Case study

From Inorganic to Organic: Initiatives from the Local Government of Malvar, Philippines

ABSTRACT

Aim: This paper aimed to discuss the development efforts of the Municipality of Malvar towards the achievement of its vision to be Organic Capital of Batangas.
Methodology: It made use of secondary data from Municipal Environment and Natural Resources Office and Municipal Agriculture Office and qualitative methods of observation and interview from different stakeholders such as farmers, municipal agriculture officer, municipal environment and natural resources officer, partner-nongovernment organization, and community residents. Then, an analysis based on organic agriculture sustainability metrics was provided.
Results: As a result, the intensified waste management program had made segregation and collection of biodegradable wastes easier, thus shredding of wastes was made easier also. These shredded biodegradable wastes would be used to feed the African Night Crawler that produced vermicast which would be available as organic fertilizer and later on foliar and insecticide once fermented. The biogas facility, on the other hand, was expected to produce methane gas to promote and adopt organic farming technologies and transfer of technology on renewable energy. Last was the adoption of agro-silvo-pasture technology through planting long term cash crops and raising livestock. Indeed, there was a successful transition from inorganic to organic.
Conclusion: The making of the Organic Capital of Batangas could be realized because of the following factors: first is the strong political will of the LGU to implement the vision; second is the appropriateness of the projects that geared towards the attainment of the vision; third is the participation of the different stakeholders in the implementation of the projects. Thus, the intensified solid waste management of MENRO has resulted to successful vermin-composting producing organic fertilizer subsidy to farmers; biogas technology facility that also produces organic fertilizer for the agro-silvo-pasture technology.

Keywords: [organic farming, vermin composting, biogas facility, agro-silvo-pasture technology, Malvar, Batangas, Philippines

1. INTRODUCTION

Earth's land cover is about 38% occupied by agriculture [1]. Agriculture is the primary source of income for an estimated 70% of the world's poor in rural areas [2]. Also, agriculture contributes significantly to the Philippines economy [3] by contributing 11.2% gross development product (GDP) in 2013 [4] in [5]. About 30-35% Filipinos in the rural areas relies on agriculture and over 12 million are employed in agricultural sector [6] in [5]. However, industrial agriculture has brought negative direct and indirect impacts [7] on human health, rural communities and the environment [8], [9] such as greenhouse gases, biodiversity loss, agrochemical pollution, and soil degradation [10], [11], [12]. Thus, a call to make agricultural and consumer practices more sustainable [13], [14] gave birth to organic agriculture (OA). For example, OA in Japan was driven by various concerns: food safety; medical improvement movement in rural areas; farmers' will to alter modern agro-technology because of lost soil fertility; and the acquisition of economic added value [15]. According to the global report on OA [16], there were about 2.7 million producers applying OA in 178 countries in 2016 [17].

The concept of 'organic farming' has diverse meanings among countries [18] and is generally categorized into two types among the industrialized countries: the "Euro-American type" and the "Japanese type" [19]. Either type is a promising strategy enhancing the ability of agriculture to contribute to environmental goals [20], [21]. In fact, organic farming systems produce lower yields, yet, equally or more nutritious foods, more profitable and environmentally friendly [22]. In "organic farming", farmers use organic fertilizers to nurture soil and natural pesticides such as strong smelling plants to control pests [23].

Today, OA is getting more and more attractive to concerned people worldwide [24]; thus, organic farming is spreading worldwide. It is reported that 35 million hectares of agricultural land are certified according to organic standards [17] covering 0.81% of the world's agricultural land.

In the Philippines, OA emerged in the early 1980s in response to the negative effect of green revolution, though there had been efforts to promote it [25]. However, government efforts began in the 2000s [26]. The Department of Agriculture-Bureau of Agriculture and Fisheries Product Standards (DA-BAFPS) established the Philippine National Standards for Organic Agriculture (PNSOA) products and processes. Then, Administrative Order No. 13 was issued providing

accreditation guidelines for certifying bodies to comply with the PNS requirements. The government issued Executive Order 481 establishing the regulations and guidelines, certification and accreditation, market promotion and networking, organic information, R & D and extension in OA in 2005 [26]. Lastly, in April 2010, Republic Act (RA) 10068 known as the 'Organic Agriculture Act of 2010 was enacted. OAA provides for the development and promotion of organic agriculture in the Philippines. Section 2 of this Act stipulates that it is the policy of the State to promote, propagate, develop further and implement the practice of organic agriculture.

Among the first local governments in the country to incorporate organic farming in its development plans to revive the vegetable farming industry was La Trinidad, Benguet [27] in Cordillera Administrative Region. In region IV-A (CaLaBaRZon), Malvar is one of the 1,514 municipalities in the country. It is a second class municipality of Batangas, situated between cities of Lipa and Tanauan, with nine rural and six urban barangays. In support of RA 10068, the municipal government envisioned Malvar to be the Organic Capital of Batangas. To materialize this vision, the Sangguaniang Panlungsod passed an ordinance offering an organic agriculture support fund in the municipality of Malvar in 2012. To insure sustainability in the implementation of organic agriculture in Malvar, a working technical committee was created composed of the mayor as chairman, municipal agriculturist as vice chairman with the following members: committee chair on agriculture and cooperative, municipal local government officer (MLGOO), municipal agriculture and fishery council, *Kasama Ka Organik Koop*, school district supervisor, *Organikong Magsasaka* ng Malvar Association, municipal health office, food crops sector, rotary club and *U & I* club, a professional organization. Within this context, this study aimed to discuss the development efforts of the Municipality of Malvar towards the achievement of its vision to be Organic Capital of Batangas. Specifically, this paper focused on the different organic farming initiatives of the national, local and non- government organizations in Malvar such as biodegradable wastes segregation and shredding, vermin composting, biogas facility for backyard hog raisers, and agro-silvo-pasture technology adoption.

2. METHODOLOGY

This study made use of secondary data gathered from the offices of Municipal Environment and Natural Resources Office (MENRO) and Municipal Agriculture Office (MAO). To strengthen the results of the data, qualitative methods such as observation of situation [28], interview [29] using open-ended questions [30] were utilized.

Ten informants were observed and interviewed from different stakeholders, namely the farmers, municipal agriculture officer, municipal environment and natural resources officer, partner- NGO, and community residents were performed. The interview was conducted using open and unstructured list of questions. Observation was done after the implementation of the project and during the interview with the informants. In qualitative studies, data can be based on 1 to 30 informants [31]. Sample size depends on the research question to be answered with sufficient confidence [32]. Observation was used to concretize the result of the interview. Lastly, an analysis was provided based on OA sustainability metrics: productivity, environmental impact, economic viability, and social well-being [22]. Though production refers to compared yield differences between organic and conventional systems, this study is limited to production as output of the program being implemented by the local government. Environmental impact in this study supports the perception that organic farming systems are more environmentally friendly. Economics, as the financial performance of organic system compared with conventional system, and social well-being, as progress of community, cannot be determined yet on this implementation stage. Impact study must be conducted after years of implementation to determine economic viability and social well-being.

3. RESULTS AND DISCUSSION

Through RA 10068, a comprehensive program was developed for the promotion of community-based organic agriculture systems [33]. In compliance, the municipal government led by the mayor advocated organic agriculture as one of his flagship programs. He envisioned to make Malvar as the organic capital of Batangas. Thus, organic farming was conceived to start with organic fertilizer to be distributed to 500 farmers of Malvar. Prior to this, MAO used to distribute inorganic fertilizer from Department of Agriculture. Inorganic subsidy in the Philippines started to improve agricultural productivity and ensure food security for the Filipinos, making provision and usage of fertilizers as one of the major agricultural program components. In fact, nitrogenous fertilizers such as Urea (34%) and Ammonium Sulfate 920%) were the most supplied fertilizers in the country from 1990-2016 [33]. Likewise, the implementation of RA 9003 or the Ecological Solid Waste Management Act of 2000 [33] gave hope to the bio-fertilizer industry. Also, RA 9003 laid the framework for biodegradable waste to be used for organic fertilizer production [33]. A facilitative delivery and extension system can also provide an enabling environment for the promotion of the use of organic fertilizers [34]. Therefore, the challenge to replace the inorganic subsidy distributed through MAO with organically produced fertilizer was tasked on MENRO. This office had equated organic fertilizer with solid waste management. Thus, different organic farming initiatives were all related to the programs of MENRO.

On the other hand, MAO, being mandated by RA 10068, had done also its part in the implementation. The office after attending training on the principles of organic agriculture had also trained and converted 30 farmers out of the 287 registered farmers of Malvar. "Only few farmers were converted due to the difficulty of changing their orientation, knowledge, skills, attitudes, and practices (KSAP)", the MAO said. This is expected since lack of technical knowledge and lack of organic inputs usually are the main reasons hindering farmers to shift [35]. In addition, one farmer explained that to

be organic is difficult, requiring a lot of work unlike the one step, one click spraying of inorganic fertilizer and pesticides. However, though very few, these trained farmers had organized themselves and formed their own group named as *Organikong Magsasaka (ORMA).* This social network is important to establish linkages, enhance capacity building, and seek cooperation [36].

Then, an organic agriculture technology demo farm was established in Luta Sur, one of the 15 barangays. The farmers were also taught of the vermi-composting technology, but only two out of the 30 farmers were successful. One farmer said that African Night Crawlers (ANC) are very sensitive to temperature; they escaped or died.

In addition, the Office had also initiated the creation of the first organic trading post in the region where organic products (vegetables, fruits, and vermin-tea) of *ORMA* were sold. Aside from these, MAO explained that in 2014, the office also pursued attending trade fairs promoting organic products of Malvar. One of which was through participation in one of the mall's programs "Town of the Month" featuring products produced in the town. MAO also initiated the creation of market day for organic products.

On the other hand, MENRO, as the proponent of the flagship program of the LGU to be "Organic Capital of Batangas" has the following projects:

3.1 Intensified Solid Waste Management

The Republic Act 9003 also known as the Ecological Solid Waste Management Act of 2000 stipulates the need to adopt a systematic, comprehensive and ecological solid waste management programs which shall ensure proper segregation, collection, transport, storage, treatment and disposal of solid waste. It also provides for the establishment of materials recovery facility (MRF) for composting activities which is particularly important to meet the provisions of Section 7 of the implementing rules and regulations of RA 9003 which states that at least 25% of all solid waste from waste disposal facilities should be diverted through composting [33]. The LGUs shall be primarily responsible for the implementation and enforcement of the provisions of this Act within their respective jurisdictions (RA 7160, otherwise known as the Local Government Code).

Figure 1. Available shredding machine for biodegradable wastes

In compliance to this Act, the municipal government enacted an ordinance as a framework for the implementation of the municipal SWM and created the MRF. With the improvement of MRF, incredible increase of garbage collection to 60 truckloads per week from five urban and one rural barangays was no longer a problem. The procurement of two units of shredding machine had hastened the shredding of bio-degradable wastes and plastic/diaper. The provision of containers for collecting biodegradable wastes from barangays San Pioquinto, Luta Norte and Santiago had shortened the time spent in segregating wastes. At the end of the day, all wastes were segregated and were all in the proper places. This results to reduction of methane at landfills, assimilation of existing sectors working in collection, separation, and recycling of wastes [37].

Also, the support of partner- NGO in providing equipment like harvester and power spray was a big help to expedite the process of utilizing wastes into organic fertilizer.

The establishment of controlled compost pit for diapers to become fertilizer was a breakthrough. Believing that in developing countries as much as 80% of the waste stream is compostable [37], Mrs. Eusebio coined the idea of utilizing diapers as fertilizers instead of throwing them near river tributaries like the San Juan River. "At first, it was difficult because it required special and careful management to ensure safety of the workers", Mrs. Eusebio (MENRO officer) said. But, through right attitude toward work, the initiative turned to be a success. The use of disinfectants and bio-enzymes available in the market were options to hasten decomposition of parts of diapers.

But prior to this, community residents were hesitant in the segregation and collection of diapers. “We used to bury or throw diapers near river tributary but because of the policy of MENRO, we gradually embraced the policy, or else, our garbage will not be collected,” one resident explained. Through this effort, huge volume of diaper waste was turned into fertilizer.

3.2 *Vermin Composting*

Composting is the process of mixing waste products, and creating conditions to enable biological decomposition result to a higher-quality organic resource [38]. On the other hand, vermiculture is one of the most promising technologies to answer the demand of people who used organic fertilizer [39]. Vermicomposting is the process of producing compost with the aid of vermi [40], [41]. Vermi worms are placed in vermi-beds out of shredded papers and are fed by burying food scraps into it [42], [43], [44]. The end product, or vermi-compost, contains most nutrients in forms readily taken up by the plants [45].

The project started with five vermin-beds, then 13 beds from the shredded biodegradable wastes at the municipal MRF. The decomposed wastes became food for the African Night Crawler (ANC). After feeding the ANC, they would produce vermicast that would be scraped from the upper portion of the beds. This vermicast or the excreta of earthworm consists more amount of NPK [46] was a very good organic fertilizer. From the produced vermicast, it would be further processed to produce vermin-tea. Two kilos of vermicast mixed with one (1) kilo of brown sugar and 30 liters of water loaded to a vermin-tea brewer could produce 30 liters of foliar and insecticide. This vermin-tea were tested in a 5, 000 square meter portion of the MRF area which is presently planted with vegetable crops.

On the other hand, compost is used as a soil improver [37], [47], [48], [49] or directly as a planting substrate [38]. Application of compost results in an increase in, not only crop yield [50], [51], but also soil fertility [48], [52], [53]. Furthermore, it helps mitigate environmental imbalances brought by the increasing carbon dioxide concentration in the atmospheres [33].

Figure 2. Vermicomposting beds

This successful vermin-composting experience of MENRO was the first among LGUs according to Mr. Aladino Moraca, Executive Director of Ecological Development Foundation, Inc. based in Bacolod City. He exclaimed that among the LGUs they visited Malvar was the first to be successful in propagating ANC and feeding them with residual wastes such as shredded diaper. “Kudos for your mayor”, he added. This is because of having a good MRF that fed the ANC.

Through this effort, the fertilizer subsidy program of the MAO providing 500 bags of inorganic fertilizer to farmers worth PhP350,000, is now converted into organic fertilizer. The Municipal Government now provides 1.5 tons subsidy a month to 500 farmers of Malvar.

With the thrust to become the “Organic Capital of Batangas, Malvar participated at ALA EH Festival 2012 Booth Competition with vermicast as the most saleable item at ₱15.00 per kilo.

3.3 Biogas Technology

Biogas refers to gas produced by fermentation of organic matter such as sludge, municipal solid waste or biodegradable waste or biomass (biological organic materials that are renewable and can be recycled into gas [54]). Biogas or the anaerobic digestion technology is one of the oldest forms of renewable energy [55]. Biogas technology is also known to

be one of the most appropriate alternatives to treat organic waste [56] such as sludge, municipal solid waste, or biodegradable waste [57] in [5].

Figure 3. Biogas technology project in Malvar

Not only in Malvar, usually, small household and backyard farms excrete waste to surface waters or dispose of waste material in an open pit to decompose, or simply landfill the waste material close to the stalls [58]. Livestock manure when released into the water or accumulated in the soil may pose serious threats to the environment [59] especially into bodies of water through eutrophication [60].

To have a model for a sustainable hog farming adopting a technology for solid waste management and renewable energy, a biogas facility with four (4) cubic meter digester and six (6) cubic meter hydraulic pressure tank was constructed at Poblacion, Malvar, Batangas. This project was sponsored by Ecological Development Foundation, Inc., an NGO whose main thrust is to promote and adopt organic farming technologies and transfer of technologies on renewable energy. The technology was a source of organic fertilizer for the farming community of Malvar since effluents have high organic matter content and significant amounts of potassium, phosphorus, calcium and sulfur, that can be suitable to soil amendments for increased agricultural productivity [60].

For the implementation of biogas facility among commercial farms (Continental Farms, Batangas Farm, Gnilo Farm, and NSL Farm) in Malvar, the municipal government had strengthened the monitoring of their biogas facilities since based on the monitoring team they have malfunctioning biogas facilities.

3.4 *Agro-silvo-pasture technology adoption*

Agro-silvo-pastoral systems have trees, shrubs, agricultural crops (mainly cereals), and livestock as components in a mixed pattern [61]. This system is better practiced by farmers than of other types of the agroforestry system in the lowland areas [62]. This project is situated in the MRF area. The model farm used a combination of planting cash crops and perennial crops and raising livestock utilizing wastes as fertilizer and feeds. For the planting of long-term crops, dragon fruit was already planted as live fence of the tree nursery underneath acacia trees with hybrid papaya and dwarf coconut. The perimeter of the controlled dumpsite was planted with *madre de agua* used as feeds for the organic hogs. For the cash crops, leafy vegetables like kangkong, mustard, pechay, lettuce, ube, and squash were already planted. All other vegetables including hot chili, hot pepper, tomato and eggplant can be inter-planted with the long-term crops. For the livestock, at least 10 free-range chicken and five (5) ducks for egg and poultry/white meat production were raised.

3.5 ***Future plans***. To achieve the vision of becoming the “Organic Capital of Batangas”, several plans were already laid out:

- Dialogue between the Municipal Government of Malvar and *Kasama Ka Organik Kooperatib* in partnership with Lacto Asia Pacific Corporation and the Department of Agriculture to manage a 31M Environment and Organic Fertilizer Program to process and utilize all compostable wastes in Malvar;
- 1, 000 hectares of agricultural lands to be converted into organic farming;
- Establish pilot organic gardens in 15 public schools;
- Improved Central MRF;
- All 15 barangays with functional composting facility;
- Established Organic Trading Post;
- Malvar Organic Restaurant and *Pasalubong* (souvenir) Center.

3.6 Analysis

A key area for the successful implementation of projects geared towards the making of Organic Capital of Batangas is the political will of the LGU concerned. The local government in the 1990s is far different with the present management for having this flagship program. That strong political will encourages the participation of different stakeholders. Participation is a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them [63]. Based on observation and interview conducted from various groups of stakeholders, people's participation can be categorized as interactive participation. Pimbert and Pretty [64] described this kind of participation as having joint analysis to joint actions; possible use of new local institutions or strengthening existing ones; enabling and empowering so people have a stake in maintaining structures or practices. With this, participation can be seen as a process of empowerment of the deprived and the excluded based on the recognition of differences in political and economic power among different social groups and classes. Participation in this sense necessitates the creation of organizations of the poor which are democratic, independent and self-reliant [65]. On the other hand, natural resource management development is a main area of application of participatory approaches. In general terms, the purpose is to improve the living conditions of local people, particularly the poor, by helping them manage the natural resources available to them or under their control with greater effectiveness, sustainability and equity [66].

Will this vision of making organic capital of Batangas sustainable? Reganold & Wachter [22] proposed a sustainability metrics for organic agriculture, namely: productivity, environmental impact, economic viability, and social well-being. Based on production, the four mentioned initiatives are sustainable because of better garbage collection, faster shredding of biodegradable wastes, shorter waste segregation, more jobs in the segregation and recycling process, and more fertilizer from diaper waste, except for the biogas technology which is still on initial phase with minimal emission. Based on environmental impact, all initiatives are environment friendly especially the breakthrough on converting diaper waste to fertilizer and feeds for ANC. There is no literature available on diaper as ANC feed. This is truly sustainable since diaper is a necessity among babies. Economically, these initiatives are not yet viable because they are not yet financially performing. Profitability factors like crop yields, labor and total costs, price premiums for organic produce and potential cost savings [22] cannot be determined yet. Lastly, social well-being based on social equity and quality of life for farm families and communities [22] remains unclear due to limited research, same with these initiatives of LGU Malvar. Therefore, these initiatives are productive and environmentally friendly, but have to develop and improve on economic viability and social well-being.

4. CONCLUSION

The making of the Organic Capital of Batangas could be realized because of the following factors: first is the strong political will of the LGU to implement the vision; second is the appropriateness of the projects that geared towards the attainment of the vision; third is the participation of the different stakeholders in the implementation of the projects. Thus, the intensified solid waste management of MENRO has resulted to successful vermin-composting producing organic fertilizer subsidy to farmers; biogas technology facility that also produces organic fertilizer for the agro-silvo-pasture technology.

MAO, on the other hand, having the organic agriculture mandate has also done its part. But, it would be better if the two offices would work collaboratively towards the achievement of the vision. Therefore, it is strongly recommended that MENRO and MAO must work together as a team, and not two distinct offices promoting organic agriculture. It is also recommended that a participatory monitoring and evaluation of the impacts of all the programs be done.

REFERENCES

[1] Food and Agriculture Organization of the United Nations FAOSTAT Online Database (accessed August 2015); http://faostat.fao.org/site/377/default. aspx#ancor

[2] World Bank. World Data Bank-Agriculture Indicators. Washington, DC: World Bank. 2016.

[3] Chandra, Alvin. Paul Dargusch, Karen E.Mcnamara, Ana Marie Caspe& Dante Dalabajan. A Study of Climate-Smart Farming Practices and Climate-resiliency Field Schools in Mindanao, the Philippines, World Development. 2017. http://dx.doi.org/10.1016/j.worlddev.2017.04.028

[4] World Bank-last update, Agriculture, Value added. 2015a. Available: http://goo.gl/UkA9rF

[5] Mojares, Juvy G. Implementing Biogas Technology Project in Malvar, Batangas, Philippines. Asia Pacific Journal of Multidisciplinary Research 2015. Part III, 3 (4). pp158-164

[6] SNV Netherlands Development Organization & Winrock International. 2010. Feasibility study of a national biogas programme on domestic biogas in the Philippines. Available: http://goo.gl/tAyFMx

[7] Jongeneel, Roel., Nico Polman and G. Cornelis van Kooten. How Important are Agricultural Externalities? A Framework for Analysis and Application to Dutch Agriculture. WORKING PAPER 2016-04 REPA Resource Economics & Policy Analysis Research Group Department of Economics University of Victoria. DOI: 10.22004/ag.econ.241699

[8] Pretty, J., Brett, C., Gee, D., Hine, R., Mason, C., Morison, J., Rayment, M., van der Bijl, G. and Dobbs, T. Policy challenges and priorities for internalizing the externalities of modern agriculture. Journal of Environmental and Management 2001. 44 (2), 263–283.

[9] Tegtmeier, E.M. and Duffy, M.D. External Costs of Agricultural Production in the United States. International Journal of Agricultural Sustainability, 2004. Vol. 2, No. 1.

[10] Rockström, J. et al. A safe operating space for humanity. Nature 461, 472–475. 2009. 13. Godfray, H.

[11] C. J. et al. Food security: the challenge of feeding 9 billion people. Science 327, 812–818. 2010. 14.

[12] Amundson, R. et al. Soil and human security in the 21st century. Science 348, 1261071. 2015.

[13] Pretty, J.N., Ball, A.S., Lang, T. and Morison, J.I.L. Farm costs and food miles: An assessment of the full cost of the UK weekly food basket. Food Policy. 2005. 30(1), 1-20

[14] Porter, J., Constanza, R., Sandhu, H., Sigsgaard, L. and Wratten, S. The value of producing food, energy, and ecosystem services within an agro-ecosystem. AMBIO: A Journal on the Human Environment, 2009. 38(4): 186-193.

[15] Ikegami, Koichi. Changes in the Purpose of Organic Farming and the Roles of Newly- Involved Farmers in Japan. Paper presented in the 4th ARSA International Conference in Legazpi City. 2010.

[16] Willer, H., D Schaack, J Lernoud. Organic Farming and Market Development in Europe and the European Union. The World of Organic Agriculture. Statistics and Emerging Trends. International Federation of Organic Agriculture. 2018.

[17] Acosta, Lilibeth, Elena Eugenio & Jemily Sales. Assessment of organic certification in the coconut oil value chain in the Philippines. UNCTAD Project (DA-1617AI): Fostering the development of green exports through Voluntary Sustainability Standards. 2019. Retrieved from https://unctad.org/meetings/en/SessionalDocuments/UNCTAD_Assessment_VSS_VCO_Philippines.pdf

[18] Atsushi, Makino and Yang Ping. Analysis of the Social Conditions Conducive for Sustainable Organic Rice Farming Around Lake Biwa in Japan. Paper presented in the 4th ARSA International Conference in Legazpi City, Philippines. .2010.

[19] Adachi Kyoichiro. *Organic farming can feed world (Yuki Nogyo de Sekai ga Yashinaeru)*. 2009. Tokyo. Commons. (In Japanese)

[20] Lasco R. D., Habito, C. M. D., Delfino, R. J. P., Pulhin, F. B. and Concepcion, R. N. Climate Change Adaptation for Smallholder Farmers in Southeast Asia. Philippines: World Agroforestry Centre. 2011. 65pp

[21] Scialabba, N. E. H. and Muller-Lindenlauf, M. “Organic agriculture and climate change.” Renewable Agriculture and Food Systems 2010. 25(2), 158-169. Cambridge University Press. doi:10.1017/S1742170510000116

[22] Reganold, John P. and Jonathan M. Wachter. Organic agriculture in the twenty-first century. Nature Plants. 2016. DOI: 10.1038. Retrieved from: http://www.agroecologia.net/wp-content/uploads/2016/02/Reganold-2016-Organic-farming-in-XXI-Nature-Plants.pdf

[23] Hirokawa, Sachika. Promoting Sustainable Agriculture Development and Farmer Empowerment: A Case of Northeast Thailand. Paper presented in the 4th ARSA International Conference in Legazpi City. *2010.*

[24] FiBL & IFOAM. *The world of organic agriculture: Statistics & Emerging trends 2010*. Bonn. FiBL& IFOAM

[25] Piadozo, Ma. Eden S. Fordeliza A. Lantican, Isabelita M. Pabuayon, Alicia R. Quicoy, Aprille M. Suyat, & Paul Kenneth B. Maghirang. Rice Farmers’ Concept and Awareness of Organic Agriculture: Implications for Sustainability of

Philippine Organic Agriculture Program. J.ISSAAS. 2014. 20 (2): 142-156. Retrieved from https://pdfs.semanticscholar.org/432f/edbc4324125d4a538d5f1787e67f21e42d0e.pdf

[26] Shimoguchi, N.N., M.E.S. Piadozo, & A. Fujimoto. Development of Organic agriculture in the Philippines: Case Study of a certified organic farm in Nueva Ecija province, paper presented at the Farm Management Society of Japan conference, Chiba University, Matsudo campus, Sept. 20-22, 2013.

[27] Colting-Pulumbarit, Clarice., Rodel D. Lasco, Carmelita M. Rebancos, & Jesusita O. Coladilla. Sustainable Livelihoods-Based Assessment of Adaptive Capacity to Climate Change: The Case of Organic and Conventional Vegetable Farmers in La Trinidad, Benguet, Philippines. Journal of Environmental Science and Management. 2018. 21-2: 57-69. ISSN 0119-1144

[28] Eastwood, G.M., B. O′Connell, & J. Considine. **Low-flow oxygen therapy in intensive care: an observational study**. *Australian Critical Care*, *24.* 2011, pp. 269-278

[29] Wann-Hansson, C., I.R. Hallberg, R. Klevsgård, & E. Andersson. Patients´experiences of living with peripheral arterial disease awaiting intervention: a qualitative study. *International Journal of Nursing Studies*, *42*, 2005, pp. 851-862

[30] Donath, C., A. Winkler, E. Graessel, & K. Luttenberger. Day care for dementia patients from a family caregiver′s point of view: a questionnaire study on expected quality and predictors of utilisation – Part II. *BMC Health Services Research*, *2011* (11), pp. 1-7

[31] Fridlund, B. & C. Hildingh. Health and qualitative analysis methods**.** B. Fridlund, C. Hildingh (Eds.), *Qualitative research, methods in the service of health*, Studentlitteratur, Lund. 2000, pp. 13-25 Google Scholar

[32] Krippendorff, K. *Content analysis: an introduction to its methodology* Sage Publications Inc., Thousand Oaks, California. 2004. Google Scholar

[33] Ani, Princess Alma B. and Meliza F. Abeleda. A Review of the Policies Affecting the Philippine Fertilizer Industry. AGROPAGES. 2018. Retrieved from http://news.agropages.com/News/print-27283.html

[34] Aquino, A.P., Deriquito, J.A.P. and Tidon, A.G. 2010. Fertilizer Policy for Ensuring Sustainable Food Production in the Philippines. International Seminar on Fertilizer Policy for Ensuring Sustainable Food Production in the Asia- Pacific Region, International Technology Cooperation Center (ITCC), Rural Development Administration, Suwon, South Korea, 21-26 June 2010.

[35] Janjhua, Yasmin., Rashmi Chaudhary, Piyush Mehta and Krishan Kumar. Determinants of Farmer's Attitude toward Organic Agriculture and Barriers for Converting to Organic Farming Systems: Research Insights. International Journal of Economic Plants 2019, 6(2):097-103 DOI: HTTPS://DOI.ORG/10.23910/IJEP/2019.6.2.0303

[36] Guzman, Rowena P. de, Gloria Luz M. Nelson, Girlie Nora A. Abrigo and Rowena Dt. Baconguis. "Selected Organic Agricultural Organizations' Social Networks in the Promotion of Organic Agriculture in Quezon Province, Philippines." 2017. Corpus ID: 150054800

[37] Nandal, Meenakshi & Geeta Dhania. Enrichment of Organic Waste Compost with Microbial Inoculants. AGROBIOS (International) Emerging Technologies, Towards Agriculture, Food and Environment. 2018 Chapter 23. pp. 299-306. Retrieved from https://shorturl.me/DWF7r

[38] Nguyen, Thanh Nghi. Ryan R. Romasanta, Nguyen Van Hieu, Le Quang Vinh, Nguyen Xuan Du, Nguyen Vo Chau Ngan, Pauline Chivenge & Nguyen Van Hung. Rice Straw-Based Composting. In: Gummert M., Hung N., Chivenge P., Douthwaite B. (eds) Sustainable Rice Straw Management. Springer, Cham. DOI: https://doi.org/10.1007/978-3-030-32373-8_3

[39] Villaver, Jeffrey P., Renante A. Panlaan & Moises Glenn G. Tangalin. Perceptions of Vermi Raisers on Different Vermicomposting Practices Adopted in Zamboanga Del Sur, Philippines. International Journal of Science and Management Studies (IJSMS) 2019. E-ISSN: 2581-5946

[40] Aira M, Monroy F, Dominguez J, Mato S. How earthworm density affects microbial biomass and activity in pig manure. Eur J Soil Biol 2002. 38:7–10

[41] Aalok, A., Tripathi, A. K., & Soni, P. Vermicomposting: A better option for organic solid waste management. Journal of Human Ecology, 2008. 24(1), 59–64.

[42] Dandotiya P., Agrawal O. P. Vermicomposting of food and household organic waste using epigeic earthworm (Eudrilus eugeniae). International Journal of Current Research 2013. 5(10):3016-3019.

[43] Dandotiya P., Chauhan P. S., Samadhiya H., Agrawal O. P. An eco-friendly management of household organic waste. Octa Journal of Environmental Research. 2015, 3(2):117-128.

[44] Perera K. I. M., Nanthakumaran A. Technical feasibility and effectiveness of vermicomposting at household level. Tropical Plant Research. 2015, 2(1):51–57.

[45] Dominguez J, Edwards CA. Vermicomposting organic wastes: a review. Soil zoology for sustainable development in the 21st century, Cairo, 2004 pp 369–395

[46] Karmegam, N., & Daniel, T. Effect of appplication of vermicasts as layering media for an ornamental plant Codiaeum variegatum (L.) Bl. Dyn Soil Dyn Plant, 2009. 3, 100–104.

[47] Tejada M, Garcia C, Gonzalez JL, Hernandez MT. Use of organic amendment as a strategy for saline soil remediation: influence on the physical, chemical and biological properties of soil. Soil Biology and Biochemistry 2006. 38: 1413–1421.

[48] Mrabet L., Belghyti D., Loukili A., Attarassi B. Effect of household waste compost on the productivity of maize and lettuce. Agricultural Science Research Journals. 2012. 2(8):462-469.

[49] Tulin, Anabella, Chris Dorahy, Simon Eldridge, Agustin Mercado, Juanita Salvani, Carmelito Lapoot, Valeriana Justo, Lorena Duna, Nelda Gonzaga, Cecille Marie Quinones, Rolland Rallos, Michelle Rañises, Regie Bicamon and Marciana Galambao. “Enhancing profitability of selected vegetable value chains in the southern Philippines and Australia” - Component 1 – Integrated soil and crop nutrient management. ACIAR 2019. ISBN 978-1-925747-40-9. Retrieved from https://www.aciar.gov.au/sites/default/files/project-page-docs/final_report_hort.2007.066.pdf

[50] Bercero, Digno II M., Edgardo C. Aranico, Alicia Catalina E. Tabaranza, & Ruben F. Amparado Jr. Performance of single and combined compost enhancers in composting urban wastes at the household level. Advances in Environmental Sciences - International Journal of the Bioflux Society 2016.

[51] Chan, K. Y. 2010. Integrated soil and crop nutrient management in vegetable crops in the southern Philippines (Australia, CROA Site). Annual report May, 2010.

[52] Goyal S, Sindhu SS. Composting of rice straw using different inocula and analysis of composting quality. Microbiol J. Haryana Agricultural University, India. 2011.

[53] Vo-Van-Binh, Vo-Thi-Guong, Ho-Van-Thiet, Le-Van-Hoa. Long-term effects of application of compost on soil fertility improvement and increase in yield of rambutan fruit in Ben Tre Province (in Vietnamese). Scientif J Can Tho Univ, 2014. 3:133–141

[54] Ezenou, FC. Nigerian Journal of Energy. 2002. P.53-57.

[55] Abbasi, T.; Tauseef, S.M.; Abbasi, S.A. Biogas Energy; Springer: Berlin/Heidelberg, Germany, 2012; pp. 1–169.

[56] Andante Hadi Pandyaswargo, Premakumara Jagath Dickella Gamaralalage, Chen Liu, Michael Knaus, Hiroshi Onoda, Faezeh Mahichi and Yanghui Guo. Challenges and an Implementation Framework for Sustainable Municipal Organic Waste Management Using Biogas Technology in Emerging Asian Countries. Sustainability 2019, 11, 6331; doi:10.3390/su11226331 www.mdpi.com/journal/sustainability

[57] Philippines Biogas for the Cagayan de Oro City Jail” an ICRC-funded environmental and livelihood project in the Philippines , URL: http://goo.gl/mnTk0s

[58] Eastern Research Group (ERC). Barriers and constraints to implementation of anaerobic digestion systems in swine farms in the Philippines 2010. https://www.globalmethane.org/documents/partners_philippines_ag_barrierstoad.pdf

[59] Gerber, P. and Menzi, H. Nitrogen losses from intensive livestock farming systems in Southeast Asia: A review of current trends and mitigation options. International Congress Series, 2006. 1293(0), pp. 253-261.

[60] Grajo, Maria raiza D., Lucille C. Villegas, Andrew d. Montecillo, Lorele C. Trinidad, Julieta A. Anarna, & Veronica P. Migo. Effect of Organic Fertilizer Amina P on the Yield of Pineapple (*Ananas comosus* L.) Merr. And Soil Microbial Population. Philippine Agric Scientist. 2017, Vol. 100 Special Issue S12-S20. ISSN 0031-7454. Retrieved from https://shorturl.me/yul2C

[61] Gebrehiwot, K. Ecology and Management of Boswellia Papyrifera (Del.) Hochst. Dry Forests in Tigray, Northern Ethiopia; Cuvillier Verlag: Göttingen, Germany, 2003.

[62] Gebru, Belay Manjur, Sonam Wangyel Wang, Sea Jin Kim and Woo-Kyun Lee. Socio-Ecological Niche and Factors Affecting Agroforestry Practice Adoption in Different Agroecologies of Southern Tigray, Ethiopia. Sustainability 2019, 11, 3729; doi:10.3390/su11133729 www.mdpi.com/journal/sustainability

[63] World Bank 'Philippines: Mindanao Rural Development Program - Indigenous peoples development framework'. IPP184 Indigenous Peoples Plan. Manila: World Bank. Protected Area Management'. *Discussion Paper No. 57.* Geneva: UNRISD. 1999.

[64] Pimbert, M. and J. Pretty. 'Parks, People and Professionals: Putting Participation" into protected area management Discussion paper 57 UNRISD Geneva 1994.

[65] Ghai, D. 'Participatory Development: Some Perspectives from Grassroots Experiences'. *Discussion Paper No. 5.* Geneva: UNRISD. 1988.

[66] Guimaraes, J.P. Participatory Approaches to Rural Development and Rural Poverty Alleviation. Working Paper. Institute of Social Studies, 2009. The Hague, Netherlands.