 pesos respectively with the total cost of 198,499.00 pesos. This means that there was a greater cost percentage entailed in the first year and it lowered down its cost from the 2nd to 4th years of operation for IBF decreased the developmental costs in the following years.. The table further showed the yearly incomes of the IBF Model kept increasing from its first to third year of operations and decreased its figure to 66,095.00 in the fourth year. Although the yearly income suddenly decreased its figure with negative return of investment in the first year yet the IBF still provided an ROI of 16% of the four year production operation. This means that despite of the common crops, poultry and livestock problems, there was still an amount of 0.15 centavo will be returned in every peso invested.

ENVIRONMENTAL IMPACT OF THE INTEGRATED BIOSYSTEM FARMIMG (IBF) MODEL

The performance of an IBF model on environmental impact relied on the efficiency of the ecological system. The positive performance provided a more favorable conditions to the system that promoted a healthier molecular, cellular and organismic reproductions to the fish, crops, poultry and livestock . It enhanced the recycled available resource within the system and maintained the conducive surrounding conditions for the normal activity of the organisms. The following performance indicators of the IBF Model on environmental impact were focused to the following 1.) soil nutrition, 2.) soil utilization 3.) ambient temperature, and 4) rainwater conservation

Soil Nutrition

Soil nutrition is the key factor for higher crop production. Crops have specific requirements on the amount of nutrients needed for the normal growth which is dominantly found in soil. Table 19 presents the IBF model results of the soil analysis in terms of the organic matter, phosphorus, potassium content and the potential hydroxyl ion concentration.

Table 19

IBF Model Results of the Soil Analysis

Soil Test Data	Organic matter (ppm)	Phosphorus (ppm)	Potassium (ppm)	pH
Before	2.0	15	deficient	7.3
After	3.5	30	deficient	7.2

Table 19 presents the organic matter content increased from 2.0 before the creation of the IBF to 3.5 after the IBF was established at a difference of 1.5. Phosphorus content also increased from 15 part per million (ppm) to 30 (ppm) which is twice the amount before the IBF was

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established. Although potassium content is quite deficient on both treatments. As noticed, the hydroxyl ion concentration is lowered down to near neutral level at a difference of 0.1.

This implies that just a matter of four years, the IBF helps increased the nitrogen and phosphorus content of soil and slightly lowered down the potential hydrogen ion concentration.

Soil Utilization

Planting in the pots or in the garden plastics used voluminous of garden soil which quite too expensive in the local market or too destructive in the natural landscape. The key to minimize and regulate the used of soil is soil utilization. This soil utilization was practiced in the development of an IBf Model. The records of the volume of utilized soil in the development of an IBF model is presented in Table 20

Table 20

Volume of Utilized Soil in the Development of an IBF Model

Item	Quantity	Size	Mass of Soil per size (kg)	Total Mass (Kg)	Total Volume of Soil (m^3)	% Volume of Raintree leaves &etc (90%)	Cst /m^3	Total Cost
1	500	10″x10″x14″	24	12 000	12	10.8	2, 000.00	21, 600.00
2	500	8″x8″x10′	8	4 000	4	3.6	2 ,000.00	7, 200.00
TOTAL	1000			16,,000	16	14.4		28, 600.00

As shown in Table 20 that the total mass of soil utilized in the development of an IBF was 14,400 kilograms or equivalent to 14.4 cubic meters. If this soil was bought at an amount of 2,000 pesos per cubic meter, it has a total cost of 28, 600 pesos. In this case, the IBF model used the fallen leaves of rain tree and locally called acacia aure found immediately in the vicinity instead of soil with the ratio of 90% leaves, 5 % manure and 5% soil.

Ambient Temperature

The ambient temperature provides freshness and soothe of air . This can be determined with the hotness and coldness of the air inside and outside of the IBF with the used of thermometer. This hotness and coldness is referred to the temperature that can be measured in degree Celsius, Fahrenheit and Kelvin units. The records of the ambient temperature is shown in Table 21.

Table 21

Ambient Temperature Records

Number of Testing (Day)	Temperatures (^{0}C)	
	IBF (Outside Environment)	IBF (Inside Environment)
1	30.5	29.5
2	31.5	30.3
3	31.5	31.0
4	31.9	31.0
5	31.5	31.0
6	31.5	31.2
7	30.9	30.4
8	32.0	31.5
9	31.2	30.8
10	31.2	30.5
Average	31.37	30.72

Table 21 reflects the ambient temperatures of the inside-outside environment. It showed the IBF outside environment had the higher temperature at an average of 31.37 ^{0}C compared to the temperature of the IBF inside environment at 30.72 ^{0}C with a temperature difference of 0.61 ^{0}C.

This implies that the farming system affects the ambient temperature inside the IBF.

Rainwater Conservation

Rainwater conservation was an essence of establishing a backyard fishpond rather than it was just water ran off. It conserved a considerable amount of rainwater every times it rained. Rainwater conservation was closely related to cost cutting of expenses of the water used. Table 22 below shows the computed volume of rainwater conserved in the fish farming operation.

Table 22
Volume of Rainwater Conserved in the 4 Years Fish Farming Operation

Substance	Computation Details								
	Unit	Volume of water per pond (m^3)	Number of Ponds	Total Volume of Water (m^3)	Number of Change Water	Volume of Water Used per Year (m^3)	Volume of Water Used for 4 Years (m^3)	Cost/m^3	Total cost
Rain water	m^3	1.674	15	m^3 25.056	4x/year	m^3 100.224	m^3 400.80	20.00	8,000.00

It can be gleaned directly from the Table 22 that rain water conserved was about 400.80 cubic meters for four years operation. If every cubic meter costs 20 pesos in the commercial waterworks system then it saved money at around eight thousand pesos (8,000.00).

PROBLEMS ENCOUNTERED IN THE DEVELOPMENT OF AN INTEGRATED BIOSYSTEM FARMING MODEL

In any aspect of development, problems were always associated with it There were no sound development if the problems existed would not be properly solved. Each problem strengthened the foundations and provided a strong positive anticipation of the things to greater probabilities of occurrence. This made us always prepared and always performed ahead before things would be happened. The list of the problems encountered in the development of an IBF model is presented in Table 23.

Table 23
Problems Encountered in the Development of an IBF Model

Number	Aspects	Frequency
	1. Animals	
1	Backyard chicken	100
2	Bird	20
3	Carnivorous rat	5
4	Cat	40
5	Children	45
6	Earthworm	30
7	Frog	90
8	Mole cricket	60
9	Mole rat	79
10	Stray dogs	2
11	Toad	96
2. Insects	**3.**	
1	Ants	25
2	Aphids	30
3	Butterfly	15
4	Fruit fly	50
5	Lemon fruit suckers	120
6	Moth	20
7	Termites	40
	Grasshopper	
	4. Microorganisms	
1	Fungi infection	
2		43
	5. Artificial/Natural Occurr	

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	ing Activities		
1.	Eutrophication		
2.	Extreme heavy down pour	12	10%
3.	Intrusion of roots	25	21%
4.	Intrusion of unwanted species	15	13%
5.	Water acidity	50	42%
6.	Overpopulation of fishes	5	4%
7.	Chlorinated water	80	67%
8.	Egg laying insect	75	63%
9.	Fallen dried leaves	120	100%
10	Overfeeding	45	38%
11	Overgrowth of water lilies	100	83%

Table 23 reflects that there were 30 organisms/ occurring activities as problems encountered in the development of an IBF and the corresponding action taken to partially solve the problems. The following organisms or occurring activities that became problems to the IBF development were:

1. Stray dogs. One considered big problem in the IBF development was the group of stray dogs. These dogs destroyed cages and pens which eventually ate or killed the rabbits, quail, chicken and lovebirds. These dogs also disturbed the newly planted materials or accidentally uproot the plants that indeed resulted to sudden death.
2. Carnivorous rats. Sometimes these rats went down from the tree and burrow in the ground to give birth of their young. Since these rats fed with flesh and intestinal organs, they destroyed the screen of the cage and eventually attacked or killed the poultry inside.
3. Mole cricket was another problem in the IBF development especially in the pond for it bored the laminated sack. In this case, pond water level slowly lowered down until the pond became empty.
4. Mole rats was considered problem in the IBF development for they burrowed the ground and made hole to the laminated sack that resulted to sudden lost of the volume of water in the pond.
5. Rapid multiplication of water lily was a problem despite it helped in the balance of the pond ecosystem in absorbing organic materials and in maintaining carbon dioxide - oxygen gas cycle. Problem came out when it multiplied rapidly competed the space and nutrients of the fish to grow.
6. Fruit sucker bug was again the another problem in the IBF development . This bug continually sucked the fruits juice of the calamansi until the fruit became dehydrated, shrunk in appearance and changed to yellowish color until it fell to the ground immature.
7. Aphids. Another problem experienced in the IBF development was the infestation of aphids in ampalaya, eggplants and string beans affected the fruit bearing performance of the plants. It shown also stunted growth and even resort to the death some branches or stems of the plants.
8. Fungi infection was also a problem encountered in the IBF development particularly of the few fast crops and marcottedcalamansi which was noticed of its swollen and rotten stem and roots found near the ground. The infection resulted to the gradual death of the plants.
9. Intrusion of unwanted species. Common problem encountered in ornamental fishes was the intrusion of unwanted species like Tilapia. Tilapia was raised nearby ponds that might be accidentally fallen down or jumped out in the basin. Or in any case, the very tiny one clang in the push and bag net was recently used to catch Tilapia was also used to catch ornamental fish was caught unnoticed. It combined freely to the ornamental fish as got adult became a voracious feeder when kept undetected it resulted to the gradual decreased of the aquarium fishes.
10. Cat. Although helpful against rat and snake. Cat became a problem to the raised fish for cat knew fishing. It skillfully caught fishes especially the medium and big size tilapia, gold and

carp if ignored the pond fishes had nothing to be left.

11. *Earthworm..* Another problem encountered in the development of IBF was the inhibition of eartworm in the potted marcottedcalmansi. The earthworm distracted the root system that resulted to unhealthy growth and consequently provided poor fruit bearing performance.
12. Toads. The occurrence of toad especially during rainy days became a serious problem in the IBF development for it destroyed the firmly fixed laminated sack on the pond sidings or accidentally detached the standing pipe that totally drained out the pond water. Another propagating problem was these toads laid eggs that changed later into tadpoles. These tadpoles compete the given pelletized feeds or floater feeds and even interfered the space and water nutrients for the normal growth of fishes.
13. Butterflies. Butterflies are pollinators yet in the IBF development was considered a problem for they laid number of eggs on the leaves that definitely turned into pest as it changed to larvae or caterpillar. They were voracious leaf eater affected the photosynthetic activity of the calamansi plants hence retarded the fruiting period and even affected the fruit bearing performance. of the calamansi
14. Moths. Moths are nocturnal yet considered problem in the IBF development for they made punctured on the fruits and sip the juice that resulted to deformed and early fell down of fruits.
15. Backyard chicken. Chicken brought potential problem in the development of an IBF for they scattered the soil of the potted and ground crops, ate the seeds and uprooted the newly planted marcot citrus. In all of the time, chicken created a mechanical damaged resulted to torn and fractured branches that retarded the growth of the crops. Sometimes, chicken went fishing on shallow pond water and ate the small one or fingerlings.
16. Roots. Another problem encountered in the development of an IBF was the enlargement of the root from the peripheral trees near the pond which produced a deformed or a cracked concreted sidings.
17. Dried leaves. Naturally trees casted off matured leaves. And this resorted a problem in the development of an IBF for it polluted the pond water when undergone decomposition. These fallen leaves were decomposed by the aerobic bacteria that required oxygen, hence; it used the dissolved oxygen in water thus it compete the fishes resulted to the occurrence of the oxygen depletion. This occurrence was severely stressful to fishes that slowed down the growth and even resulted to sudden death of some fishes.
18. Children. Children always have fun in playing. This fun of playing became a resorted problem in the development of an IBF. The children were not even thought it harmed and destroyed some structures of the pond, left doors' cages and pens wide opened that allowed organisms to flee and even over stressed the animals for they made them as pets. They incidentally uprooted plants, picked young flowers and fruits , cut and broke plant stems or branches.
19. Chlorinated water. Water was a problem during summer season. This time it relied too much in the commercial water work system in which water is seasonably treated with chlorine for disinfection. Sometimes, this was caught unnoticed that was used in refilling the water level of the pond resulted to sudden death of the fish. There was also a time it was used to water the plants created a stooped leaves. A withered crops needed to recover its normal condition with a big sacrificed of its growth or else if not resorted to death.
20. Termites. One of the common problems encountered the development of an IBF was the infestation of termites on wooden cages and the laminated sack underground contact of clay soil-the favorable house of the termite. It rotten the structures of wooden and cages and in the pond , it left tiny holes on the laminated sack caused the pond water gradually decreased its level.
21. Ants. Infestation of ants in potted citrus, pepper, eggplant, string beans became problem in the development of an IBF.

Ants formed colony at the base of the plants, it destroyed the root system, bit the stem, made the soil infertile and turned the soil acid which made the crop pale, unhealthy and definitely produced poor quality of fruits.

22. Extreme heavy down pour. When heavy down pour came, fishpond compartments were fully filled with rainwater made the pond water overflowed from the standing pipes and in the compartment sidings.. The overflowed water loosen the soil formation and eventually dilapidated the pond foundation which resulted the pond to collapse.
23. Mud snake. Another problem encountered in the IBF development was the mud snake. Mud snake occasionally visited the pond and did a timely hunting on fish and on poultry animals.
24. Eutrophication. The IBF encountered the eutrophicated water. This was happened when organic matters were very abundant. It encouraged the rapid growth of microscopic algae to a maximum level known as algal bloom that eventually undergone a sudden die off. The dead alga settled at the pond bottom for decomposition. This phenomenal activity caused the death of the body of water and changed the water condition became toxic and deprived by dissolved oxygen which resulted to the death of fishes.
25. Frogs The presence of bull frogs brought out a serious problem in the ponds especially in the reared ornamental fishes. Ornamental fishes such as the molly, guppy, platy and sword were vulnerable to predation. Another problem created by frogs was they laid great number of eggs which turned into tadpoles. These tadpoles compete the space and feeds that resulted to stunted growth of the fish.
26. Overpopulation of fishes. This was ones another common problem encountered in the development of an IBF. Tilapia and ornamental fishes were prolific, they produced more young in one laying period. and the pond compartments were fully filled up. In this cases, newly hatched fishes exposed to maximum tolerance of water disturbances that resulted to stunted growth and hastened rapid deterioration of water quality due to the excessive secretion of fecal waste of the fishes.
27. Bird. This was considered another problem encountered in the development of IBF for it predated the raised fishes. This bird darted quickly to hunt the fish that surfaced out in the water. If ignored with their presence, number of fishes gradually diminished inside the pond and left nothing.
28. Egg laying insect. This was another insect problem encountered in the development of an IBF. This insect laid eggs in the fruits particularly eggplant, ampalaya, and jackfruit that resulted to the partially deformed and rotten which fell to the ground immature.
29. Overfeeding. This was a human mistaken problem encountered in the development of an IBF. The onset of the poor water quality and the rose of water acidity was detrimentally contributed to overfeeding. We kept on feeding even fish did not respond the feeds that unknowingly settled at the pond bottom. The uneaten feed sped up water deterioration and changed water became toxic that caused the death of water as well as the fish.
30. Water acidity. This was one of the common problems encountered in the development of an IBF. The increased of hydrogen ion concentration in water was contributed mainly by overfeeding. Decomposing feed reacted with the hydrogen ion in water that made the water became acid which in turned resulted to fish kill.

Chapter 4
A TECHNO-PACKAGE

This chapter presents the techno-package on integrated biosystem farming for technology dissemination to the farmers. It is presented in a detailed description for practical application and utilization.

The formulation of this techno-pack aimed for the widespread dissemination of the new farming practices. Alongside with the research and extension services of the university and the support and cooperation of the government and private sectors. This technology will be made available and readily accessible to the farmers and to the plants and animals enthusiasts as a hobby.

NO	Materials	Quantity and Unit
1	Grand Cement	2 sacks
2	Hollow blocks	40 pcs
3	sand	1/2 cubic meter
4	Gravel	1/2 cubic meter
5	8 mm Corrugated bars	6 pcs
6	laminated sack	6.5 meter
7	G.I nails	1/2 kilo
8	8ft bamboo strip	4 pcs
9	8x8x14 Polyethylene bag	50 pcs
10	2" PVC pipe	1 pc
11	2" PVC elbow	1 pc
12	rubber bond	1 pc

The techno-pack therefore was composed of six major components:

The Rationale. This part discusses the brief background of the integrated biosystem farm and its ecological interactions.

The Objectives. This part presents the general and specific objectives on the intention of the formulation of the techno-pack.

The Materials and Equipment. This part presents the materials and equipment needed in the creation of an integrated biosystem farm.

The Cost and Analysis. It presents the estimated cost involved in the development of an integrated biosystem farm.

The Proposes Seminar Workshop. It deals with the farming design.

Enclosed in this chapter is the primer of the integrated biosystem of the integrated biosystem farm technology package.

A Technology Package on the Integrated Biosystem Farming

I Rationale

Integrated biosystem farming is a farming practice that follows the law of nature where both plants, animals, microorganisms and environment established an inter relationship each other. These components in nature have niches to perform in a favorable habitat to live, grow and reproduce.

Integrated biosystem farming helped attain for the maximum maximization of available resource found both land, air, water and energy for sustainable and profitable production of the basic needs of man.

This farming practice can be done alone by farmers with the association of resourcefulness, perseverance, positive outlook and scientific and technical initiative.

II General Objectives

This techno package was created to ensure the fast and accurate communication of the research results to the farmers' community and enable them to adopt and utilize the new and productive farming practices in extracting foods and income from the farm.

Specific Objectives:

1. to inform community to switch a farming practice to integrated biosystem farming for the maximum maximization of the air, land and water use.
2. To utilize water from the ground and from the roof gutter for fish farming
3. To reduce pollution related problems in the community where proper solid waste disposal activities are undertaken;
4. To serve as a mean of sustainable source of livelihood opportunity for the farmers, family members and other sectors of the society;
5. To provide sample model and share technical expertise on the establishment of an integrated biosystem farm;
6. To pursue social adaptability and acceptance of the farming system.

III Materials and Tools Needed

Tools

Hammer hacksaw
roller meter
Shovel cross cut saw
meter stick
Planer bolo
levelling hose
Digging bar ax
pliers

IV Procedure Involved in the Creation of an Integrated Biosystem Farm Techno-Guide

Excavating of soil for dike formations, extracting of weeds, and underground roots and dead trunks.

Leveling is an activity took place with the used of leveling instrument such as the used of transparent hose commonly used by construction worker to find the correct land level. This is very important for the pond to have well leveled pond bottom in order to have uniform water level in both sides of the pond

Piping is done through setting of underground pipes to serve as water passage during the pond undergone change water. The pond water will be drained out when standing pipe inside the pond will be temporarily removed which allowed water to pass through the hole that passed to connected pipe lines designed for drainage.

Wall concreting of the pond measured 16 ft by 5 ft by 1.5 feet on its height , This height can be the water deep when the pond is filled with water. The study used ratio of cement, sand and gravel was 1:6:3. This means one sack cement, six sack of sand and 3 sacks of gravels for the wall construction.

Installing a laminated sack on 16ft by 5ft by 1.5ft. The sack was firmly fixed on the pond size. It was then clipped by a bamboo strip to keep the sack attached to the hollow blocks walls. The standing pipe was installed to the center by making a hole of the sack where drainage pipe is located. The standing pipe located at the center to get water balance from both sides of the pond served two functions as a overflow pipe and a drainage pipe.

Water filling and stocking were done after laminated sack was carefully fixed. The pond was ready to be filled with water at 20% level. After it stood for 5 days, the pond was ready for stocking. The fry should be acclimatized first by letting the vessel used temporarily submerged with entrance wide open in the pond water for 10-15 minutes until the fry adjusted the pond water parameter and swam freely.

After the pond construction. The plant establishment followed. It undergone the following activities such as preparing soil for potting media, marcottingcalemonden and planting crops. The soil medium was composed of 80 % decaying acacia leaves, 15% soil and 5%animal manure was practiced in this study. This was put in a 8 inches by 8inches by 14 inches polyethylene bag and watered for 5 days before these were planted with the specified crops and marcottedcalemonden (Citrus). Then, this marcottedcalemonden was arranged both sides of the pond. This made the pond surrounded the marcottedcalemonden used to provide shade to the fish and to protect the sack from prolong exposure of the solar radiation for the purpose that it will not be easily destroyed.

V Cost Analysis

Integrated Biosystem Farming (IBF) average return of investment (ROI) is 15% that for every peso invested 0.15 cents will be returned.

VI Proposed Seminar Workshop on Do-It-Alone IBF Creation

In order to make the IBF readily accessible and available to the target clientele, technology dissemination is necessary through seminar workshop.

The framework of a proposed 4 Saturdays seminar workshop training design on the IBF is hereby presented. The seminar workshop can be completed within 16 hours. All interested individuals are enjoined to participate on the seminar workshop.

The proposed two day IBF seminar workshop will be tentatively scheduled on the month of December, 2010. Table 24 shows the suggested seminar workshop design on IBF Model.

Table 24
Seminar Workshop Design on Integrated Biosystem Farming

Suggested Activities	Objectives	Material Cost	Person Involved
1. Layouting, Extracting roots and trunks, Excavating	To demonstrate how to layout, extract roots and dead trunks and excavate soil To let appreciate the principle of learning by doing	digging bar sharp bolo gloves ax shovel	Elementary and Secondary TLE and HELE Teachers, Principal Supervisor
2.	To	Hack saw	and Secondary

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leveling and Underground piping, Setting for the wall foundation	demonstrate how to level pond and to construct underground pipe and make strong base foundation for the wall	Transparent hose/leveling instrument	TLE and HELE Teachers, Principal Supervisor	Saturday of October		
3. Mixing masonry materials, hollow blocks filing, bar cutting and bending	To demonstrate how to mix masonry materials with the prescribed mix ratio To cut bars and form an L-shaped to be used for the hollow blocks support To let participants acquire skills in filing a hollow blocks at a correct level and position	sand and gravel, hollow blocks, corrugated bars, hacksaw, shovel, cement planer	and Secondary TLE and HELE Teachers, Principal Supervisor	2ndSaturday of October	1500.00	DepEd
4. Installing a laminated sack	To demonstrate how to install laminated sack and the standing pipe used for drainage and overflow pipe	laminated sack bamboo strip GI nails	and Secondary TLE and HELE Teachers, Principal Supervisor	3rd Saturday of October	400.00	DepEd
5. Stocking	To demoinstrate how to acclimatize new arrived fingerlings for stocking	fry fingerlings	and Secondary TLE and HELE Teachers, Principal Supervisor	3rd Saturday of October	100.00	DepEd
6. Re-marcotting a marcotted calemond	To know how to marcotcalemonden	one bag marcottedcalemonden	and Secondary TLE and HELE Teachers, Principal Supervisor	4th Saturday of October	100.00	DepEd

6. Preparing the soil Media in the polyethylene bag	To know how to prepare the soil media using the acacia leaves			and Secondary TLE and HELE Teachers, Principal Supervisor

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATION

This chapter presents the summary of findings, conclusions, and recommendations, which has made possible through the gathered data from the investigation conducted and other viable information yielded from this study.

The main purpose of this study was to assess the integrated biosystem farming model at Cebu Technological University during the inclusive years 2006 – 2010 as basis for technology package. Specifically, the study sought to answers the following problems:

1. What is the process flow in establishing an IBF?
2. Based on the data gathered on the IBF model, what is the performance in terms of the cost, productivity, and the return of investment, and also the performance on the environmental impact in terms of soil nutrient and utilization, ambient temperature and the rainwater conservation.
3. What are the problems encountered in the development of an IBF?
4. Based on findings, what technology package could be developed?

SUMMARY OF FINDINGS

Based on the results of the gathered data, the following are findings of the study.

1. The process flow of establishing an IBF were the following

1.1 Selection of site had the remarkable factors to be considered in selecting a suitable site for the establishment of an IBF such as the 1) water supply, 2) type of soil, 3) topography 4) vegetation 5) drainage

6) free from flood 7) easy means of transportation 8) nearness to market 9) supply of poultry and livestock, and 10) cheap supply of skilled labor.

1.2 Planning, designing and lay outing was essential in the development of an IBF model for this was blue print of the actual set up after all activities were done.

1.3 Inputs. These were the procured materials and the labor needed in establishing an IBF model of fish, crops, poultry and livestock.

1.4 Crops, poultry and livestock establishment required a strategic location of fish, crops, poultry and livestock in which it maximized the space both land, air and water.

1.5 Production, care and feeding practices were performed constantly in the entire operations of the IBF

1.6 Pre harvest, harvest and post harvest were done in routine activities in harvesting crops, fish, poultry and livestock.

1.7 Marketing was the technique undertook in selling the products produced by the IBF that can be sold directly to the buyer through farm visit, order or being displayed in the IBF store.

2. Based on the data gathered that the performance of the IBF model in terms of the cost on development and operation for 4 years was 198,499.00 with the productivity of 229,229.00 for 4 years operation. This has return of investment (ROI) of 15%. This means that for every peso invested there will be 0,15 cent will be returned.

The study also showed that the soil nutrition in terms of the organic matter and phosphorous content were increased after the IBF was established from 2.0 to 3.5 and from 15 ppm to 30 ppm respectively in which the hydroxyl ion concentration was lowered to near neutral level. It also further showed that the volume of utilized soil and the rain water conserved were 14.4 cubic meters and 80 cubic meters respectively and these a lot of money. It further revealed that the temperature inside the IBF was lowered down to an average of 0.16 ^{o}C..

3.The frequent problems encountered in the development of an IBF were the following: chicken, toad and frogs and mole rat.. For insect was the lemon fruit sucker got the highest percentage followed by the fruit fly and for the problem of microorganism was the infestation of fungi. And for the frequent problems encountered in the naturally/artificially occurring activities in the IBF were the fallen dried leaves, overgrowth of water lilies, chlorinated water and overpopulation of fishes..

4. Based on the findings of the study, The technology package was developed in establishing an IBF Model.

CONCLUSIONS

Based on the findings, the study therefore that the integrated biosystem farming model involved a sound process flow in establishing sound ecological interactions in maximizing the available resource both land, air and water.

The integrated biosystem farm was productive for it utilized and conserved the natural resources. Thus it saved a lot of money. The IBF was a good source of additional income and means of living for food self sufficiency. This study was feasible for an entrepreneurial venture.

1. With the positive results of this developmental research work through a case study was proposed a package of technology for an Integrated Biosystem farming that has a farmers-based application. It was recommended that seminar-trainings workshops has to be done for wide spread dissemination and adoption.

RECOMMENDATIONS

Based on the findings and conclusions, the following recommendations are offered for considerations that the the formulated techno-pack is recommended for adoption and dissemination.

And for further study of the following topics are hereby recommended:

1.1 integrations of various floating crops on the fish ponds

1.2 Integrations of selected cage animals above the ponds

GLOSSARY OF TERMS

Acclimatize. This is a process in which fishes were temporarily stayed in few minutes inside the transported basin that was submerged to the pond water. This process allowed the fingerlings or fry to make adjustment to the immediate pond water parameter condition.

Aquarium fish. This refers to any ornamental fishes that can be raised in a glass or in any basin as a pet animal. In the study, these were the Japanese Koi or Carp, sword tail, black molly, black moor and shabonkin.

Bagging. This is putting of planting media such as the soil, decayed acacia leaves, and animal manure inside the polyethylene bag which is known as garden plastic.

Climbing Plants. These are the plants that climbed in fences and trails when matured it produced fruits. Climbing plants used in the study were the patola, bitter gourd, hanging patatas and ube.

Epiphytes. This refers to aerial plants such as orchids. This plant used by the study to utilize the air space available.

Excavation. This refers to digging and burrowing up and the removal of soil from its natural position to be used in the construction of pond dikes and leveling the land surface of some portion of the location of the study.

Extraction. This is an uprooting activity where underground roots and dead trunks were removed for the installation of pond compartment.

Fishpond. This is referred to an earthen compartment walled with hollow blocks and it was protected by a laminated sack against rapid water infiltration or percolation from the ground.

Fry or fingerlings. These are healthy, young fishes of Tilapia and Aquarium fish that were ready to be stocked in the grow-out pond and independently survived and nourished its own in a new environment.

Laminated sack. It is a water proof sack made of waxy coated cellophane used by the study to hold water which served as a very important material to make a fishpond.

Marcotted Citrus. This refers to marcotted Citrus or lemon plants used to surround the pond for protection of the pond water from direct and prolong exposure from sunlight that will help reduce rapid evaporation and also used for protection of the laminated sack for fast deterioration.

Organic Matter In the study, refers to substances especially hydro carbon atoms as product of decomposition of organic matter such as decayed plants and animals

pH. It is the amount of potential hydrogen ion concentration present in the soil that is used to determine the degree of acidity and alkalinity.

Pipe Fitting. This refers to fixing of 2" diameter PVC pipes which were used as drainage pipe and also used as an overflow pipes. For drainage pipes, these were underground pipes that run at the middle of the compartment. And the overflow pipes were either mounted at the center as standing pipe which water will be automatically drained or at the sides which were allowed the water to be transferred to the low level ponds during heavy down pours.

Pond leveling. This refers to an activity that required technique in leveling a pond compartment especially with respect to land elevation and slope.

Remarcotted. This refers to a process where marcottedcalemonden reached to a matured branches were also marcotted. This is done by girdling the specific site of the stem and were tightly wrapped by wet soil.

Tilapia. This refers to a bony fish with high tolerability to any water conditions whether in freshwater and brackish water and can be cultured in upland fish farming practices.

Vermiculture. As used in this study, this referred to culturing of an earthworms that was confined in a concreted compartment which were fed with kitchen left overs and decomposable plant parts.

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APPENDICES

January 8, 2006

Genes M. Pasaje,DPA
Campus Director
CTU-Barili Campus
Cagay, Barili, Cebu

Sir:

The undersigned is going to conduct his developmental research study entitled Integrated BIosystem Farming with the inclusive years 2006-2010 at CTU-Barili Campus Staff House Backyard.

In this connection, the undersigned would like to ask an approval from your good office.

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Thank you very much.

Very respectfully yours,

CRISOSTOMO C. CANENCIA
Researcher

Recommending Approval:

HERMOGENES P. JUANILLO, Ed.D
Adviser

Approved by:

GENES M. PASAJE, DPA
Campus Director

SOIL ANALYSIS

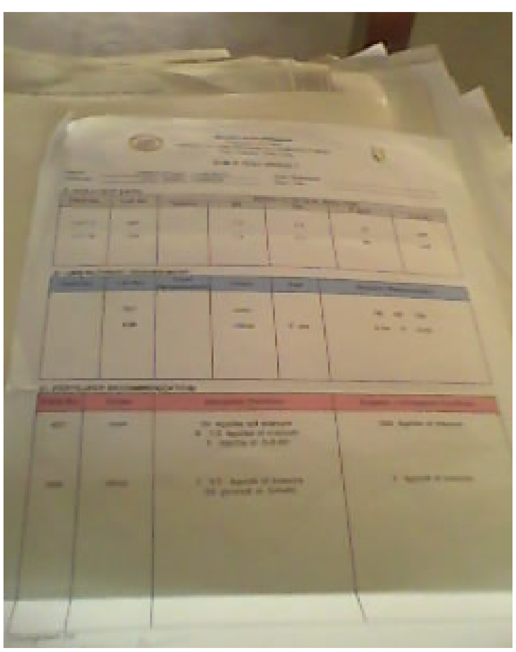

Plate 1. View Before IBF

Plate 2. Leveling of Soil

Plate 3. Extracting of Root and Excavating of Soil

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Plate 4. Pond Cemented Wall and Bottom

Plate 5. Acclimatizing and Stocking of Fingerlings

Plate 6. Mixing and Potting of Soil Media

Plate 7. Remarcotting the Marcotted Citrus

Plate 8. Harvesting the Marcotted Citrus

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Plate 9. Citrus-Lovebirds-Aquarium fish

Plate 10. Vermi-Rabbit Pen

Plate 11. Quail-Chicken-Fish

Plate 12. Banana-Orchid-Citrus-Fish Farm

Plate 13. View After IBF