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Challenges in the Growth of the Compostable Bioplastic Industry in the Philippines and the Role of Policy

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ABSTRACT

Alternative strategies and nature-based technologies are being sought to solve plastic pollution as a result of plastic waste mismanagement. Compostable bioplastic is deemed to be a potential solution. However, the bioplastics industry has a very slow growth in the Philippines. This study investigates the reasons for such sluggish growth by exploring current policy support for manufacturers and consumers to produce and use bioplastics, respectively. Key informant interviews, online data collection, and focus group interviews of a total of fifteen (15) respondents were used to gather data from institutional representatives of upstream and downstream plastic manufacturers, the food packaging industry, and local government units as regulators of plastic use. Sixty-four (64) wet market sellers of meat and poultry were surveyed regarding their knowledge about and their willingness to buy compostable bioplastics. Thematic analysis and descriptive statistics were used for data analysis. Results showed that there is no clear bioplastics policy in the Philippines and this hinders manufacturers from investing in its production. The incentives that can potentially influence a shift in decisions are competitive pricing, access to technology, and government subsidies. The conditions leading to the adoption of compostable bioplastics in the food packaging industry are access to technology and cheap raw materials. Wet market sellers will use bioplastic if it is cheap and durable. Information, education and communication strategies are also needed to educate the public about the technology. LGUs can work with local institutions to promote bioplastic use.

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Keywords: compostable bioplastics, policy support, plastic manufacturers, food packaging industry, wet market sellers, local government, Laguna, Philippines

Abbreviations: Cellulose Acetate (CA); City Environment and Natural Resources Officers (CENRO); Department of Trade and Industry (DTI); Extended Producers Responsibility (EPR); focus group interview (FGI); Information, Education, and Communication (IEC); Key informant interview (KII); Local Government Unit (LGU); Board of Investment (BOI); Municipal Environment and Natural Resources Officers (MENRO); National Academy of Science and Technology – Philippines (NAST PHL); polyethylene (PE); polyethylene terephthalate (PET); polybutylene adipate terephthalate (PBAT); Philippine Plastics Industry Association (PPIA); polyhydroxyalkanoates (PHA); polylactic acid (PLA); polyvinyl chloride (PVC); South East Asia (SEA); Supervising Environmental Management Specialist (EMS)

INTRODUCTION

Plastic is a technology that has promoted convenience in modern society. However, much of the literature has shown that plastic wastes have become a public problem (Mastrolia et al. 2022). Health and environmental effects of plastics are widely documented (US EPA 2025; Cooper 2025; Greenpeace Philippines 2024). In terms of health impacts, chemical exposure is dangerous as plastics contain endocrine disruptors and other toxins leaching into food and water that may cause hormonal imbalances, reproductive issues (reduced sperm, early puberty), and developmental/neurological disorders. Children are at risk for birth defects, impaired lung growth, and childhood cancers (Geneva Environment Network 2025). Tiny plastic particles or microplastics can enter the body through ingestion and inhalation, potentially damaging cells and causing inflammation, which could possibly cause cardiovascular problems. Environmental effects include impact on wildlife when animals ingest plastic, that leads to internal injuries, organ blockage, and death, and with microplastics accumulating in food chains; ecosystem contamination such as when microplastics contaminate soil, disrupting plant growth, nutrient cycles, and microbial communities; and persistent pollution, as plastics do not decompose but break down into microplastics, spreading toxins and polluting oceans, soil, and air globally. In summary, plastics introduce harmful chemicals and particles into our environment and bodies, threatening human health, and thus, demanding urgent action.

In the public sector economics framework, these externalities need government intervention. Several strategies have been pursued to minimize or at least manage plastic waste in the country (Rola 2019), e.g., banning its use, encouraging the use of eco-bags, plastic waste being sent to cement factories, re-use, etc. However, in the aggregate, huge quantities of plastic waste are still observed. Further, the OECD's first Global Plastics Outlook (2022) revealed that both rising populations and incomes drive an increasing use of plastics, but at the same time, policies to manage its impact on the environment are not enough.

One strategy to minimize long-term plastic residues is the use of compostable bioplastics. It is important to distinguish compostable bioplastics from partially biodegradable bioplastics. Bioplastics are polymers produced using renewable raw materials and are classified into biodegradable and non-biodegradable, as per bioplastic industry classification (Precedence Research 2023; Statista 2023). Fully biodegradable or compostable bioplastics make use of biodegradable polymers such as polylactic acid (PLA), starch blends, polybutylene adipate terephthalate (PBAT), polyhydroxyalkanoates (PHA), and cellulose acetate (CA) as well as starch-based polymers from cassava, potatoes, corn, wheat, tapioca, and rice. On the other hand, non-biodegradable bioplastics are produced using non-biodegradable polymers such as polyethylene (PE), polyvinyl chloride (PVC), polypropylene (PP), polyethylene terephthalate ((PET) also from renewable sources and are similar to those from fossil-based sources. While the compostable bioplastics are fully degraded into carbon dioxide and water, the non-biodegradable bioplastics are degraded only under optimal industrial composting conditions and their degradation in nature may take a long period of time such as decades or centuries. In addition, the so-called oxo-degradable or oxo-biodegradable plastics are manufactured using conventional plastic polymers with additives that promote the fragmentation of the plastic material, but are not fully degradable in nature. The degradation of such bioplastics and plastics has resulted in microfragments of plastics (microplastics) which have contaminated bodies of water, food products, the

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atmosphere and, thus, pose potential harmful effects on human health (Abbas et al. 2025; Winiarska et al. 2024).

The bioplastic industry is nascent in the US and other developed countries. The European Union and United Nations are the major advocates and motivators of the bioplastics market (Global Data 2021); however, significant efforts are still required to promote the adoption of compostable bioplastics.

Furthermore, Filho et al. (2021) highlighted the need for effective government policies about bioplastics. In Southeast Asia, Thailand leads in providing facilitative policies to boost its bioplastic industry. For instance, its Board of Investment currently offers a wide range of non-tax and tax incentives for activities related to the industry to support the manufacturing of eco-friendly chemicals and eco-friendly products (Table 1). As a result of these incentives, Thailand is the second-largest manufacturer of bioplastics in the world after the USA, making it the largest in Asia. Data on bioplastics production in Thailand include the following: 90% of bioplastics (resins) are exported, while 10% are consumed domestically. The total current production is 95,000 tons/year. There is a planned increase in production of 75,000 tons/year aiming for a total of 170,000 tons/year. This will surpass the USA, which currently produces 150,000 tons/year (Kerdlap 2024).

Table 1 shows the bioplastic policies in other Southeast Asian countries, which shows that government support through fiscal incentives (e.g., taxes) is a popular instrument. This is true for both Malaysia and Thailand. Cambodia and Indonesia promote the use of biodegradable plastics, supported by a law. It is revealed that the Philippines does not have a national policy on bioplastics; however, several local governments have passed ordinances to regulate the use of oxy-biodegradable plastics, the outcomes of which need to be evaluated.

Table 1. Bioplastics policies in Southeast Asia (Source: Kerdlap 2024)

Country	Policy
Cambodia	Adopted a sub-decree that promotes biodegradable plastics and public plastic bag reduction through reusing plastic bags or using eco-friendly bags.
Indonesia	Ministry of Industry of Indonesia enacted the Ministerial Regulation Number 55/2020 regarding Green Industry Standards for petrochemical plastic and bioplastic shopping bags.
Malaysia	• Established ecolabelling criteria for biodegradable and/or compostable plastic packaging materials. • Stimulates bio-based and biodegradable plastics production through tax breaks.
Philippines	• In 2013, the Caloocan City government enacted the Plastic and Polystyrene Regulation Ordinance that states that bags must be clearly marked as “oxo-biodegradable,” “degradable,” or “biodegradable” and printed with the Plastic Coding System emblem.
Thailand	Board of Investment of Thailand currently offers a wide range of non-tax and tax incentives for activities related to the industry to support the manufacturing of eco-friendly chemicals and eco-friendly products.

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Given the above, this paper aims to uncover some of the reasons why the Philippines is lagging behind its Southeast Asian neighbors in terms of growth in the compostable bioplastic industry, and the potential role of policies. Specifically, it will answer the following questions: 1) What are the conditions and challenges of plastic manufacturers in the production of compostable fully biodegradable bioplastics? 2) What are the conditions and constraints faced by the food packaging industry in using bioplastics? 3) What might influence wet market sellers to use compostable bioplastics and what is the role of local governments? 4) How will current policies be reformed to incentivize both manufacturers and consumers alike to produce and use bioplastics, respectively?

This is an exploratory study. Qualitative information on conditions, challenges, and constraints was generated from the various plastic industry actors. Knowledge and attitudes about bioplastics were asked of wet market sellers and the LGU representatives, though some results are not reported here for brevity. Local government discussion was limited to data on attitudes of three institutional representatives of the study sites.

MATERIALS AND METHODS

Conceptual Framework

In 2000, the Philippines passed Republic Act No. 9003, or the Ecological Solid Waste Management Act. The law sets "guidelines and targets for solid waste avoidance and volume reduction through source reduction and waste minimization measures, including composting, recycling, re-use, recovery, green charcoal process, and others, before collection, treatment, and disposal in appropriate and environmentally sound solid waste management facilities in accordance with ecologically sustainable development principles."

The measure paved the way for the creation of the National Solid Waste Management Commission, which has been tasked to oversee its implementation and is composed of representatives from both the government and private sectors. However, more than two decades after its passage, the law has yet to see substantial progress. Due to the slow implementation of the law, concerned sectors continued to call for more action from the government. This prompted the Philippine Congress to pass another national law to address further waste management problems, involving major stakeholders in the process. Republic Act No. 11898, or the Extended Producers Responsibility (EPR) Act of 2022, mandates large companies, those with assets worth over ₱100 million, to assume full responsibility for the "recovery, treatment, recycling or disposal" of their products after they have been sold and used by consumers to reduce the generation of plastic waste. Those who fail to comply shall pay hefty fines ranging from ₱5 million to ₱20 million.

The current laws are found to be less effective, partly due to lack of implementation and possibly due to lack of knowledge among stakeholders (COA 2023). In this paper, we argue that policy support can be targeted to both manufacturers and their clients, such as the food packaging industry (Fig.1). Policy support in terms of incentives could drive changes in the behavior of both manufacturers (in terms of supply) and plastic users (in terms of demand).

If there are adequate communication and information, the public will also be aware of the externalities of plastic waste mismanagement. Public behavior can change if policies also support plastic waste management. This public behavior can also influence the shift by plastic consumers to use more bioplastics and practice rationale use of plastics, which can improve the physical environment and public health. In turn, the use of bioplastics and the rationale use of plastics will influence plastic demand by type and quantity, which will influence manufacturing responses regarding the production of compostable bioplastics vis-a-vis partially biodegradable bioplastics and the oxo-biodegradable plastics.

The Research Design

This is an exploratory study, with a heavier emphasis on the qualitative data and analysis. The researcher needed to probe deeper into the challenges and constraints of manufacturers to produce compostable bioplastics.

The respondents of the study were the institutional actors such as the upstream and downstream manufacturers of plastics to represent the industry supply, the institutional food packaging industry

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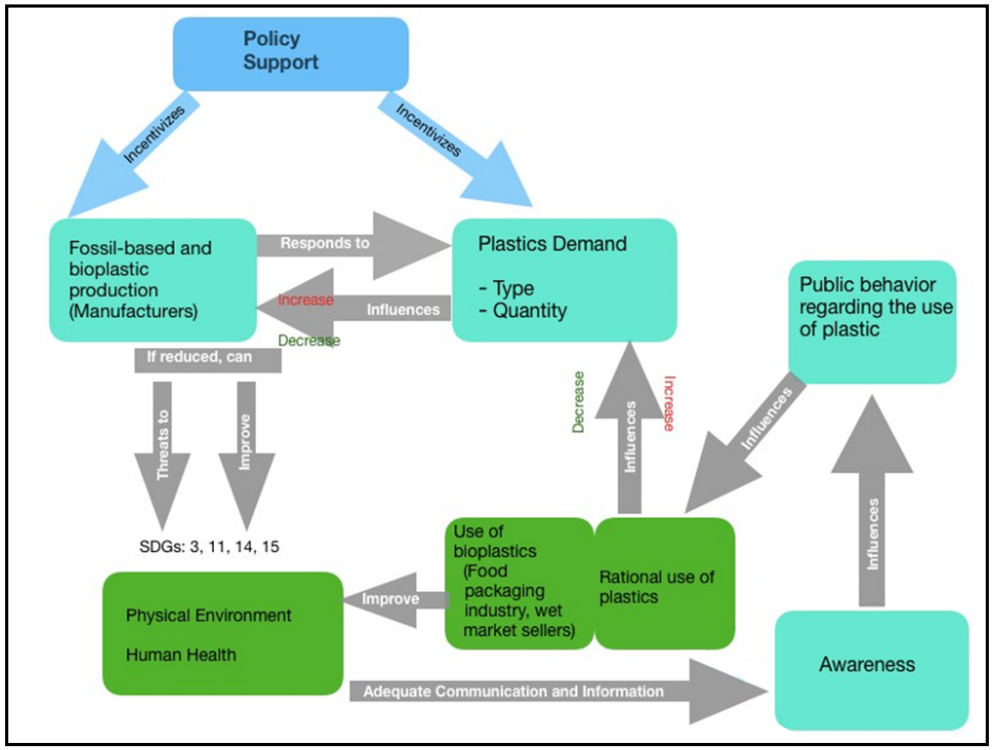

Figure 1. Conceptual framework on the role of policy on the supply and demand of bioplastics in the Philippines (Modified from Filho et al. 2021)

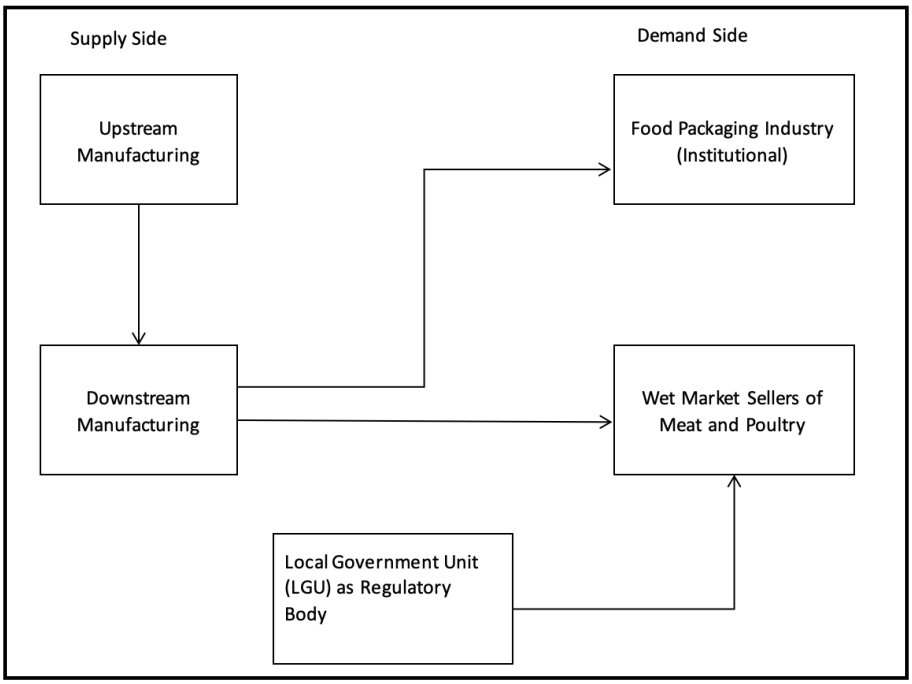

Figure 2. Industry framework identifying the actors engaged in this study

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representatives and sampled wet markets sellers in the two towns and one city in Laguna to represent the demand side, and the officials of the local government units (LGUs) of market survey sites as case representation of plastic use regulators (Figure 2).

Laguna was chosen as the case study site due to its proximity to the researcher and due to budget constraints. The Data Privacy Act was complied with. All Key informant interview (KII) respondents and market survey respondents signed the consent letter to document their agreement to their voluntary participation in the data collection.

Data and Methods of Collection

Qualitative data gathered included: conditions and incentives influencing the decision to produce bioplastics by upstream and downstream manufacturers; conditions affecting the food packaging industry firms' decisions to use bioplastics; plastic waste management beliefs and practices by food packaging industry representatives; constraints and challenges in the possible adoption of bioplastics by these actors; and the LGU representatives' attitude on the use of bioplastics. Quantitative data included the demographic characteristics and factors for buying and not buying bioplastics by wet market sellers, among other quantitative variables gathered.

Table 2 presents the methods of data collection, the profile of the actors, and the number of samples per actor classification. A total of thirteen key informant interviews (KII) were conducted, four of which were done online. These included two upstream manufacturers, four members of the plastic industry association representing the downstream plastic manufacturers, four representatives of the food packaging industry, two Municipal Environment and Natural Resources Officers (MENRO), and one City ENRO. One focus group interview (FGI) was also done with two high-ranking officers of the plastic industry association. The name of the firms of the sampled interviewees was taken from the list found on the internet, where a total of four (4) potential manufacturers (upstream) and nine (9) food packaging industry were then assumed as the population for these actor classifications. The Philippine Plastics Industry Association (PPIA) represents the "voice of the downstream plastic manufacturers" and consists of about 160 member firms. Those members willing to answer our questionnaire became our respondents.

The researcher tried to reach out to these small firms of downstream actors, but they were difficult to find due to the absence of formal addresses or phone numbers.

The small sample size used in this study is justified as it aims to understand the "how" and "why" behind experiences, which requires in-depth information from each participant. Hennink and Kaiser (2022) empirically assessed sample sizes for saturation in qualitative research and found that studies using empirical data reached saturation within a narrow range of interviews (9–17) or focus group discussions (4–8), particularly those with relatively homogenous study populations and narrowly defined objectives. This study qualifies as such as actors are mostly in the plastic industry, and the research question is narrowly defined.

Upstream manufacturers

Two out of four listed upstream manufacturers agreed to be interviewed. The respondents were both females and were in charge of the business operations. As upstream manufacturers, they produce resins to create the raw materials (PVC, resins) for use by downstream manufacturers. The downstream clients use the resins to produce plastic packaging.

One company was involved in sustainable food stock production, i.e., biodiesel, ingredients for personal and home care products, like coconut oil. It has a sister company that produces biodegradable plastics, but this is located outside of the country. The other respondent's firm also produces 100% traditional, synthetic, non-biodegradable plastics.

Downstream manufacturers

Four firm managers who are members of the PPIA submitted their completed questionnaires via email. All the firms produce traditional, synthetic, non-biodegradable plastics for plastic bag packaging, household items, plastic bags, and other types of plastics, including "sando" and "labo", used by wet market sellers. Two top officials of the PPIA have consented to have a focus group interview (FGI) with the researcher.

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Table 2. Methods of data collection, profile of actors, and number of samples per actor classification.

Type of data/method of collection	Actor classification	Profile of actor respondents	Number of samples
Qualitative data			
Key informant interview (KII) -13			
Face to face	Upstream manufacturers	Company officers	2
(online)	Downstream manufacturers	Members of the PPIA/small plastic firm owners	4
Face to face	Food Packaging Industry Reps	Financial director, quality control supervisor, operations and planning officer, sales representative	4
Face to face	Municipal /City Government Reps	Municipal/City Environment and Natural Resources Officer	3
Focus Group Interview (FGI) (Online)-1	Downstream manufacturer	Top PPIA officers	2
Total			15
Quantitative data			
Market survey Face to face	Plastic consumers in municipal wet markets	Meat and poultry sellers	64

PPIA-Philippine Plastics Industry Association

Food packaging industry

Four of the listed nine food packaging firms agreed to have key informant interview (KII) with the researcher. They are trading companies and producing packaging materials, such as resealable bags and pouches, which are imported from Taiwan, Korea, and Japan, coffee and chocolate pouches, food packaging and manufacturing (e.g., noodles), and a manufacturing company for food and food supplements. One is foreign owned company whose products are 100% non-biodegradable. It uses traditional plastic, while some use a combination of paper and plastic. One respondent supplies reusable poly bags. Another produces eco-friendly, customized resealable bags and pouches that have oxo-biodegradable properties.

LGU respondents

LGU respondents are the MENRO officials and the city LGU respondent is the Supervising Environmental Management Specialist (EMS). The educational attainment is striking, with all respondents having postgraduate degrees. MENRO is an optional item in the local government code and not all towns/cities have MENROs/CENROs.

Wet market sellers

Regarding the quantitative data, wet market sellers of poultry and meat using the “labo” (without handle) and “sando” (with handle) plastic containers, in 1 first-class town, 1 second-class town and 1 city, all in Laguna, were interviewed. Both the labo and sando single-use plastics dominate the plastic waste as seen in the wet markets. The interview was done via a pre-tested survey questionnaire. The list of respondents was taken from

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the town or city office issuing business permits/licenses. For the city and the second-class town, the population of meat and poultry dealers in those places were interviewed. For the first-class municipality, sample respondents were chosen from the list through random sampling.

A total of 64 respondents, consisting of 22 from the city, 31 from the first-class municipality, and 11 from the second-class municipality, were interviewed.

Data Analysis

Qualitative data were analyzed using themes. Thematic analysis produces themes from texts in KII or FGI transcripts. The method synthesizes information from the transcripts so that clear responses to the questions emerge. It is a preferable method to use when one wants to tease out respondents' knowledge, attitudes, or experiences on a topic. It starts with familiarization, then coding the responses and generating the themes. Deductive coding was used to determine the themes, because, as was previously mentioned, there are predetermined factors found in the literature. The study validated the presence of these factors in the Philippines.

The survey data were encoded in Microsoft Excel and were analyzed via descriptive statistics.

RESULTS AND DISCUSSION

Conditions for Upstream and Downstream Manufacturers to Produce Bioplastic

Table 3 contains the responses by both the upstream and downstream manufacturers on conditions they perceived will influence their clients to shift from traditional synthetic plastic production to bioplastic production. Both answered that the economics and supportive legislation are important conditions. Upstream manufacturers were concerned with the acceptance of the market, while the downstream manufacturers were more concerned with access to raw materials and technology.

Table 3. Conditions/incentives for the production of compostable bioplastics by upstream and downstream manufacturers

Item	Upstream manufacturers	Downstream manufacturers
Conditions to manufacture/ use bioplastics	Lower cost of manufacturing, supportive legislation, acceptance of the market.	Lower cost of manufacturing, access to raw materials, access to technology, supportive legislation.
Policy environment that encourages bioplastic use as alternative	Need implementation of programs on reduction of plastic, more responsive to global call on environmental issues.	Tax incentives, market demand, access to technology, government subsidy in research.
Features of the law as incentives to shift to bioplastics use	not aware, many gray areas, overlapping provisions, no implementation	Strict regulations, research and development
Company incentives that government can offer to shift to bioplastic use	Reduction of sales tax, value added tax, incentives on logistics, manufacturing costs, power costs, renewable energy use as incentives.	Tax incentives, government subsidies, Business-related incentives.

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The upstream respondents perceived that the current policy in plastics manufacturing is promoting the use of bioplastic as an alternative, but this needs implementation of programs on reduction of plastics and being more responsive to the global call on environmental issues (such as promotion of circular economy). For downstream respondents, a favorable policy environment is to have tax incentives, market demand, access to technology and government subsidies, especially in research. If there is market demand, downstream respondents will be willing to produce compostable bioplastics but in a profitable way. They also request a waste management infrastructure to be put up. Right now, they feel the situation is heavy on regulations, as contained in the various senate bills.

Upstream manufacturers were not aware of incentives as features of the law to influence them to promote bioplastics. They observed that the current law supporting plastic use is not being implemented, that the Extended Producer Responsibility (EPR) Act has many gray areas and overlapping provisions with the other laws such as the National Solid Waste Management Act. But the industry is active in coordinating with the DENR. For downstream manufacturers, features of the law as incentives to shift to bioplastics should have strict regulations (e.g., labelling), and research and development provisions. Business-related incentives can be offered by government to both the upstream and downstream manufacturers to produce bioplastics. These would include reduction of sales tax, value added tax, incentives on logistics and subsidized manufacturing costs. Upstream respondents further mentioned about subsidies in power costs and renewable energy use as incentives. Downstream respondents mentioned that without a clear national policy, it is difficult to invest in this technology.

At the global level, the sentiment is to give more support to the upstream manufacturers as they can influence the downstream. Manufacturers can have designs that promote bioplastics production (The World Bank 2022), and the plastic waste can be the new upstream (EPC 2022).

"In any suite of policy instruments, upstream incentives for producers and consumers are essential for circularity." (World Bank 2022, page 6)

Downstream manufacturers said that any proposed policy may include promoting industrial composting facilities, so the waste will be contained. "But there is still no technology for industrial composting" (PPIA official).

The downstream respondents also believed that bioplastics at the moment are not yet commercialized in the country. They are familiar with one company in Bulacan manufacturing bioplastics which they perceived as corn-based. This company has target customers, but the wet market is not one of their target markets. Accordingly, maybe the bioplastics as mentioned to be in use in the wet market could be ordinary plastics or oxy-biodegradable.

According to downstream respondents, at least two factors constrain the bioplastics to be commercialized. First, the consumers are very price-sensitive. Bioplastics will be expensive (due to lack of raw materials and technology). Any alternative to the current type of plastic should be cheaper. Second is the attitude of the consumers regarding bioplastics. It is a mind shift and consumers have to embrace this mind shift by being willing to pay for a higher priced alternative that minimizes public health concerns. The downstream respondents also recognized the research efforts of the academe but there needs further progress in the research to address this supply constraint. It was further mentioned that the downstream manufacturers' current machines are only for fossil-based plastics and not compatible with bioplastics production.

In summary, upstream manufacturers would like to see more policy-related support, while downstream manufacturers focus more on the operational issues, such as access to technology, raw materials, research and development needs, and other logistic needs, including waste disposal.

Conditions Affecting the Food Packaging Industry Firms' Decisions to Use Bioplastics

Food packaging is one of the top contributors of plastic waste. Because of this, the industry has also prioritized looking into more eco-friendly alternatives to conventional plastics (Zhao et al. 2020). The biodegradable properties of compostable bioplastics have been seen as a possible solution to keep food and

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food packaging waste away from landfills. This will help avoid more plastic from spreading into the environment, particularly the marine (Kakadellis and Harris 2020). Bioplastics are composed of materials which ensure the food products' safety and will also not cause harm to the environment due to their organic decomposition (Rahman et al. 2019).

Aside from the foreign-owned firm (Firm3), all food packaging industry respondents in this study were knowledgeable about bioplastics (Table 4). But the foreign-owned firm said that if their clients request bioplastic technology, then they will try to know more about it. Those knowledgeable about bioplastics know of the advantages such as their being eco-friendly, no need for machines to dispose them, but when used in food packaging, the food shelf life may become shorter. Information was sourced from their customers inquiring about bioplastics, from suppliers, and from self- study through the internet. Bioplastics is more expensive to use in food packaging than the non-biodegradable ones, according to the three firms which know about bioplastics. According to them, the price is double or triple the cost of the synthetic plastics. Asked about their plan to start using bioplastics in food packaging in the near future, they said that bioplastics are not commercially viable for now; but if required by government and if they find this advantageous to their business, then they will start using bioplastics. The most important decision factor for firms to shift to the bioplastics is the price. Access to raw materials was also mentioned together with access to technology and the technological maturity.

Table 4. Conditions affecting the food packaging industry firms' decisions to use bioplastics.(Demand side)

Items	Codes	Themes	Example of Quotes
Processes that will be done differently instead of using synthetic/non-biodegradable plastics	*Same process; no need to sterilize, different process*	*Lack of knowledge*	*"Most of our products come from (a foreign country), and it does not use bioplastics. Firm 3*
Conditions to shift to bioplastics use for food packaging	*Eco-friendly, availability, budget constraint, access to raw materials, technology, price, market*	*Economics, technology, availability*	*"Price, encouraging clients to use bioplastics"- Firm 4*
Current policy environment encourages bioplastic use as alternative industry to shift to bioplastics	*Client feedback, no alternative technology yet*	*Market demand, technology*	*"Hearing from my clients, there is really a goal to reduce plastics. Everyone wants to achieve this goal, but there's no technology yet." Firm 2*

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Items	Codes	Themes	Example of Quotes
Features of the law that will incentivize food packaging industry to shift to bioplastics	*Environment slant; harmonized national and local government policies, recycling facilities, uniform tax levels for same type of plastics, better waste disposal.*	*Pro-environment, policy, economics, provision of facilities, e.g., recycling machines*	*"Having everything fully recyclable – it's still a dream. There are still no facilities to recycle plastics properly. Honestly, if there is a policy from the government, I don't know how they will do it."Firm 2*
Company incentives that government can offer so food packaging industry use bioplastics	*Provide eco-friendly raw materials, generalized policy, same tax level. Provide recycling machines*	*Raw materials, policy, facilities*	*"Maybe if they can provide eco-friendly raw materials, so that the cost will be cheaper."-Firm 1*
Suggestions to promote bioplastics' use in food packaging	*Information campaign on the benefits of bioplastics, commercials, social media*	*IEC*	*"Maybe they can have commercials, to promote benefits of bioplastics". -Firm 3*

Some suggestions on the features of a law that will incentivize food packaging industry to shift to bioplastics include harmonization of both local and national policies, must have an environmental slant such as subsidizing green technologies, provision of recycling facilities, thus strengthening waste management programs for better plastic disposal. Government can provide incentives to the firms by providing eco-friendly raw materials to bring down cost and provide recycling machines.

Table 5 summarizes the constraints and challenges faced by the various actors in the adoption of bioplastics. Across the actors' space, the most common constraint is the cost, while the most common challenge is the proper plastic waste management. Based on the comments, it seems that bioplastics can be a solution to the pollution problem. But the more formidable challenge is how to design bio-based technologies and implement an effective plastic waste management at all levels of decision making.

The results of the qualitative analysis conform with what are published in the literature (Tariq 2013, Mastrolia et al. 2022, Melchor-Martínez et al. 2023). The most important constraints to the production of bioplastics are the cost of manufacturing, market acceptance, industrial composting facility, and investment in bioplastic facility. If policy is not clear, investments in bioplastic production will not be forthcoming. Further, constraints to adoption by the food packaging industry are budget, access to raw materials and technology. Challenges are also specified in Table 5, including plastic waste management not a priority policy, attitude of consumers, and lack of IEC.

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Table 5. Constraints and challenges in the possible adoption of bioplastics, by various actors. (KIIs results)

Actors	Constraints	Challenges
Upstream Manufacturers	Cost of manufacturing,	Plastic waste management not a policy priority
Downstream Manufacturers	Market acceptance	Market demand, strict regulations, research and development, attitude of the consumers regarding bioplastics, lack of the proper waste management disposal
Food packaging Industry reps	cost of manufacturing, access to raw materials, access to technology, industrial composting facility, investment in the bioplastic facilities budget constraint, access to raw materials, access to technology	Lack of knowledge on processes, lack of recycling facilities, lack of IEC, lack of coherence in practices, disposal infrastructure is lacking.

Factors Affecting Wet Market Sellers' Decisions in the Use of Compostable Bioplastics and the Role of Local Governments

Demographic characteristics of respondents

Majority of the respondents were owners (97%) of their establishments and were dominated by female (67%). The respondents were relatively older, with an average age of 52 years. A high percentage of respondents were high school graduates for charter city (41%) and second class (31%) and college undergraduates (26%) for the first-class town.

Factors influencing use of bioplastics by wet market sellers

The results of the market survey show that almost all respondents have good understanding about synthetic plastics, bioplastics, and their effects. Most of the respondents (98%) can identify two different kinds of plastics: the synthetic nonbiodegradable plastic and bioplastics. In terms of effects of synthetic plastics to human health and environment, all respondents recognized these negative effects. About 97% of respondents understood that degraded synthetic plastic fragments such as microplastics and nano-plastics can accumulate in the food chain and consumed by humans. At the same time, 95% of respondents believed that microplastics can be inhaled through air. In terms of the effects of compostable bioplastics, majority of the respondents identified it as more eco-friendly than synthetic plastics and degrade faster in the environment. Most of the respondents (91%) saw bioplastics as friendly to health. However, there is a relatively lower percentage of responses (83%) on the statement that bioplastics are from plant- based materials.

Given these data on the knowledge of health and environmental impacts of plastics, the survey explored the factors that may influence the use of bioplastics by the wet market sellers. The decision on what kind of plastics will be bought for packaging are by the owner/ self. Two respondents said that it is the municipal government that decides for them. About 94% said that they will buy bioplastics for packaging, if given the chance. This is for environmental and health reasons. However, these actions will also be constrained by the price of the material, durability and the fact that they cannot differentiate whether it is genuine bioplastic or not. But eighty six percent (86%) said that they will buy bioplastic materials if there is a label. These results conform with the food packaging industry respondents' responses.

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Table 6 summarizes the factors that may influence the willingness of the wet market sellers to use and not use bioplastics. Foremost of the factors of influence are the perceived environmental and health effects of the compostable bioplastics, as discussed above. They will also use bioplastics if there is government regulation. For those who are not willing to buy, the cost and durability were the factors that will negate or constrain them to use bioplastics. In short, price and quality should be addressed if wet market sellers are to use bioplastics. Access is a necessary but not a sufficient condition to use bioplastics.

It is noted that while manufacturers considered economics, policy, and technology as conditions for the manufacture of plastics, the wet market sellers were looking at minimizing externalities as factors for use of bioplastics. However, it must also be emphasized that price and technology quality (such as durability) are at the same time important factors for adoption by wet market sellers. Conceptually, these results align with actors' individual utilities. While manufacturers may aim to maximize profits, tempered with green technologies, local plastic consumers such as the wet market sellers were more concerned with their environment and health. They will tend to maximize their social benefits as a community, while deriving some profits from their business.

The results above are standard ones for "public bads" or harmful impacts, enough reason for government to intervene in terms of policy support to minimize the social cost, and at the same time provide incentives for bioplastic manufacturers. As illustrated in the conceptual framework (see Figure 1), policy support to the both producers and consumers will be needed to achieve their differing objectives.

Table 6. Reasons for willingness to buy or not buy bioplastics, by wet market sellers, Laguna (n=64)

Reasons for willingness to buy	**n**	**%**	**Reasons to not buy**	**n**	**%**
Less pollution	14	25.45	Expensive	5	71.43
Less garbage	5	9.09	Both expensive and not durable	1	14.29
Health reasons	13	23.64	Not profitable	1	14.29
With label	2	3.64			
Government regulation	7	12.73			
Others (better, cheaper)	11	20.00			
Not Applicable	1	1.82			
No Response	2	3.64			
Total	55	100	Total	7	100

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Role of the LGUs in Popularizing Bioplastics Use

All LGU respondents agreed that the plastic situation is a problem in their locality that will result to clogging of water ways, and thus, flooding along the way. They all agreed that local government programs are not enough to eliminate the plastic problem in the locality because

"*Plastics is a way of life*" (Second class town respondent).

However, some survey respondents mentioned that they are willing to use bioplastics if government so rules. Implementation of plastic-related ordinances in these communities were observed to be weak due to the absence of monitoring, presence of other urgent concerns such as the COVID, and the lack of capacities to implement. For bioplastics, the challenge is more serious as there is lack of positive attitude among LGU respondents that bioplastics can solve the problem of plastic pollution. For instance, the following are the answers to the questions on whether bioplastics can really solve the problem of plastic pollution:

The city representative says, "*Maybe. It will help, as alternative use of reusable bag, but synthetic plastics is here to stay*." A first class town representative says, "*No. If the consumer is still improperly disposing of these plastics, then the problem of plastic wastes will still exist.*" But the second- class town representative says, "*Yes. Attitude of people that this is doable is needed. Should have knowledge about the environment.*"

Households are difficult to manage in terms of ordinance implementation. But there is optimism in the government's role to manage plastic waste as revealed by LGU responses regarding institutions. On the question of whether institutions (stores, hospitals, etc.) in the town are receptive to plastic waste management, the responses are as follows: City representative- "*Yes, they segregate, obey policies, they have MRF, eco-centers*". First class town representative- "*Yes, selected businesses. They participate in the plastic collection.*" Second class town representative-"*Yes, but …cannot control. No monitoring, no enforcement.*"

If wet market sellers will constitute a local institution, then LGUs can effectively regulate plastic waste and help promote bioplastic use. Local government can conduct information and education campaigns for local institutions to use these. This will potentially result to a more vibrant bioplastics industry.

SUMMARY AND CONCLUSIONS

Because plastics have become a public bad, government needs to intervene to minimize the negative externalities. One way as suggested in this paper is to support the compostable bioplastics industry. However, several reasons were identified that caused the lag in industry growth in the country across the various actors interviewed namely: (a) the government did not have enough support to strengthen the industry of compostable plastics plus there is no clear national policy statement that upstream manufactures/ investors can refer to in their business decision making; (b) Lack of effort on and support to the research, development and dissemination of technologies that can incentivize downstream manufacturers to produce this technology; (c) no or lack of information on where to access raw materials, and (d) no policy on labelling which is important for both the food packaging industry and the wet market sellers.

For the food packaging industry, constraints include the budget, access to raw materials and access to technology. Government has not given sufficient importance to compostable bioplastics R and D. Lack of knowledge on processes, lack of recycling facilities, lack of IEC, lack of coherence in practices, lack of disposal infrastructure are the challenges described by the food packaging industry. These actors are becoming aware of the bioplastics and its advantages, but its economics still needs work.

Wet market sellers have a good knowledge about the externalities caused by plastic pollution. Thus, they are willing to use bioplastics, but only if the price is lower than the synthetic plastics, the quality is also at par with what is currently used, and most importantly for them, a label that could prove that they have the right product. Local government has an important role to play in terms of monitoring the implementation of national policy through their local ordinances. They cannot effectively regulate the households, but effective regulation of institutional users of plastics in their locality, as found in the study, is a good start.

Current policies can be reformed to incentivize both manufacturers and consumers alike to produce and use bioplastics.

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Conclusions

This exploratory study showed that the following are lacking: 1) policy statements on greener technologies such as the compostable bioplastics which need to be explicitly stated; 2) policies that can influence the plastic manufacturer's shift from synthetic plastics to bioplastic production including tax holidays, subsidies and other incentives; 3) information that will lead to the adoption of bioplastics by the food packaging industry which include access to technology and cheap raw materials; and 4) government support to local institutions for IEC, for awareness and eventual behavioral change to adopt bioplastics.

On the whole, an integrated policy framework is needed where incentives to upstream manufacturers will be highlighted, together with the necessary policy and technology support for downstream plastic manufacturers and food packaging industry players. Government, including the local government is a major player, for a potentially robust bioplastics industry in the country. The Thailand government, for instance, has heavily supported the country's bioplastic industry, which is much robust now (Kerdlap and Baker 2023).

POLICY RECOMMENDATIONS

The following are policy recommendations to address the challenges of slow growth in the compostable bioplastics industry.

1. On government incentives for manufacturers

Foremost is a need for a clear bioplastics policy for investors to be enticed to produce bioplastics. Government regulations and incentives such as tax breaks, subsidies and logistics support, among others, can sway manufacturers to shift to bioplastic production. Some suggestions on the features of a law that will incentivize specifically, food packaging industry to shift to bioplastics include harmonization of both local and national policies and provide for recycling facilities thus strengthening waste management programs for better plastic disposal and re use.

2. On the importance of R and D investments and access to raw materials

The most constraining factor to the production and use of bioplastics at this time is the cost. R and D could focus on how to lower cost in the sourcing of raw materials, in technology development, scaling up, mass production, and commercialization. Government can invest in R and D that will make accessible bio-based raw materials such as crops and marine sources. Incentives on how to connect the raw materials industry to bio plastics manufacturers will also help strengthen the production chain and encourage access to the bioplastic technologies by the food packaging industry and the downstream manufacturers.

3. On creating market demand for bioplastics

With the change in public behavior, there can be a rational use of plastics, and an emerging change in attitude to use more bioplastics in food packaging. Food packaging industry will convert to bioplastics use, if their clients will demand such. Bioplastic suppliers can seek a niche market, i.e. in hospitals, schools and other local businesses, such as the wet markets that are easily monitored even by the local governments. This can create demand for small bioplastic firms to grow. This proposal can be part of the provisions of the law.

4. On the role of IEC in changing human behaviour

The results of this study supported the recommendation for government to have information, education and communication campaigns (IEC) regarding the impacts of plastic pollution, the social benefits of compostable bioplastics and the long-term effects of these on human health and the environment. Social media materials to show these impacts in pictures should also be shown to policy makers to influence them to put more investments into the bioplastic industry.

Moving Forward

In August 2025, the Philippine government with the Department of Trade and Industry-Board of Investment (DTI-BOI) as lead, in cooperation with the private sector, the existing bioplastic industry actors, the academe and international partners, conducted the Bioplastic Industry Roadmapping and Validation Workshop (DTI-BOI 2025) utilizing and validating the data, information, and recommendations from the KSP-GGGI technical report (2024). The roadmap aimed to establish a stable commercialization system for biodegradable bioplastics to be used as an eco-friendly alternative to reduce plastic

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usage. The roadmap defined short term, midterm and long-term strategies along the following: system and regulation, innovation technology development (R and D), infrastructure, and human resource development, industry activation, and establishment of a bioplastic circular system. It is projected that by 2040, the commercialization of biodegradable plastics through the development of source technologies and the dissemination of results will be realized.

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