

Reverse Supply Chain: A Triple Waste Management Approach

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Abstract

As the national economy is moving towards the recovery stage brought about by the unprecedented Covid-19 Pandemic, robust intervention affecting our society, the environment, and our economy is at hand. The role that each of the members of the community plays amid uncertainty and ambiguity is urgently called for. The present study investigated the practices, policies, and measures surrounding the impact of supply chain management along reverse logistics or otherwise known as reverse supply chain (RSC) or close-loop supply chain. Whether the local government implements strict ordinances coherent with the household and business sectors. Three local government units were tapped, one from a center of commerce and two adjacent municipalities. The number of household respondents from the 3 LGUs were determined using the Raosoft sample size calculator totaling to 1,132 clustered from among the different income classes. Eight (8) business establishments from the manufacturing and merchandising industry within Metro Naga, Region V, Philippines were also invited to participate on the said key informant interview. With the use of a descriptive research utilizing both quantitative and qualitative approach, it was found out that the location of the business establishment and household population implies compliant to LGU's ordinance on solid waste management. However, data shows no concrete collaboration among the three sectors along disposal and retrieval of wastes though the business sector manifested own programs and initiatives on RSC. Furthermore, these RSC practices have not yet been introduced to households as a method of eliminating wastes. The study further envisions its utilization in establishing coherent framework towards sustainable communities.

Keywords— corporate social responsibility, reverse supply chain, solid waste management

I. INTRODUCTION

With increased uncertainty and economic turmoil brought by the present global impact of pandemic, people, and the entire social citizenry are looking for sustainable and progressive solutions. United Nations' 12th sustainable development goal is to ensure sustainable consumption and production patterns that works on decreasing material footprint, responsible disposal of electronic waste, support developing countries for potential renewable energy, and eradication of fossil fuel subsidies. In this parlance, organizations of different forms must continually revisit their production and

consumption patterns in pursuing ecological balance. Zak (2015) posited that companies must pursue objectives that are on one hand economically justified, on the other hand ecologically acceptable and socially expected. Michael Porter Paying high attention to the issues of corporate social responsibility and the process of building relationships with stakeholders, three economic drivers are challenged in addressing plausible strategies for sustainability. The government sector, household sector, and the business sector, heeding the call for sustainable business with shared vision and advocacy. The government

sector as policy maker is instrumental in shaping the behavior of their constituents as policy implementers. The household sector as consumers holds the majority share of national income. While the business sector as the engine of an economy allows people to make money, produce goods and services, and provide jobs. These economic propellers are the major players in the system of social responsibility. The emergence of corporate social responsibility is believed to be an answer in the overarching issue on sustainable business. Corporate sustainability management encompasses multiple dimension (Ozanne, Phipps, Weaver, Carrington, Luchs, Catlin, & Williams, 2016). These are the environmental, social, and economic. Companies now are evaluated within the public sphere, and within their organizations, according to the degree on how they impact the community, environment, and economy. In 1994, John Elkington, a sustainability guru, coined the phrase “triple bottom line”. The idea is that companies should focus as much on social and environmental issues as they do on profits. It consists of three elements: profit, people, and the planet. In the idea that a company can be managed in a way that it is not just about money but as well as improving people’s lives and the well-being of the planet.

The triple bottom line approach expounds on the elements of doing sustainable business. Purpose-driven leaders are discovering they have the power to use their businesses to effect positive change in the world without hampering financial performance. As firms have embraced sustainability, they’ve shifted their focus toward creating value for all stakeholders impacted by business decisions, including customers, employees, and community members. All businesses have the opportunity to contribute in making a positive impact on the planet (Harvard Business School). That companies must have clear and sound vision affecting the entire stakeholders’ expectations. It was further found out that still there is too little attention being paid to environmental issues and that profit, people, and plant are three notions that are difficult to maintain balance. However,

companies must allocate huge effort for long-term benefits. After all, each company is an element of the business, social, and ecological infrastructure.

II. REVERSE SUPPLY CHAIN

Businesses increasingly must cope with product returns, mandated environmental regulations and increasing costs associated with product disposal (Prahinski and Kocabasoglu, 2006). Managers can improve process efficiencies, customer service, product design, supply chain practices, and after-sales service through an effective management of reverse supply chain. One articulation in the field of social responsibility is the closed-loop supply chain model also known as reverse supply chain or reverse logistics. Supply chain management (SCM) is a mechanism that solves a problem within a value chain just as so to meet the needs of the end customer which minimize cost and prepare to face global competition. While supply chain management (SCM) increases its advantage as an actor of competitive advantage, this business management concept gives hope to leveraging on waste disposal and retrieval management, hence, Reverse Supply Chain (RSC). The study of Abdulkader, Baht, & Mekkawy (2015) defined supply chain as consisting of supplier, manufacturer, distributors retailer, and customer. SCM is the coordination between all these parties and functions for the advantage of the whole supply chain. This coordination requires flow of products (in the direction of customers), funds (in the direction of suppliers) and information between different parties.

In the past years, SCM’s main objective is to provide a network between a company and its suppliers to produce and distribute a specific product to the final buyer. However, due to ecological issues and impact of the various activities of companies on our ecosystem, the recent trend explored on reverse supply chain. What is reverse supply chain? According to Harvard Business Review, reverse supply chain is a series of activities required to retrieve a used product from a customer and either dispose of it or reuse it. Reverse supply chain

which literature would prove could have a significant impact on environmental and economic issues. According to Harvard Business Review, reverse supply chains are becoming an essential part of business. Companies are being forced to set up reverse supply chains because of environmental regulations or consumer pressures. For instance, Kodak remanufactures its single-use cameras after the film has been developed. And over the past decade, the company has recycled more than 310 million cameras in more than 20 countries.

To achieve a sustainable business as well as address environmental regulations and consumer pressures, companies now are setting up reverse supply chain. A supply chain loop which may directly impact the society and environment. Atasu, Sarvary, & Wassenhove, (2008) elicited the economic and environmental benefits of product remanufacturing have been recognized in the literature and in the practice. How remanufacturing through reverse logistics have proven to be worthwhile in terms of profit and the environment. It is seen as a way of fulfilling the purpose of reverse supply chain. Remanufactured products have been widely recognized as mitigating agents of carbon footprint and good operations management practices. Guide, Harrison, & Wassenhove (2001) draws a framework for analyzing the profitability of reuse activities and show how the management of product returns influences operational requirements. Acquisition of used products termed as product acquisition management, affect several important business decisions, such as value creation and overall profitability. Atasu, et.al. (2008) cited that under competition, remanufacturing can become an effective marketing strategy, which allows the manufacturer to defend its market share via price discrimination.

Jayant, Gupta, & Garg (2012) reviewed various perspectives on design and development of reverse supply chain, planning and control issues, coordination issues, product remanufacturing and recovery strategies, understand and appreciate various mechanisms available for efficient management of reverse

supply chains. However, in making rational decisions about the reverse supply chain structure one must understand the key components and analyze its options, costs, and benefits. Such as product acquisition, reverse logistics, inspection and disposition, reconditioning, and distribution & sales. Companies that have been most successful with their reverse supply chains are those with closed-loop system who are working closely with their forward supply chains.

Savaskan, Bhattacharya, & Wassenhove (2004) addresses the problem of choosing the appropriate reverse channel structure for the collection of used products from customers. Choosing a manufacturer how has these three options: collecting directly from customers, provide incentives to retailers who already has an established distribution channel to induce the collection, and a subcontract to a third party for the collection activity. It was observed that manufacturers are leaders in this game of sustainable business being called the Stackelberg leader. It further showed that simple coordination mechanisms using the decentralized decision-making systems such as collection effort of the retailer and the supply chain profits are attained at the same level as in centralized coordinated system.

Challenges in the production and operations management concerning green-product design, lean and green operations, and closed-loop supply chains. The study is more concerned on the life-cycle of products whether it has low margin, short life-cycle to carefully integrate the forward and the reverse supply chain. And how to maximize product recovery potential over the entire life cycle of the product, and this will depend on designing product and processes carefully and developing marketing, accounting, and performance-tracking tools. On the other hand, Fleischmann, Buellens, Ruwaard, & Wassonhove (2001) showed that while product recovery may efficiently be integrated in existing logistics structures in many cases, other examples require a more comprehensive approach redesigning a company's logistics network in an integral way.

III. WASTE DISPOSAL AND RETRIEVAL

The Philippines has endeavored to improve its management of solid waste through the passage of RA 9003 or the Ecological Solid Waste Management Act that provides for a systematic, comprehensive, and ecological waste management program to ensure the protection of public health and the environment. Local governments have also issued their own ordinances for implementation at their disposal with RA 9003 as threshold. LGU's are primarily responsible for the effective and efficient solid waste management, particularly garbage segregation and disposal. Every LGU is required to develop a 10-year Solid Waste Management Plan, including establishment of materials recovery facility and sanitary landfills. Similarly, the business sector is also encouraged through appropriate incentives other than tax incentives, to initiate, participate and invest in integrated ecological solid waste management projects, to manufacture environment-friendly product to introduce, develop and adopt innovative processes that shall recycle and re-use materials, conserve raw materials and energy, reduce waste, and prevent pollution, and to undertake community activities to promote and propagate effective solid waste management practices.

As cited in (Demirbas, 2011) research, due to the expanding population and urbanization, the volume of waste has been consistently expanding. Waste includes durable products, nondurable merchandise, containers, wrappers, food scraps, yard trimmings, and various inorganic wastes from residential, business, and manufacturing industries. There are various techniques wherein waste materials are reused or recycled, it could be through "physical reprocessing, biological reprocessing, or energy recovery." An average waste administration framework contains assortment, transportation, pre-treatment, handling, and final reduction of residues.

Malinauskaite, Jouhara, Czajczyńska, Stanchev, Katsou, Rostkowski, & Spencer (2017) explicates households waste in ordinary families comprises of materials that differ in

composition. Waste depends on the locality, season, income, lifestyle of the consumers, the number of people in the family, industrialization, and commercialization, all of which impact the creation of waste. Waste management has been contemplated, and significant answer to waste administration includes "source reduction, collection, recycling, composting, incineration (burning), landfilling and simply dumping." The "transportation of waste, big processing facilities and the complex waste separation systems" remains the weakness of the waste management systems.

Solid waste management system begins with a methodical assessment of the primary kinds of partnerships, such as public-private, public-local area, local area private and private-private partnerships, conformed to its activities, including "formal collection, transportation, and disposal as well as the informal collection, trade, re-use, and recycling" says, Baud, Grafakos, Hordijk, & Post, J. (2001). They concluded that the local authorities cooperate with enormous enterprises and non-governmental organization (NGOs), however, decline to manage with the informal trade and recycling enterprises which recuperate huge parts of waste.

IV. OBJECTIVES OF THE STUDY

Integrated and close coordination between the local government, households, and business sectors are somehow challenged in outlining each roles in doing sustainable business. Each of these sectors would have to realize as soonest possible time how policies and regulations are being implemented, executed, and coordinated within their respective communities. For the local government, whether they have existing policies and legal frameworks in managing waste disposal and retrieval practices of the business and household wastes. For the business sector, whether there are existing practices on reverse supply chain and its benefits and challenges. For the household sector, whether waste disposal and retrieval practices are observed and whether there are

initiatives linking the business sector to household waste management practices.

From policy making and implementation of solid waste management in the local government level, the solid waste disposal and retrieval practices of households, and the reverse supply chain practices and challenges of the business sector. With these different interfacing variables, it is aimed that the present study would come up with viable solutions and plausible framework that would entice participation and coordination among the stakeholders.

V. METHODS AND MATERIALS

A Mixed method approach was used to facilitate the quantitative and qualitative data collection and analysis. Survey questionnaire was collected from different literatures in contextualizing relevant constructs for reverse supply chain practices. Simoes, Carvalho, Felix, and Arantes (2017) enumerated several published works using the same constructs of RSC such as performance measures and practices, reasons to adopt, benefits of adoption, and causes that affect the realization of RSC. Also explored was how the business sector perceive government's policy implementation on waste disposal and retrieval. A set of questions for household sector was also derived from different published works on solid waste management, including the solid wastes coming out from the households, the present waste management practices, such as recycling and retrieval program, and incentive program.

While for the government sector, a proponent-made questionnaire was prepared guided by an official coming from another LGU, focused on the local government's initiatives and policies on solid waste management provided to the office of Environment and Natural Resources Office. To capture important information called for this undertaking, a key informant interview was conducted to validate sensitive and crucial information. The survey tool was personally administered for the government and business sector, while a google form survey questionnaire was sent to a household member via social media chat platform. Each sector was

given informed consent with further information guided by high confidentiality. Data for the study were collected from 3 local government units, 1,132 households, and 8 business establishments where descriptive statistics was used to analyze the data gathered.

VI. RESULTS AND DISCUSSION

The study zeroes in on the impact of reverse supply chain as a tool for waste elimination, and whether these practices are compliant to government policies on waste disposal and retrieval management, attributable as well to household waste management practices. Working along the premise of sustainable development and the need for collaborative and strong compliance on the mechanisms of all these sectors. It is high time to revisit the mechanics of supply chain management specifically on reverse supply chain and what tangible contributions does it provide. With this, the business sector as an economic force could exceed budgeted profits from gaining competitive advantage brought by reverse supply chain practices.

Results of the study shows that LGUs has budget appropriation intended for solid waste management but not sufficient for small municipalities. It also shows that strategies and activities on SWM differs in one LGU from another especially when classified as center of commerce. This particular LGU is in full implementation of SWM and has several Local ordinances as follows: (1) prohibiting the use plastic bags on dry goods, regulating its utilization on wet goods, and providing penalties for violations thereof; (2) cleanliness of vacant lots; (3) establishing vigilant caretaker group for environmental care; (4) waste segregation and collection; (5) providing trash bin in front of establishment; (6) environmental solid waste management; (7) no segregation, no collection policy. Rahman & Subramanian (2012) points out that factors such as government legislation, incentive and customer demand are found to be the major drivers. Further, Tan and Kumar (2006) depicts legislation as one of the drivers of successful reverse supply chain and acts as a motivator for

low-cost innovative sustainable practices. Government intervention is indeed a strong force in transforming policies into expected results.

Other LGUs develop innovative strategies just to manage their own SWM, such as, trash to cash program for barangays, and free service collection like biocart. There is existing memorandum of agreement with private sectors on the retrieval of plastic wastes. Junkshops and other similar parties are also tapped by LGUs to collect all reusable recyclable wastes. The presence of active public platform in the communities like clean up drive activities in the barangay are also observed. However, one municipality manifested non-compliance to RA 9003, such as absence of material recovery facility and sanitary landfills. The extent to which goals and objectives of service users (households and business sector) and service provider (government) along waste disposal and retrieval management is generally fair.

Table 1 shows the level of implementation and practices of business sector in reverse supply chain is generally high. Financial investments for operational and technological costs are allotted for RSC activities in support to corporate social responsibility along environment, economy, and quality of life. Kapetanopoulou and Tagaras (2010) illustrates that appropriate allocation and effective utilization of available resources for reverse supply chain operations along with appropriate product strategy would yield assets to the firm. The result implies that RSC is not just helping the environment but more so the economy in terms of cost saving and profit generation. Respondents also showed apprehension on the implementation of RSC as it is not yet given much attention though they observe that consumers changing their buying behavior toward environment friendly items. It was emphasized that adopting sustainability programs to protect the future of the many generations must be a shared goal and responsibility. Blackburn, Guide, Souza, and Wassehove (2004) articulated that commercial product returns have been viewed as a nuisance, consequently designing the reverse supply

chain process to minimize costs. Though it takes a longer period to recover the costs of re-using and re-producing returned and waste products, yet these prolonged economic returns may be a more sustainable option. Thus, there is a need to design strategies for reverse supply chains which is relatively unexplored and underdeveloped.

Table 1. Reverse supply chain performance measure

Indicator	WM
Operational and technological cost is involved in your company's reverse supply chain activities	3.00
Financial investment is involved in your company's environmental initiatives	3.36
The relationship between your company and other parties that are involved in the reverse supply chain.	3.50
The reverse supply chain activities helped the environment	3.57
The reverse supply chain activities helped the economy.	3.36
The reverse supply chain activities contributed to the society	4.07
General Weighted Mean	3.48

Table 2 shows the level of perception on the reasons to reverse supply chain adoption which is generally high. The business understands the capabilities of RSC along customer satisfaction, logistics, legal requirement, and competitiveness. Guide, Harrison, & Wassenhove (2003) describes coordination of RSC and integration of information support system would increase the speed of recovery and profitability of the firm. This implies that the business sector highly perceives that RSC adoption do not just address environmental issues but as well as organizational performance and gaining competitiveness.

Table 2. Reasons to reverse supply chain adoption

Indicators	WM
Improve customer satisfaction	4.50
Reduce of logistics costs	4.14
Legal requirements	4.36
Recapturing value of returned products	4.29
Increasing competitiveness	4.29
Reduce stocks	3.86
General Weighted Mean	4.24

Table 3 shows the level of perception on the benefits of reverse supply chain adoption which is generally high. The business sector understands the benefits of RSC along logistics efficiency, logistics costs, improved relationship with customers, minimizing waste, and highly regarded is the improved company image. Guide, et al (2003) showed that strategic costs in implementing reverse logistics would yield substantial direct and indirect benefits to the firm. The result showed that there is an opportunity for scaling up the business in capacitating the supply chain through its reverse logistics.

Table 3. Benefits of reverse supply chain adoption

Indicators	WM
Improve logistics efficiency	4.00
Reduction of logistics costs	4.00
Improve relations/satisfaction with partners	4.14
Improved company image	4.50
Lower costs resulting from better planning	4.29
Minimizing wastes	4.43
General Weighted Mean	4.23

Table 4 shows the level of agreement on the causes that affect the realization of reverse supply chain. It is highly perceived that lack of strategic planning related to RSC, lack of information campaign, and interest by decision makers are possible impediments to RSC's success. Moreover, company's relationship with partners, financial constraints and lack of technological systems may also affect the realization of RSC. A multi-national retail

company elicited that more technological investment is being prepared as an engagement process under new situation. It should therefore be an essential part of sustainable processes in handling a diverse organization says the respondent. Blackburn, et.al (2004) posits that reverse supply chains deserve a much attention at the corporate level as forward supply chains should be managed as business processes that can create value for the company.

Table 4. Causes that affect the realization of reverse supply chain

Indicator	WM
Lack of strategic planning related to reverse logistics	4.14
Lack of training/information campaign	4.07
Lack of interest by decision makers	3.93
Relations with partners	4.14
Financial constraints	4.14
Lack of technological systems	4.14
General Weighted Mean	4.09

While the business sector is adamant in pursuing reverse supply chain, the household sector is likewise doing its best effort to take part in solid waste management. Table 5 shows the different solid wastes in terms of type; paper and plastic bottles are the ones with the highest waste composition. In terms of households, it shows that almost all of them have paper and plastics as waste, followed by metals and tin cans as well as food wastes and bottles. Along reverse supply chain, it is noted that the above types of wastes except for food wastes are relevant variables. It is therefore implied that with solid RSC practices among the business sector, this may have direct impact on the waste disposal practices of household members. Mahajan & Vakharia (2016) expounds that due to the significant increase in world population this has resulted in a larger pool of potential waste generators. Also given the rise of per capita incomes of individual consumers led increased demand for goods and services led to an increase in the rate of waste generation.

Table 5. Type of solid wastes

Solid waste	In terms of waste type (%)	In term of households (%)
Paper and carton	19.49	99.82
Plastics	19.49	99.82
Bottles	14.78	75.71
Food waste	15.51	79.42
Glass	10.83	55.48
Metals/tin cans	16.27	83.30
Used oils	0.72	3.71
Fiber bags	0.72	3.71
Old gadgets/electronics	2.17	11.13

Table 6 on the other hand shows the present waste management practices among the households coming from different income classes of the three localities. It showed that collection is the most common waste management practice although some areas are not anymore reached by garbage collector thus resorting to incineration and landfilling/dumping practices. Landfills are generally found in their backyards or nearby idle lots. Second, is source reduction, households now are limiting the use of single-used plastics and resorted to recycling due to irregular schedule of waste collection. While composting is a generally acceptable waste management practice, especially in developing countries (World Bank, 2012). Composting is a simple process where optimization efforts are used to increase the rate of decomposition, minimize nuisance potential, and produce a clean and readily marketable finished product. The result of the study implies that in the absence of mechanisms to support waste management practices, wastes segregated could still be found as recurring wastes if not properly dispose of. The study of Pokharel & Mutha, (2009) found that practices in reverse supply chain are focused on all aspects of reverse logistics – from collection of used products, their processing, and its outputs namely, recycled materials, spare parts, remanufactured products, and waste material disposal. Thus, there is evidence that RSC is significantly

associated with waste management perspectives within the households.

Table 6. Waste management practices

Solid waste	(%)	ranking
Source reduction	79%	2
Collection	81%	1
Recycling	64%	3
Composting	23%	6
Incineration	44%	4
Landfilling/dumping	33%	5

As to the question if recycling and retrieval program will be set up, would you be willing to separate materials into separate bags/bins for collection purposes? One hundred percent of the respondents answered yes. The reasons for their resounding yes are public health and safety, cleanliness, environmental concerns, easier waste management and disposal.

VII. CONCLUSIONS AND RECOMMENDATIONS

While the efforts of LGUs in solid waste management are in full implementation, there are still observable issues and challenges. It is found that there is leniency and non-cooperation among different stakeholders, particularly the business and household sectors. Lack of shared and collaborative efforts among the three sectors in environmental issues such as waste disposal and retrieval. There is a misunderstood concept of waste segregation and retrieval in the barangay levels. Households are not well educated and informed of existing business practices such as the reverse supply chain. The principle of RSC could be very helpful in developing policies in support to government's mandate for SWM and decreasing the number of wastes produced by households. The business sector is undeniably aware of the benefits and long-term gains of reverse supply chain; however, they see lack of government intervention and political will. With the glaring impact of recurring solid waste issues among different units and communities, it is highly recommended to come up with plausible solutions with solid representation among the three sectors including private

benefactors to develop a cohesive framework to address this pressing issues. The study further recommends conduct of in-depth qualitative research with participation from different groups and organizations with complementing goals along solid waste management.

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